Trends and practices in the use of non-prescription drugs among university students in the United Arab Emirates

A thesis submitted to The University of Gloucestershire

For the degree of Doctor of Philosophy in the Faculty of Applied Sciences

2019

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original, except where indicated by specific references in the text.

No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other educational institution in the United Kingdom or overseas. Any views expressed in this thesis are those of the author and in no way represent those of the University.

Signed: Date: 13/11/2019

Acknowledgements

I would, first of all, like to say a huge thank you to my sister Maha for her continued support and encouragement. I would like to thank Professor Mark and Dr. Don for their support.

I would especially like to thank the students who participated in this project and tell them that “this would never have been possible without you”. Finally, I would also like to express my gratitude to the colleges that participated in this project, and particularly to the deans.

Scientific Conference Presentations

1. Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. **"Assessing Appropriateness of Oral Non-Prescription Drugs (ONPD) Use among University Students in United Arab Emirates".** Oral Presentation at the 22nd Dubai International Pharmaceuticals and Technologies Conference and Exhibition (DUPHAT), 7–9 March 2017, Dubai, UAE.

2. Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. "**An interventional Study to Modify the Practice, Knowledge, Awareness and Attitude among university students regarding the use of antibiotics without Doctor's Prescription in UAE**". Oral- Presentation at the Global Pharmaceutical and Medical Research Conference (GPMRC), 14th-15th of April 2017, Dubai, UAE.

3. Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. "**Consequences of Irrational Self-Medication Practices among University Students in UAE**." Oral Presentation at the 10th Asia-Pacific Pharma Congress, 8–10 May 2017, Singapore.

4. Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. "**Identifying Risk Factors for Incautious Use of Non-Prescription Drugs among University Students in Emirates**-Oral Presentation at the 9th Annual European Pharma Congress,June 26-28, 2017 Madrid, Spain.

5. Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. **"What drives using Antibiotic without Prescriptions? A mixed-methods study of University Students in United Arab Emirates**" Oral Presentation at the 3rd World Congress and Exhibition on Antibiotics and Antibiotic Resistance, July 31-Aug 01, 2017, Milan, Italy.

6. Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. "**Why Not Ask a Pharmacist for advice? A cross-sectional survey of University Students in United Arab Emirates**." Oral Presentation at the 23nd Dubai International Pharmaceuticals and Technologies Conference and Exhibition (DUPHAT), 2018, Dubai, UAE.

7. Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. “**What make you frequent users of Oral Non-Prescription Drugs? A cross-sectional survey of University Students in United Arab Emirates.** ”. Oral Presentation at the 24nd Dubai International Pharmaceuticals and Technologies Conference and Exhibition (DUPHAT), 2019, Dubai, UAE

8. **Press release** of the interview study in a local newspaper “The National” in Emirate

   https://www.thenational.ae/uae/pill-popping-health-students-unaware-of-dangers-of-antibiotic-misuse-1.749339. 12th of July. 2018

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1. Al-Kubaisi, Khalid A., De SteCroix, M., Vinson,D. and Abduelmula R. Abduelkarem. **Identifying Risk Factors for Incautious Use of Non-Prescription Drugs among University Students in Emirates**. Asian Journal of Pharmaceutical and Clinical Research. 2017; 10(10)
2. Al-Kubaisi, Khalid A., De SteCroix, M., Vinson,D., Mirza R. Baig, Moustafa N. ElDin Hassan, Suleiman I. Sharif and Abduelmula R. Abduelkarem. **Appropriateness assessment and identifying the risk factors of oral non-prescription drugs’ use among university students in the United Arab Emirates.** Academia Journal of Educational Research 2017; 5(9): 1-5
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Published abstract

1. Al-Kubaisi, Khalid A., De SteCroix, M., Vinson,D. (2017**). An Interventional Study to Modify the Practice, Knowledge, Awareness, and Attitude among University Students Regarding the Use of Antibiotics without Doctor's Prescription in UAE.** Research & Reviews in Pharmacy and Pharmaceutical Sciences (RRJPPS): ISSN: 2320-1215, an open access journal. Volume 6; Issue 1.
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Submitted

Khalid Awad Al-Kubaisi, Mark De SteCroix, Don Vinson. "**Why Not Ask a Pharmacist for advice? A cross-sectional survey of University Students in United Arab Emirates.** ISPOR Journals Submitted on the 20th Janury .2019. Submitted on the 21th Janury .2019

Al-Kubaisi, Khalid A., De SteCroix, M., Vinson,D., Moustafa N. ElDin Hassan, Suleiman I. Sharif and Abduelmula R. Abduelkarem. **Self-medication with Oral Antibiotics among University Students in United Arab Emirates: prevalence and risk factors.** Tropical JOurnal of Pharmaceutical Research. Submitted on the 20 th December 2018

Under Publications

Al-Kubaisi, Khalid A., De SteCroix, M., Vinson,D.,Suleiman I. Sharif and Abduelmula R. Abduelkarem. **What make you frequent users of Oral Non-Prescription Drugs?**

Abstract

Background: A wide variety of medication, from vitamins to analgesics and anti-inflammatory drugs, can be purchased by users without a medical prescription. These are referred to as Oral Non-Prescription Drugs (ONPD). While this may empower patients to treat themselves, when used irrationally these medications can have a negative health impact. Previous research on higher education students, particularly healthcare students, has demonstrated that they might be a high-risk population for irrationally use of ONPD. In 2004, the World Health Organisation issued specific guidelines to address research in this area. However, recent investigations still indicate that irrational use of medication occurs among this population. Therefore, the current thesis will be guided by the WHO framework in an attempt to develop a strategy to address this problem.

Aim: The aim of this thesis is to determine the prevalence of irrational use of medication sold without a prescription in UAE to university students and to identify the reasons for this behaviour. A secondary aim of this investigation is to develop, implement and evaluate the effectiveness of an educational intervention to improve knowledge and awareness of, as well as attitudes and practice towards, rational use of ONPD medication by university students in UAE. To reach the aims of the study, a health behavioural model was used together with qualitative and quantitative methods.

Methodology

Study One: The *aim* of this study was to determine the prevalence and risk factors of four types of irrational use (incautious use, inappropriate use, use of antibiotics without prescription and polypharmacy) of ONPD among undergraduate students in UAE. This study used a cross-sectional design employing a randomised sampling technique (*n=2875*). Statistical analysis was used to analyse this data. *Results* obtained from this study indicated that 85.9% of students used ONPD, with 38.6% using antibiotics without a prescription. Based on WHO risk assessment criteria, this behaviour was found to the most severe form of irrational use. Additional findings indicated that female participants were 34% less likely to be incautious users (OR =0.344, 95% CI: 0. 244-0.486, $p \leq 0.001$), which set males at a higher risk of engaging in this behaviour. Not verifying the expiration date also increased the likelihood of being an incautious user by as much as 51%. Seeking drug information from health care professionals was found to be a protective factor against incautious ONPD use (OR =0. 798, 95% CI: 0.540-0.967, p967, $p \leq 0.05$). At the same time, not seeking information on cautious use of ONPD either from medical books or the internet was associated with a higher risk of incautious use (OR = 1.914, 95% CI: 1.353-2.708, $p \leq 0.001$). Being a

healthcare student significantly increased the odds of being an incautious user of ONPD (OR = 1.561, 95% CI: 1.103-2.208, $p \leq 0.05$). Using antibiotics without a prescription was reported among 35.9% of the sample, with no statistically significant difference being observed between healthcare and non-healthcare students.

Study Two: Based on the WHO Severity Rating Matrix, the use of antibiotics without prescription was found to be the most significant risk for personal and population health. Therefore, the aim of this study was to further explore the reasons for use of antibiotics without prescription among healthcare university students. This study used a qualitative design employing an interview method and a purposive sample selection technique ($n=15$) which included only the population of students who used antibiotics without a prescription. Thematic analysis was used to analyse the data. Five main themes emerged from this study: knowledge, awareness, attitude, views, and perceptions, as well as possible strategies to decrease their misuse of antibiotics.

Study Three: The aim of this study was to develop and test an intervention for reducing the use of antibiotics without prescription based on the findings of study 1 and 2. The intervention was carried out for 14 weeks. Each session was delivered on a weekly basis and comprised of a 15 minutes PowerPoint presentation followed by 10 minutes of discussion. A quasi-experimental design with purposive sampling was used in which participants ($n=140$) were assessed at baseline for knowledge, awareness, attitude, and practice of using antibiotics without prescription. Results obtained through comparing baseline measures with post-intervention measures demonstrated a statistically significant ($p<0.05$) improvement in reducing the use of antibiotic without prescription among the sample. Moderate improvements were also noted in knowledge, attitude, and awareness of antibiotic use.

Conclusion: This thesis has demonstrated that the prevalence of ONPD is high among university students in the UAE. This is particularly significant as this increased prevalence occurs concomitantly with irrational use. The most significant risk was related to using antibiotics without prescription. Although the intervention to change this behaviour was successful, other issues such as access to health care and lack of time to see medical practitioners may still promote the use of antibiotics without prescription. Recommendations underlined in this investigation include educating pharmacists to provide information to ONPD buyers.

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Chapter One: Introduction

The scope of this thesis is to measure the prevalence of irrational use of oral non-prescribed medication by university students in the United Arab Emirates (UAE) and identify the reasons for this type of use. Furthermore, this thesis will implement an educational intervention to improve knowledge, awareness, attitudes and practice towards rational use of oral non-prescribed medication by university students in the UAE. This first chapter will discuss the use of medication that can be taken without a medical prescription and the resultant potential threats to human health. Finally, the aims and objectives of three studies carried out for the scope of this thesis will be discussed in this section.

1.1. Background

Over-the-counter (OTC) is a term generally used in the USA to describe drugs that are designed and labelled to be used without a physician's prescription and is usually for the treatment of non-serious, common symptoms (Federal Drug Administration, 2013). These types of medication are also referred to as non-prescription medication (NPM) in the UK (MHRA, 2018) and in the UAE (UAE Government, 2018). For the scope of this study, the terms OTC or NPM will be used as non-prescription drugs or NPD. This term will be used in order to provide consistency across this work, encompassing UAE, USA, and UK terminology.

Using NPD is known as self-medication, which falls under the broad umbrella of self-care. Self-care is in itself important as it includes notions of self-medication and refers to the processes that people undertake to maintain health, improve their lifestyle and deal with illnesses. Therefore, the goal of self-medication is to manage disease in a self-care process. The appropriate use of NPD drugs in self-medication has multiple benefits for both the patient and the community. NPD drugs provide the opportunity for an individual to treat themselves without visiting a healthcare practitioner, saving time for the patient and the healthcare provider. It is also a way of giving the patient fast and direct access to disease management, which can be particularly important in terms of contraception (Ruiz, 2010). The use of NPD medication is also beneficial in terms of cost, particularly in countries that have a nationalised health service (Ruiz, 2010; Hughes et al., 2001).

Despite these benefits, there are also potential risks for users of NPD when these are not used according to medical indications provided in the drug leaflet drugs (Ruiz, 2010; Hughes et al., 2001). These risks include antibiotic resistance in regions where antibiotics are sold as NPD and risks associated with not using the recommended dose. Additional risks include not following the recommended frequency of use and finally, risks associated with taking more than one drug to treat a single symptom. Each of these risks will be discussed below.

Firstly, a significant risk associated with NPD is present in countries where antibiotics can be sold as NPD. Because of poorly managed self-medication with antibiotics, in these regions, antibiotic resistance is a significant issue (WHO, 2014). As stated above, a significant risk of NPD use is antibiotic resistance, particularly in countries where antibiotics can be purchased as NPD. The World Health Organization (WHO) recently published findings on the threat of bacterial resistance worldwide. According to the WHO, this significant health issue may affect people of all ages and nationalities in every region of the world (WHO, 2014). Bacterial resistance is an imminent global threat that carries a significant potential threat of worsening (WHO, 2014), and self-medication with antibiotics is the main cause; several studies have concluded that the resistance rates are higher in regions where people commonly buy antibiotics without prescriptions (Morgan et al., 2011; Biswas et al., 2011; WHO, 2014). Other studies also identified self-medication as a key cause for increased antimicrobial resistance (Bennadi, 2014; WHO, 2001) thus, as a consequence, the increasing use of self-medication with antibiotics is of global public health concern, particularly in developing countries (Biswas et al., 2011; Sapkota et al., 2010; Shah et al., 2014; Shehadeh et al., 2015).

Self-medication with antibiotics has been reported to be high among university students, with the highest prevalence reported among students in Pakistan (77%) (Javed, 2013) and in Sudan (80%) (Awad et al., 2005), while lower levels were reported among students in Palestine (41%) (Sawalha, 2008), in Iran (40%) (Sarahroodi et al., 2010), at the University of Sharjah, in the UAE (40%) (Sharif and Sharif, 2013), in Nigeria (43%) (Ehigaiator et al., 2013), in India (34%) (Badiger et al., 2012), and in South India (39%) (Kumar et al., 2013). Therefore, investigating self-medication is a necessity which will be addressed by this thesis. The thesis focuses on identifying the problem with self-medication and the types of drugs used the most, determining the views students have about their medication habits and intervening to improve the education of these students regarding self-medication.

Recent studies (Cohen et al., 2013; Brauner et al., 2017; Wistrand-Yuen et al., 2018) demonstrated that antibiotic resistance can occur through various mechanisms that do not necessarily involve genetic mutations in bacteria; however, these do allow bacteria to develop resistance. Some bacteria can develop antibiotic resistance through persistent populations. Persistent populations are a subpopulation of bacteria, which can withstand initial antibiotic treatment because of small genetic variations (genetic heterogeneity) (Gefen and Balaban, 2009). This mechanism of resistance is generally linked with taking antibiotics for a shorter period than the recommended course of treatment. Because persistent bacteria can withstand initial antibiotic treatment, stopping the course of treatment before all bacteria are destroyed results in a recurring infection, this time with a persistent population of bacteria. When this process is repeated, the genetic variation which allowed the few bacteria to survive will now dominate the entire new population. Therefore, if the antibiotic treatment is not taken with the appropriate frequency, this could result in resistance. Therefore, the bacteria population may develop even more antibiotic-resistant potency (Cohen et al., 2013; Brauner et al., 2017). This phenomenon is referred to as 'time persistence', as the killing curve of the bacteria under antibiotic administration is biphasic (Brauner et al., 2016).

Persistence differs from tolerance and resistance. Antibiotic resistance in bacteria occurs when the *resistome* or the totality of genes responsible for antibiotic resistance are present within bacteria (D'Costa et al., 2006). Tolerance, on the other hand, defines the ability of bacteria to withstand a transient administration of an antibiotic, even in high dosages. This ability can be acquired due to a mutation, or due to environmental conditions, such as long-term exposure to low doses of antibiotic (Wistrand-Yuen et al., 2018; Brauner et al., 2016). In humans, this may occur with using an inappropriate dose of antibiotic. Persistence is only observed in a subpopulation of the same species of bacteria, whereby following the administration of an antibiotic, the rest of the bacteria population is rapidly killed, while persistent populations survive. These are eventually killed in the second wave of antibiotic administration, which results in the biphasic kill curve (Brauner et al., 2016). Eventually, tolerance and persistence result in antibiotic resistance.

Considering these aspects, tolerance and persistence have been referred to as complimentary bacterial adaptations to antibiotics (Vogwill et al., 2016).

To avoid these complementary mechanisms, antibiotics should be taken only as prescribed by a physician. Taking antibiotics to treat a viral infection is the most common misconception among the general public in relation to the use and functionality of antibiotics (Tanday, 2016). Physicians have also been urged to apply responsible prescription of antibiotics, only to treat infections caused by bacteria and not as preventive practice for otherwise healthy patients (Tanday, 2016). Furthermore, as indicated by recent studies (Cohen et al., 2013; Vogwill et al., 2016; Brauner et al., 2017; Wistrand-Yuen et al., 2018), bacteria complementary mechanisms can lead to antibiotic resistance. These mechanisms have been connected with administering antibiotics in dosages that are too small or not administered in the correct time frame to destroy the bacteria leading up to the development of tolerance and respectively persistence.

Noting that the development of antibiotic resistance is connected with irrational use of medication such as incorrect diagnosis of infection cause, incorrect dosages or/and incorrect administration times, a primary strategy to avoid antibiotic resistance is responsible prescription and avoidance of the use of antibiotic without prescription. Educational interventions have been proposed as a way of raising awareness among antibiotic users to improve knowledge about the potential dangers of drug overuse or misuse (Ashe et al., 2006). The efficacy of this type of approach depends on the materials used and the type of information given. Considering the significant threat posed by antibiotic resistance to the entire population of the world, the intervention developed in this thesis will be focused on reducing the use of antibiotics without prescription among students in the UAE. This will be attempted via an educational intervention.

Other than the risk associated with antibiotic resistance, another context in which NPD can become potentially hazardous to health is when these medications are taken outside the recommended dosages. One of the most common examples is NPD pain medication, specifically the analgesic paracetamol. It is useful for the relief of pain and fever and is accessible in pharmacies and supermarkets in different forms and dosages (Pettie and Dow, 2013). In large doses, however, paracetamol is incredibly toxic and poses a risk to the consumer when proper warnings are not followed.

The prevalence of self-medication using NPD is high amongst university students worldwide. While this may not be problematic, as students can avoid the costs of medical consultations by using NPD for minor symptoms, this becomes a problem when NPD are not used rationally. In Palestine, for example, the majority of University students in one survey stated that they had self-medicated at some point in their life (98%) and a large proportion had done so in the last month (38%) (Sawalha, 2008). The UAE is no exception to this trend, and NPD are commonly used amongst students in higher education (Sharif et al., 2012; Sharif et al., 2015). Common reasons cited include the absence of affordable health care for students or lack of time in getting medical consultations for adequate prescriptions. The market for this type of drug is also expected to grow in the UAE, with the high overall power of suppliers of NPD, the moderate spending power of consumers and wide access to these products (Ontario Ministry of International Trade, 2009). For safe and effective use of NPD, it is important to read and understand the informational insert leaflet or drug fact label (Bolaños, 2005; Calamusa et al., 2012). In a global review of consumer surveys regarding the use of NPD, researchers found that a high percentage of people always read the drug fact label or drug information leaflet completely before taking NPD for the first time (WSMI, 2010). In the UAE, the matter of reading the information leaflet is more stringent than in the UK or the USA. This is because information in relation to how the medication must be used is not listed on the NPD package (Gharibyar et al., 2013). Considering this aspect, for UAE NPD consumers reading the leaflet becomes essential, to know how to take the correct dose, at the correct frequency and for the right symptom.

The use of NPD becomes problematic in several contexts; initially, it has to be considered that a significant number of people do not read the information leaflet. Therefore, this may result in an incautious use NPD which can determine serious adverse effects. Subsequently, people who practice self-medication may be unaware of the adequate dosages or time of administration and active ingredient when taking a drug without reading the information leaflet. This can result in an inefficient and potentially health-hazardous treatment. One of the recommendations to reduce medication errors and harm is to use the “Five Rights 5R”: the right patient, the right drug, the right dose, the right route and the right time (Federico, 2016; Grissinger, 2010). For safe and effective use of NPD, there are a number of tasks that must be performed by drug consumers that are usually carried out by a physician. These include: accurate self-diagnosis of the symptoms, appropriate selection of a drug along with the appropriate dosage and dosage schedule, consideration of multiple drug use (World Health Organization (WHO, 2000).

The use of NPD can also be problematic when using multiple drugs to treat a singular symptom within 24 hours (polypharmacy). Polypharmacy, is also recognised as being a problem that might result in serious negative health consequences, including the potential for drug-induced symptoms, drug–drug interactions, food–drug interactions, unnecessary combinations of drugs, hospital admission and drug-related mortality (Ruiz, 2010; Pinheiro, 2011; Hardon et al., 2004; Rambhade et al., 2012). For example, self-medication using several kinds of cold and cough preparations that contain more than one active ingredient is a problem that needs to be addressed because sometimes these drugs may contain active ingredients that counteract each other: one ingredient acts by suppressing a cough, while another encouraging it (WHO, 2004). A failure to recognize that the same active ingredient is already being taken under a different brand name is a potential risk of self-medication practice at an individual level (WHO, 2002). Therefore, it was necessary for the present research to measure the prevalence and the risk factors of polypharmacy among university's students in UAE as it has been never measured to the best of researcher knowledge.

The high prevalence rate of NPD use is therefore problematic only when people practicing self-medication engage in irrational use. This includes incautious use of NPD (not reading the information leaflet), inappropriate use (i.e. inappropriate diagnosis), using antibiotics without prescription and engaging in polypharmacy. Considering that there are several types of negative behaviours related to self-medication which result in risks associated with NPD use, the terminology used in this investigation to describe these behaviours needs to be clarified. The following subsections will provide the statement of the problem and a description and justification for the terminology used in this thesis.

1.2. Statement of the Problem

As early as 1985, WHO defined rational use of medication as: "Patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community" (WHO, 1985: 3). According to World Bank (2016), rational medicine use relies on two key principles: (1) the use of drugs according to scientific data on efficacy, safety, and compliance; and (2) the cost-effective use of drugs within the constraints of a given health system. However, the concept of "rational use of medicine" is not fully understood by users, policymakers or healthcare practitioners, albeit these categories of people need to collaborate for rational use to be practice (Ofori-Asenso & Agyeman 2016). In 2004, WHO published a guideline suggesting steps for creating an effective intervention that would make drug use more rational (WHO, 2004). The guideline advised that researchers measure different types of drugs used irrationally in their community and then identify the reasons for this drug use. Then, it suggests prioritizing and analysing these reasons in order to develop effective interventions. Even so, not using medications rationally is still a pressing matter. Irrational prescribing and irrational use can result in serious adverse effects especially for people with comorbidities and geriatric patients (Hamilton et al., 2009).

Several studies from 2012 and beyond show that irrational use of NPD is high among university students and recommend educational interventions to improve knowledge, and to raise students' awareness (Aljaouni et al., 2015; Ibrahim et al., 2015; Sharif and Sharif, 2014; Sarahroodi et al., 2012). Nonetheless, the vast majority of these studies do not suggest the technique that should be used to select, create, develop and conduct such interventions. Nor do they identify the core components of the educational materials and the important variables that should be controlled and measured in order to develop successful interventions. Furthermore, they fail to suggest the best approach to deliver the educational materials of the interventions. A literature review shows that there are some studies that aimed to improve knowledge, attitude and practice of using prescribed and NPD among public and school students rather than university students (Ashe et al., 2005; Bauchner et al., 2001; Jha et al., 2013; Shehadeh et al., 2015; Taylor et al., 2003). There are a number of limitations to these studies.

Firstly, none of those studies followed the WHO guidelines. They failed to measure the prevalence of irrational use and also failed to identify the reasons behind the misuse before developing and conducting the intervention. Secondly, these studies tended to ignore existing motivators for irrational demand and use as well as strategies to avoid irrational use (Norris et al., 2013). Thirdly, none of the studies communicate with their target population about good ways to deliver any educational interventions. Fourthly, the time devoted to delivering the educational materials was limited. For example, in the aforementioned studies, the interventions lasted between 90 and 60min and were delivered in one single session (i.e. Azevedo et al. (2013) and Jha et al. (2013)). Finally, the majority of these studies used a single method or technique rather than multifaceted approaches for developing and delivering the intervention (i.e. only a video; only a poster). Additionally, these studies failed to suggest alternative ways the target population could manage their symptoms, as recommended by WHO and other public health organizations (WHO, 2013; National Prescribing Service (NPS), 2016).

The purpose of this thesis is to measure the prevalence of irrational use of NPD by university students in UAE and identify the reasons for this irrational drug use. Additionally, the thesis aims to, develop and conduct an educational intervention for improving knowledge, awareness, attitudes, and practice of rational use of a specific type of NPD by university students in the UAE. A goal of this thesis is for this intervention to be used usable by other universities after piloting to be adapted and refined for their cultural needs

1.3. Research Evidence

This section will present evidence in relation to the prevalence of irrational ONPD use and the use of antibiotics without prescriptions, thus justifying the need for interventions in addressing these issues. Furthermore, this section will underline the existing research gaps in assessing and addressing irrational medication use behaviour. Pan et al. (2012) showed that 47.8% of 1300 Chinese students took antibiotics without a physician's' prescription. Therefore, the authors proposed an educational intervention to promote the rational use of antibiotics among university students. The same situation occurs in developing nations, such as Sudan, where Awad et al. (2005) demonstrated that the rate of using antibiotics or antimalarial drugs without a prescription among university students was about 80%. Hence, they advised that educational interventions should be used to promote the rational use of antibiotics/antimicrobials among students (Awad et al., 2005). In this case, both studies demonstrated that there is a high prevalence of irrational use of antibiotics without prescriptions, which in return increases the risk of bacterial resistance and adverse drug reactions. Furthermore, the target population in both studies comprised of university students who represent an educated population segment. Some of the populations investigated were health care students and given the nature of their university studies, this population might represent healthcare practitioners who will be prescribing antibiotics in the future. Because of this, educational interventions among these students become a necessity.

Another part of irrational NPD use is the inappropriate use of analgesic medication. The use of analgesics is widespread worldwide. For example, paracetamol is an effective OTC-analgesic commonly used for relieving pain and reducing fever (antipyretic). This NPD is easily accessible in pharmacies and supermarkets in different dosage and forms (Pettie and Dow 2013). Even though this NPD can alleviate pain and reduce the need for physician visits, thus acting as a strategy to minimize the medical burden on the system, paracetamol misuse is common and overdose is frequent (Pettie and Dow, 2013). An adverse reaction resulted from exceeding the maximum recommended daily dose of paracetamol is acute liver failure, which can be fatal (Pettie and Dow, 2013). Paracetamol overdose is considered one of the most common types of drug-related self-poisonings (Hameed et al., 2014).

The assessment of paracetamol toxicity is complex (Pettie and Dow, 2013). In Dubai, Hameed et al. (2014) studied the prevalence of poisonings in patients admitted to hospitals over one year, and found that drug overdose accounted for 56% of cases of self-poisoning. , Paracetamol ingestion represented 14% of all poisoning cases. Although this indicates that this medication is a common factor for self-poisoning, paracetamol and Non-Steroidal Anti-inflammatory Drugs (NSAIDs) are commonly used among university students, including students in the UAE (Akici and Basaran, 2013; Kumar et al., 2013; Al Malak et al., 2013; Bashir et al., 2013; Ehigiator et al., 2013; Stephen et al., 2013; Sharif et al., 2012; Sharif and Sharif, 2014).

Outcomes presented by Sarahroodi et al. (2012) following a prevalence of use study in Iran, indicated that 432 out of 564 university students engaged in self-medication with analgesics. Thus, they suggested the implementation of educational programmes to make students aware of the potentially dangerous effects of self-medication. Although the authors did not determine if participants used this NPD inappropriately, the increased prevalence of use combined with the percentage of adverse effects reported by Hameed et al. (2014), suggests that the issue may reside in dosages and frequency of use. Furthermore, this implies that there is a low level of education among participants as related to NPD use.

In a Kuwaiti study, the frequency of self-medication among university students was reported by Al-Hussaini, Mustafa and Ali (2014) to be around 97.8%. This significant percentage was used by the authors to propose an intervention to improve students' awareness of potential mistakes associated with self-medication. Some of these awareness factors included the potential to set an erroneous a self-diagnosis, inappropriate use of drugs and the adverse effects of drugs. Because the researchers measured only the prevalence of NPD use, they suggested an educational programme aimed only at one aspect of irrational drug use, specifically, inappropriate drug use. However, it is to be noted that Al-Hussaini et al. (2014) did not initially assess if students used NPD irrationally. Hence a comparison to assess the effectiveness of the educational intervention in terms of improved rational use was not carried out. This further suggests that, what is needed first is to decide whether that use is rational or irrational, followed by an identification of the type of irrational drug use. . This can be incautious or inappropriate use. Finally, based on this data, suggestions can be made for an educational intervention. This is another gap that will be addressed by this thesis.

As previously stated, several types of irrational drug use are distinguished. One of these is incautious drug use, determined by the behaviour of not reading the drug information leaflets when using a NPD for the first time. In the Kingdom of Bahrain, James et al. (2008) surveyed 141 healthcare students using a convenience sampling technique at the Arabian Gulf University. The authors found that (94%) of the participants read the information leaflet, but that females had more difficulty than males in understanding the drug information. In an earlier study, James et al. (2006) surveyed 134 healthcare students at the Arabian Gulf University in the Kingdom of

Bahrain and identified that (71.6%) of the respondents read the information leaflet.; However, a higher proportion of females reported reading the drug information leaflets by contrast to males, thus suggesting that this behaviour may be dictated by a gender variable. . Despite a gender difference that has been reported among university students in regards to reading the drug information leaflets, to the best of researcher knowledge, there is no study measuring the prevalence of reading the drug information leaflets among university students in the UAE. Furthermore, no study has investigated whether gender or other factors have an association with the behaviour of students to read the drug information leaflets. Therefore, the present study will measure cautious use of NPD in university students in the UAE and then identify the factors associated with this behaviour.

The outcomes of a Saudi study by Aljaouni et al. (2015) showed a 64.8% prevalence of self-medication among university students. Considering these results, the authors recommended the use of educational courses to increase awareness and knowledge of students in relation to the risks of using NPD. Furthermore, a research conducted by Ibrahim et al. (2015) demonstrated that 75.2% of 504 Saudi students had self-medicated during the preceding six months (Ibrahim et al., 2015). Thus, these authors also recommended an intervention and other strategies to improve the practice of self-medication (Ibrahim et al., 2015).

In 2012, Sharif et al. found that in 2011 around 86% of 169 university students in the UAE who responded to their questionnaires had used drugs without a prescription (Sharif et al. 2012). Their proposition was that academic regulators should create awareness among students to promote rational self-medication (Sharif et al., 2012). Furthermore, Sharif et al. (2012, 2014) conducted two different studies, one in 2012 and one 2014. In the 2012 investigation, they discovered that the use of antibiotics without and with a physician’s prescription among healthcare students stood at 40% (Sharif et al., 2012). In the following year, Sharif and Sharif used a sample of 250 students and found that the prevalence of self-medication was at 59% and respondents’ awareness of rational drug use and the risk of bacterial resistance was poor (Sharif and Sharif, 2013). This indicates an increase of 19% in the use of antibiotics without prescription in a time span of two years.

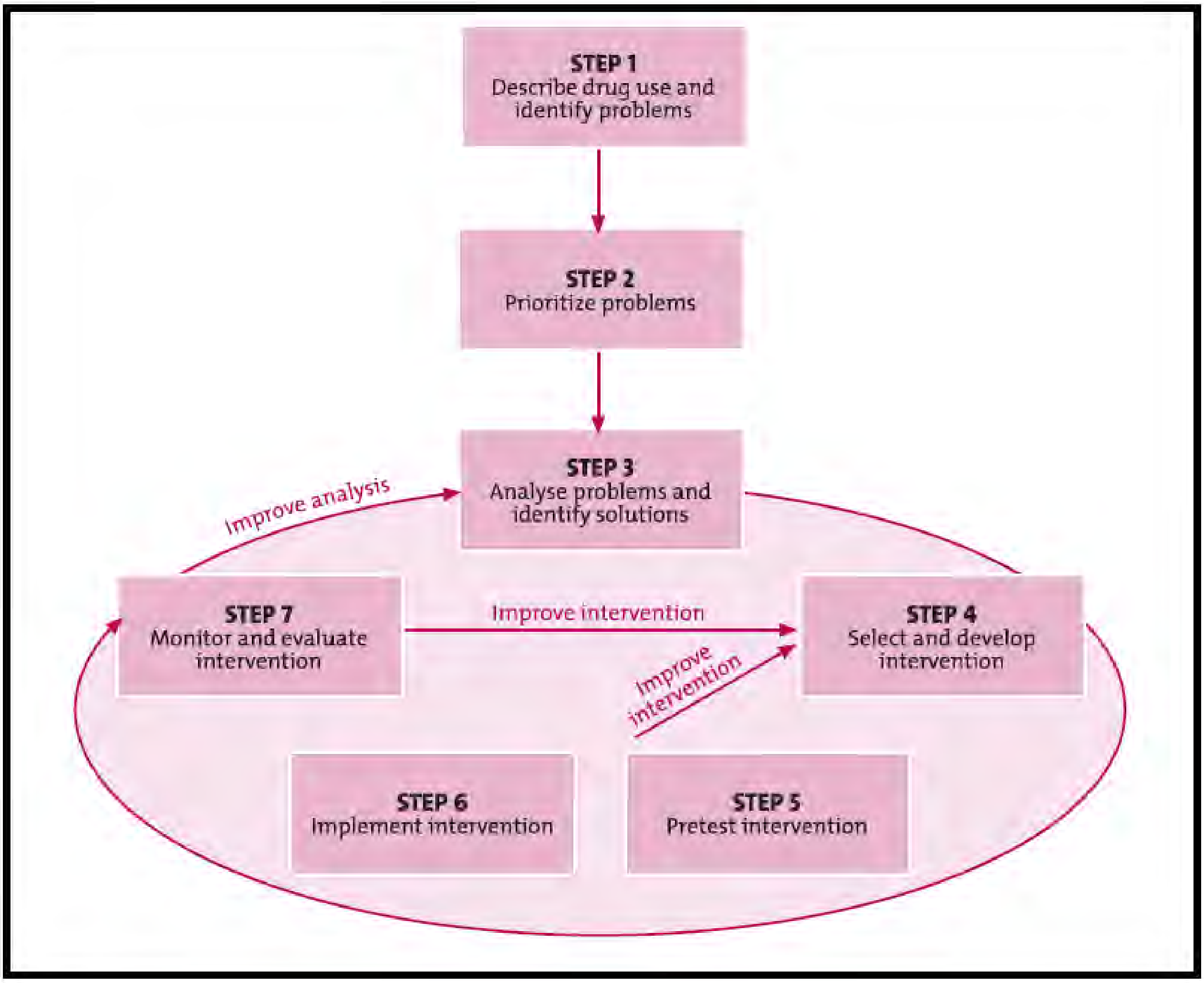
Using an antibiotic is always irrational if it has not been prescribed by a physician. However, the prevalence of use in both studies was high and coexistent with limited awareness about bacterial resistance. Nevertheless, this study was carried out by using a sample of non-healthcare students. This may suggest that health care students could potentially have better awareness of bacterial antibiotic residence. In both studies, the authors recommended that educational initiatives, such as elective courses, lectures, leaflets and seminars should be used to increase students' awareness of this problem. Furthermore, they asserted that such plans would enforce rational self-medication.

Two observations may be made in regard to these studies. First, the majority of the studies identified a high prevalence of NPD use by university students without identifying the prevalence of rational or irrational drug use and specifying the type of irrational drug use in particular. Second, despite various methods employed to determine use, and across a range of countries, all agreed on a need for an educational intervention to improve students' knowledge, awareness and to decrease the practice of irrational drug use. Furthermore, some of these studies suggested multifaceted approaches to delivering the educational intervention rather than employing approaches based on a single method. Nevertheless, these studies have some limitations (see problem statement section 1.2.). WHO (2004), in collaboration with other academic institutions, published a manual as a practical guide for researchers aiming to investigate the use of drugs by consumers. The guidelines showed that researchers need to gather specific information on:

- "The types of irrational use that occur in their country or district, so that strategies can be targeted towards changing specific problems;
- The amount of irrational use, so that the size of the problem is known, and the impact of the strategies can be monitored;
- The reasons why medicines are used irrationally, so that appropriate, effective and feasible strategies can be chosen" (Hardon et al., 2004, p.2).

The guideline also illustrates step-by-step methods for researchers to develop effective interventions to enhance rational drug use, as shown in Figure 1.1.

Figure 1.1 WHO steps to develop effective interventions



WHO (2004) Steps to develop effective interventions to enhance rational drug use by consumers, p.5

In order to select and develop an effective intervention, it is important to identify the problems associated with drug use by consumers and then to prioritise these problems so that choices can be made regarding which problems to address, as shown in Figure 1.1. It is evident there are three gaps in the existing research with respect to investigating drug use. These are:

(1) Measuring the prevalence of different types of irrational drug use within the community (i.e. determining the number and size of the problems).

(2) Prioritising these problems so that strategies can be developed to address specific ones.

3) Identifying the reasons *behind* the problems so as to develop and conduct an effective intervention.

There are various types of interventions that aim to improve rational prescribing, dispensing and use of antibiotics worldwide. These include educational interventions, managerial interventions and regulatory interventions (WHO, 2001). Educational interventions aim to change consumers' behaviour by changing their knowledge through multiple approaches, e.g. formal education, written materials, seminars and training (WHO, 2001). Managerial interventions aim to guide behaviour through treatment guidelines, audit, feedback and formulary lists. Regulatory interventions state what is essential and legal; e.g. Professional licensing, registration, practice laws (WHO, 2001). According to WHO (2001), the target population of such interventions is:

(a) Prescribers such as physicians and paramedics

(b) Dispensers, including pharmacists and others

(c) Drug users within communities

Nonetheless, the interventions are most typically targeted at the prescribers of antibiotics rather than populations within communities (WHO, 2001). As this study wanted to reach university students, it was essential to create and develop an educational intervention to change students' behaviour at high risk of misusing antibiotics. However, in order to develop an appropriate intervention, it was first necessary to conduct a survey study to determine which drugs are most often used without a prescription among students in the UAE, being necessary to also determine their opinions and their reasoning for using these drugs (which was done in the second study via qualitative interviews). With the information obtained in the two studies, the intervention study was developed.

Evidence suggested that public health educational campaigns focusing on how to avoid infection and treat minor infections can be more successful than those aiming to restrict the use of antibiotic by consumers (Norris et al., 2013). Additional research is required in order to determine the best format for training methods, as well as the contents of the educational programs themselves. The goal would be to endow future practitioners who are now healthcare students, with the ability to reduce the irrational use of antibiotics in the future (Dyar et al., 2013). The cultivation of a prudent attitude towards antibiotic use is what may create a platform for further healthcare education (Dyar et al., 2013).

A number of studies have been carried out to improve the knowledge and behaviour of the public towards rational antibiotics use since antibiotic resistance became a global concern (Ashe et al., 2005; Bauchner et al., 2001; Jha et al., 2013; Shehadeh et al., 2015; Taylor et al., 2003). These studies used different interventions, such as educational posters (Ashe et al., 2005), educational videos (Bauchner et al., 2001), presentations with or without discussion (Azevedo et al., 2013; Trepka et al. 2001) videos and educational pamphlets (Taylor et al., 2003). Other methods included brief presentations using an educational card (Shehadeh et al., 2015), presentations with leaflet information distributed to participants (Jha et al., 2013) and web site teaching resources (Madle et al., 2009). Educational campaigns stressing alternative and traditional ways of treating symptoms can be more successful when compared to interventions that focus directly on limiting the use of antibiotics (Norris et al., 2013). However, these studies have a number of limitations (see problem statement section 1.2. page 14). Therefore, the present thesis aims to fill the gaps in the existing research.

1.4. The UAE National Healthcare System

The UAE is located on the Persian Gulf, sharing borders with Saudi Arabia to the west and south, and with Oman to the east. The total population in the UAE was estimated at 9,346,000 million people in 2013 (WHO, 2016). However, UAE nationals are only a minority of the population (11.4%) according to the latest statistical report issued in 2010 from the National Bureau of Statistics in the UAE [The Federal Competitiveness and Statistics Authority (FCSA) in UAE, 2015].

The UAE national healthcare system is dynamically expanding to serve the growing needs of its population and to support the diversification of its economy. Academic institutions, leading United States medical centres and corporations play a significant role in this expansion (United States-United Arab Emirates (US-UAE) Business Council, 2014). The development of healthcare services is a top priority for the UAE. In 2013, an estimated $16.8 billion was spent in the healthcare industry and this spending is expected to grow for the foreseeable future (US-UAE Business Council, 2014). Four federal and emirate-level government entities form the publicly regulated and managed healthcare services in the UAE: The Abu Dhabi Health Services Company (SEHA), the Health Authority Abu Dhabi (HAAD), the Dubai Health Authority (DHA) and the Ministry of Health (MOH). These entities collaborate with foreign healthcare organisations to manage hospitals and clinics across the UAE (US-UAE Business Council, 2014). Additionally, privately owned healthcare companies operate hospitals and clinics to supply specialised and full-spectrum healthcare services to UAE residents.

The use of NPD drugs is encouraged by the government of the UAE (US-UAE Business Council, 2014). The NPD drugs market in the UAE is open and highly competitive; offering companies tax-free profits and income. This market is expected to grow because of the strong overall power of suppliers, the moderate overall power of buyers, and wide access to medical products and equipment (Ontario Ministry of International Trade, 2009). The pharmaceutical ONPD market in the UAE includes drugs sold only by legal prescription elsewhere, such as antibiotics (Abasaeed et al., 2009; Al Akshar et al., 2014). In the UAE, although policies prohibit the sale of antibiotics without prescription, these laws are not enforced. This combination of wide-ranging easily accessible drugs and the multi-cultural university student population makes the UAE an ideal country for the investigation of the use of ONPD by university students.

1.5. Key Terminology

To facilitate the understanding of the concepts used, main terms will be explained as related to several domains and subdomains based on their use within the wider literature. An illustration of these concepts is presented at the end of this section. Following an investigation of the literature concerning NPD use, it was observed that several self-medication behaviours are described by authors using different terminologies. Furthermore, in some cases (i.e. terminology to describe the behaviour of taking more than one medication to treat one symptom) there was a lack of terms to describe certain behaviours. Some key terms have been adapted from WHO terminology (i.e. incautious use) and applied as antithetic terms to definitions issued by WHO. This was done because the literature did not provide any key term for medication use behaviours that this thesis investigates. For other terms, the authors of seminal evidence papers that described specific terms were contacted to determine if certain behaviours detailed in their work could be used as antithetic terms to describe opposed behaviours (i.e. responsible use versus irresponsible use). Individual rationales for using each key term in this thesis to describe certain self-medication behaviours are provided below.

1.5.1. NPD

The official definition of OTC was provided in America by the FDA, based on the Durham-Humphrey Amendment in 1951. According to this legislation, two classes of medication were to be distinguished: Rx legend, or prescription and OTC or non-prescription (Abood, 2011, p.122; Doyle et al., 2001). Prescription medication was, as implied by the term, delivered to consumers only based on the prescription of an accredited health care practitioner. This was because of the fact that the drug could have potentially serious side effects or had increased toxicity, which also had to be specified on the label of the drug (FDA, 2018). All other medications that did not meet the criteria of toxicity and the need for label warnings were listed as OTC (Abood, 2011). Another class of medication deriving from the legislative changes is behind the counter medicine (BTC). These medicines are only sold in pharmacies and do not require a medical prescription but do require a pharmacist consultation (Senak, 2008; Abood, 2011).

In the U.K., the term OTC is considered to be informal by the Medicines and Healthcare products Regulatory Agency (MHRA) (2018). The term 'non-prescription medication' is preferred. The MHRA (2018) defines this class of medicines as medication that can be bought from a pharmacy or general sale without a prescription. Prescription medication is defined as medication that can be bought only based on a medical prescription from an accredited health care practitioner (Dennis, 2018; MHRA, 2018). According to the Human Medicines Regulations (2012), some classes of drugs that are qualified as non-prescription medication may only be sold in pharmacies, similar to the *BTC* concept practiced in America.

Considering the legislative and regulatory evidence as related to the definitions of non-prescription medication, for the purpose of this thesis, the term drug and medicine will be used interchangeably. Because a consensus seems to exist between what constitutes a prescription and a non-prescription drug among American and British regulatory bodies, the term non-prescribed drugs NPD will be used in this thesis to define all classes of medicine that can be purchased by consumers from pharmacies or general stores, without prior prescription from an accredited health care practitioner. Considering the most common and easiest form of drug administration is via oral administration (also referred to as *per os*) (Taha, 2014; Le, 2012) this investigation will focus on oral non-prescribed drugs (ONPD).

1.5.2. Irrational Use of Medication

Irrational use of medication will hereby be used as an antithetic term to the definition provided by WHO (2004, p. 1) to the rational use of medication. WHO defines rational use of medication as: "Patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community". For the scope of this research, based on WHO's (2004) approach to rational use, irrational use of medication will be investigated under four dimensions: incautious use, inappropriate use, use of antibiotic without prescription and use of multiple drugs for treating a single symptom a day.

During the initial preparations for the conceptualization of this work, the term "responsible use" Dickinson et al. (2001, 157) was intended to be used instead of *cautious use* (Bolaños, 2005, p.104-105). However, after contacting one of the collaborators participating in the work by Dickinson et al. (2001), Professor T. Raynor, it was pointed out that an opposing term for responsible use cannot be irresponsible use as this would cause ethical issues related to patient empowerment as derived from the ethical principle of autonomy.

This term was therefore replaced with cautious *use* (Bolaños, 2005, p.104-105). A literature examination of this term (Bolaños, 2005; Vinker et al., 2006; James et al., 2006; James et al., 2008; Sharif and Sharif, 2014; Sharif and Sharif, 2013; Sarahroodi et al, 2012; Ruiz, 2010; WHO, 2000) revealed that that although the term is not specifically used to define patients that read the information leaflet before the first use, the description of this behaviour matches the cautious concept as related to use of NPD elaborated by (Bolaños, 2005, p. 99). A study assessing factors that lead to incautious use of Non-Prescription Drug (NPD) was published by the researcher in collaboration with others (Al-Kubaisi et al., 2017a). The study is available for commentary in a high impact journal listed in the SCOPUS, the Asian

Journal of Pharmaceutical and Clinical Research, volume 10, issue 10. The term was also used in two international congresses (9th Annual European Pharma Congress and 6th World Pharmacists and Clinical Pharmacy Annual Congress) and one international conference, 5th International Conference and Exhibition on Pharmacology & Ethnopharmacology" during March 23-25, 2017 in Orlando, USA. The invitations and speeches held at these gatherings were based on publications of articles in high ranked journals (Al-Kubaisi et al., 2017b; Al-Kubaisi et al., 2017c).

1.5.3. Incautious Use

Since the publications, no comments have been received from the research community as related to the utilization of **incautious use** to describe self-medicating people who do not read the information leaflet before the first use. Therefore, to describe the first dimension of irrational use of medication, the antithetic term of *cautious use* was employed: incautious use.

1.5.3.1. Inappropriate Use

To define appropriate use of medication the literature (Awad and Eltayeb, 2007; James et al., 2006; James et al., 2008; Sclafer et al., 1997) surrounding this topic as related to self-medication was investigated. Based on this investigation, it was concluded that appropriate use can be characterized by five assessment criteria: appropriate self-diagnosis, appropriate self-selection of ONPD, appropriate dose, appropriate frequency of use and appropriate food-drug administration. This approach also coincides with the "5R" criteria (Federico, 2016; Grissinger, 2010) as related to reducing medication error when drugs are administered by health care practitioners: the right patient (appropriate diagnosis), the right drug (appropriate drug selection), the right dose (appropriate dose), the right route and the right time (appropriate frequency). In this case, drug interactions are to be considered by the medical practitioner (Federico, 2016).

Consequently, when assessing the appropriateness of self-medication, the antithetic term of appropriate use, inappropriate use, was used in this study to characterize this dimension of irrational use. The antithetic terms of the five assessment criteria were therefore used: inappropriate self-diagnosis, inappropriate self-selection of ONPD, inappropriate dose, inappropriate frequency of use and inappropriate food-drug administration.

A study (Al-Kubaisi et al., 2017d) using this term alongside with the criteria for assessment was published in a high-ranking journal (Academia Journal of Educational Research (AJER); journal impact factor 1.308), as well as in a conference (Appendix) held in Dubai (Oral Presentation at the 22nd Dubai International Pharmaceuticals and Technologies Conference and Exhibition (DUPHAT), 7–9 March 2017, Dubai, UAE).

1.5.3.2. Self-medication

Self-medication in this context has been defied (Sawalha, 2008; Al‑Hussaini et al., 2014; Pandya et al., 2013; WHO, 2014) as a behaviour in which a person, to the best of their knowledge, takes medicine without prescription in order to treat certain symptoms. For self-medication to be effective the consumer must meet the standard for appropriate use. In the context of this thesis, self-medication is not to be confused with self-care. As extracted from the literature (Stearns et al., 2000; WSMI, 2010) self-care can be defined as behaviour oriented towards maintaining health, preventing illness and managing disease when this is present (WSMI, 2010). Considering this aspect, self-medication is to be regarded in this thesis as a sub-domain of self-care.

1.5.3.3. Assessing Inappropriate Use

To define each of the five assessment criteria for inappropriate use, the concept of self-medication was considered as defined by WHO (2000, p. 10) and other literature because the current project seeks to be developed under the WHO framework of responsible medication use. This definition notes that self-medication is the use of drugs to treat self-diagnosed symptoms with NPD safely and effectively. This concept automatically assumes that the user must accurately recognize symptoms which he/she wants to treat. Hence, when the user does not accurately recognize symptoms, the first assessment criteria of inappropriate self-diagnosis will be used. This will be based on notions of self-reported symptoms; hereby noted as symptoms that are described by the person engaged in self-medication and not set by a health care professional (Sclafer et al., 1997; Sarahroodi et al., 2012; Pinheiro, 2007; WHO, 1998; Wilkinson et al.1987).

Considering that humans have various pathologies characterized by an array of symptoms, only symptoms that can be treated via self-medication and are not clinical signs of complex diseases (i.e. cardiovascular disease) have been used to assess self-diagnosis. As exemplified by the U.S. National Library of Medicine (2013) and the U.K. National Health Service or the NHS (2014) symptoms that will be considered for investigation in this study will be referred to as ‘minor symptoms’ or ‘minor illnesses’ and will include: cough; cold symptoms; indigestion; diarrhoea; constipation; headache; toothache; muscular aches; backache and occasional pain along with fever; sore throat; allergies; nausea and vomiting; skin rash and itching. The author acknowledges that some of these symptoms may signal more severe diseases (i.e. dry cough associated with heart disease) and that some percentage of participants may indeed suffer from a more aggravating condition that requires long term medication. However, in the investigations carried out in this thesis, the focus was exclusively set on ONPD as used for treating minor symptoms. Therefore, it is less likely that such sample characteristics may have influenced the final results or that these characteristics may have produced an erroneous terminology as related to minor symptoms.

The second assessment criteria of inappropriate use, specifically inappropriate self-selection of ONPD is defined as an opposing term to the WHO (2000, p.10) definition of appropriate drug use. This definition notes that appropriate drug use is the appropriate selection of the drug to be used in self-medication practice based on the symptoms experienced in order to attain safe and effective use. Inappropriate self-selection of ONPD is therefore defined in this thesis as the inappropriate selection of the drug to be used in self-medication practice based on the symptoms experienced. This terminology was also applied by other investigations (Al-Qallaf, 2015; Awad and Eltayeb, 2007; Sclafer et al., 1994) aiming to determine if users can match their symptoms with the appropriate medication. The researcher attempted on several occasions to contact the authors of the earliest study (Sclafer et al., 1994) on appropriate vs. inappropriate drug use since it has been observed by reviewing the literature that their work was seminal in this domain. The authors have been attempted to be contacted via direct mail as well as through contacting the Ministry of Health in Indonesia, however, no reply was received.

Therefore, in this case, the terminology was used as an antithetic concept to the WHO’s (2000) definition of appropriate use and as utilized in previous studies (Al-Qallaf, 2015; Awad and Eltayeb, 2007; Sclafer et al., 1994). Consideration was also given to British National Formulary (2012) recommendations of appropriate drug self-selection. When participants failed at taking the appropriate medication for their symptoms but did take another medication that was intended for other symptoms (i.e. antihistamines intended for allergies taken as pain reliefs medication), the behaviour was classified as inappropriate self-selection of Oral Non-Prescription Drug (ONPD). The same meaning will be attributed to inappropriate self-selection of ONPD in this work.

The third assessment criterion, inappropriate dose, is defined based on recommendations on dosages made by the 63rd edition of the BNF (2012). Taking more or less than the recommended dosages by the BNF (2012) qualified users as inappropriate dose users. In the present study it is expected that users will not be aware of this guide, however, they can be aware of the correct dosages based on reading the information or by consulting a health professional. Because of this, this criterion will be measured on a presumption that participants both know the correct dosages and choose not to take medication based on these recommendations or they are not aware of the correct dosages. Therefore, in both cases, the participants will be noted as inappropriate dose.

Several studies (e.g. James et al., 2006; Awad and Eltayeb, 2007; Al-Qallaf, 2015) have investigated inappropriate dose alongside inappropriate frequency of use. This is because in some cases while patients may take the appropriate dose they may take it at an inappropriate frequency. This can result in the drug being self-administered at intervals that facilitate the accumulation of a higher dose than the recommended dose. Subsequently, when medication is self-administered at time intervals longer than the recommended frequency, this may lead to a lower dose than the recommended dose. It is therefore acknowledged that these two criteria are connected. In the present investigation, these will be assessed both separately, as well as individually. The reason for this approach is that as underline by the studies cited above and by the BNF (2012) guideline, people may take the correct dose of medication but at improper time intervals. Hence both elements should be assessed in order to underline the type of inappropriate use.

Finally, the fifth criterion for assessing inappropriate use is inappropriate food-drug administration. Several studies (Bobroff et al., 2009; FDA and NCL, 2013; Al-

Qallaf, 2015) point to the fact that several food-drug interactions may cause side-effects to people taking these medications or may result in a diminished effect of the medication. According to the 76th volume of the BNF (2018), if a medication has known interactions, including with foods, these interactions will be specified beneath the drug entry. This implies that participants in this study will be aware of inappropriate food-drug administration based on whether they engage in cautious behaviour. If they are unaware or aware but not considered the interaction, then they will be considered as inappropriate food-drug administration.

1.5.4. Use of Antibiotic without Prescription

The third dimension of irrational use of medicine to be explored in this thesis is the use of antibiotic without prescription. For the purpose of this investigation, the use of antibiotic without prescription will be considered as inappropriate use encompassing all its characterized assessment factors but applied specifically in the context of antibiotic use. Other investigations (Hardon et al., 2004; Awad and Eltayeb, 2007; Sclafer et al., 1997; Sharif et al. 2012; Sharif and Sharif, 2013; Sharif and Sharif, 2014) used this approach to research use of antibiotic without prescription. These studies concluded that the majority of the participants manifested several of, or all criteria of assessment for inappropriate use, which was most often the result of people taking antibiotics without a medical prescription that would provide them with the appropriate diagnosis, appropriate drug selection, appropriate dosages, appropriate frequency of use and appropriate warnings as related to food-drug interactions.

The use of antibiotic without prescription derives not only from irrational use of medication, but also from administrative structures that allow people to gain access to antibiotics without prior medical consultation. In this context, the antithetic term of irrational use of medication will be considered as rational prescribing, exclusively for the use of antibiotic without prescription domain. The term will be used as defined by WHO (2001) to include educational interventions, managerial interventions and regulatory interventions.

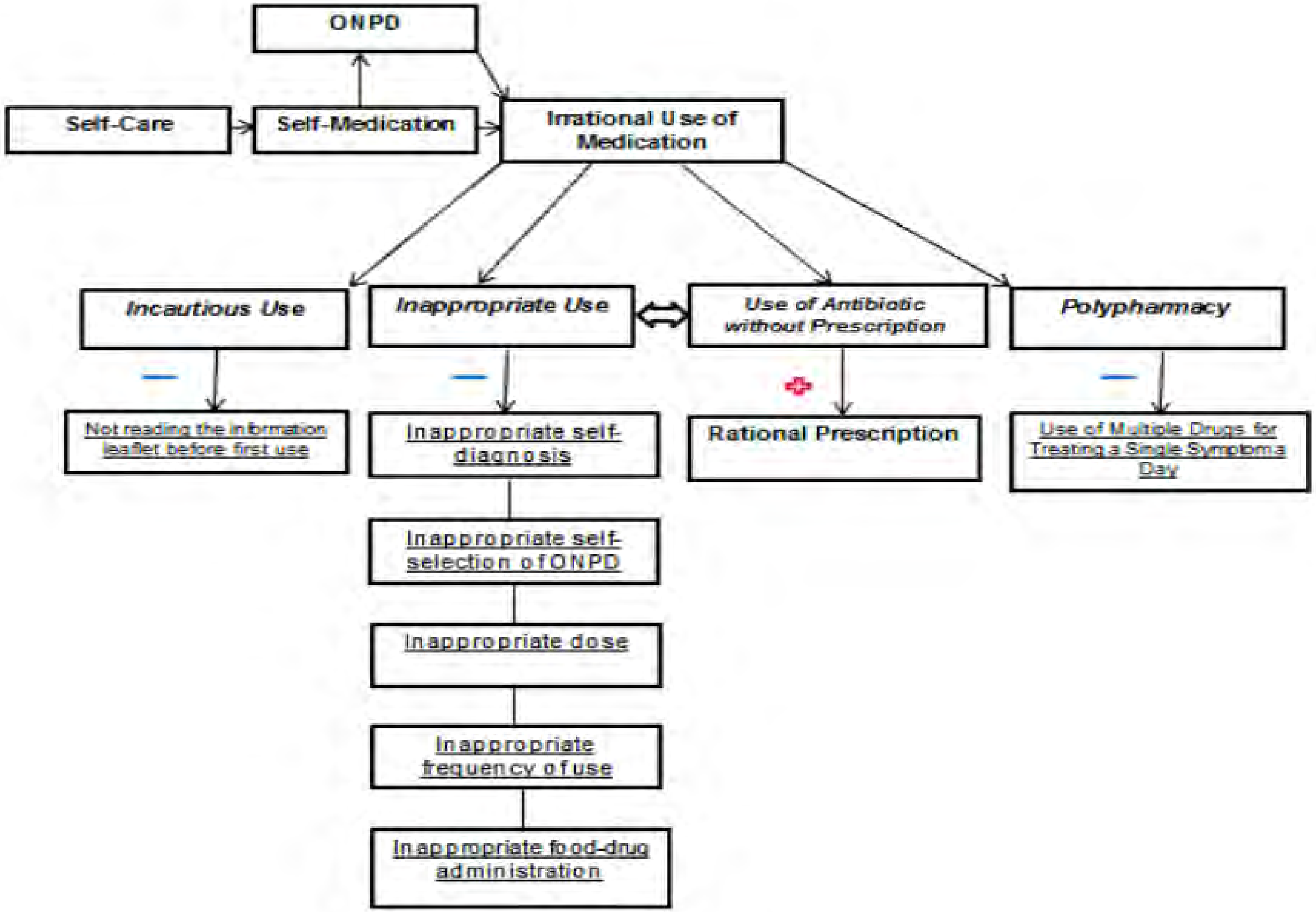
1.5.5. Polypharmacy

The fourth and final dimension of irrational use of medication to be investigated in this thesis is the use of multiple drugs for treating a single symptom a day. In the present investigation, this subdomain is intended to be used as synonymous with polypharmacy.

Within the wider literature (WHO, 2000; Brager and Sloand 2005; Faries et al. 2005 Pinheiro, 2007; Rambhade et al., 2012), the term polypharmacy has been sometimes used as exclusively related to prescription medication. In other cases, (Lee et al., 2017; Ruiz, 2010; Goh et al., 2009) this term has been used to describe the risk of self-medicating behaviour resulting from taking more than one drug for treating the same symptom. In an extensive literature review, Masnoon et al (2017) similarly concluded that there is an increased heterogeneity among the literature as related to definitions of polypharmacy. Therefore, there is no consensus on whether or not polypharmacy can apply for ONPD.

For the purpose of this investigation and for achieving clarity for what is to be investigated, the use of multiple drugs for treating a single symptom a day will be used interchangeably with polypharmacy and will define the behaviour of a self-medicating person characterized by taking more than one drug to treat a single symptom in a day, and thus exposing him/herself to the risk of side effects. The image below illustrates the main terminology used in this thesis alongside with the relations created between these terms. Relations between terms that result in negative self-medication behaviours are noted with – while relations that result in positive attenuating behaviour are noted with +.

Figure 1.2 Key Terminology



1.6. Primary Aim of the Thesis

The purpose of this research is to measure the prevalence of irrational use of ONPD by university students in UAE and identify the reasons for this irrational drug use. This data will be used to create, deliver and evaluate an educational intervention to improve knowledge and awareness of, as well as attitudes and practice towards, rational use of ONPD by university students in UAE.

1.6.1. Primary Objectives of the Thesis

To achieve this aim, the following general objectives have been set:

(1) To gather specific information about four types of irrational use of ONPD by university students in UAE; to identify the reasons behind this irrational use; and to prioritise these problems by applying the WHO- criteria for *Severity Rating matrix.*

(2) To create, deliver and evaluate an intervention to increase rational use of ONPD among university students at high risk of specific types of irrational drug use in UAE.

There are many different types of NPD dosage forms (oral, inhalational, parenteral, topical, and suppository). It was therefore not feasible for the present investigation to include all currently dosage forms. Oral dosage form was selected because it offers several advantages over other dosage forms in terms of self-administration. This thesis investigated four types of irrational use of (ONPD) among undergraduate students in the UAE. These are:

- Incautious drug use (i.e. not reading the drug information leaflets before use),
- Inappropriate drug use (i.e. inappropriate self-diagnosis, inappropriate self-selection of the drug, inappropriate dosage, inappropriate frequency of use and inappropriate food-drug administration)
- Use of antibiotics without prescriptions
- Use of multiple drugs for treating a single symptom in a day (i.e. polypharmacy behaviour).

This thesis is divided into seven main chapters. Chapter two describes the research design. Chapter 3 reviews existing literature in the field. Chapters Four, Five and Six describe the main survey study, the interview study, and the intervention study respectively. The sections below will detail the main aims and objectives of the survey study, interview study and intervention study.

1.6.2. Main Study: Survey

To gather specific information as advise by WHO guidelines, an investigation collecting quantitative data is the most suitable method (justification of the methods discussed in Chapter Four, p.55). This method enabled the researcher to gain access to extensive data related to participants' use of ONPD and to determine the prevalence of four types of irrational use of NPD. Additionally, this survey allowed for the identification of factors related to irrational use of ONPD and facilitated the decision to carry out an intervention to prevent irrational drug use.

1.6.2.1. Research Questions of the Survey Study

Research Question 1

What is the current status of ONPD use among university students in the UAE, in terms of:

a) The prevalence of ONPD use;

b) The prevalence of cautious ONPD use;

c) The prevalence of appropriate ONPD use for the most recent symptom;

d) The prevalence of incautious and inappropriate ONPD use;

e) The prevalence of using antibiotics without a physician's prescription;

f) The prevalence of polypharmacy

Research Question 2

What are the risk factors for incautious ONPD use among university students in the UAE?

Research Question 3

What are the risk factors for inappropriate ONPD use among university students in the UAE?

Research Question 4

What are the risk factors for using antibiotics without a prescription among university students in the UAE?

Research Question 5

What are the risk factors for polypharmacy among university students in the UAE?

Research Question 6

What are the reasons for ONPD use; the sources of ONPD information; the sources of ONPD acquisition; and the therapeutic categories of commonly used ONPD among university students in the UAE?

1.6.2.1.1. Objectives

(1)To measure the prevalence of four types of irrational drug use among university students in the UAE, namely: incautious ONPD use, inappropriate ONPD use, use of antibiotics without a prescription and polypharmacy;

(2)To identify the risk factors for the incautious ONPD use, inappropriate ONPD use, use of antibiotics without a prescription and polypharmacy among university students in the UAE;

(3)To create, develop and implement an appropriate educational intervention for students at higher risk of a particular type of irrational drug use.

1.6.2.2. Prioritisation of the problems

Problems of drug use identified from the main survey study one will be prioritised to find solutions. As discussed above, the WHO identified four criteria for prioritising the problems related to irrational drug use by consumers (WHO, 2004). These criteria have been used to determine the target of the intervention and will be discuss under the following subsection.

1.6.2.2.1. The Scale of the Problem

- How many people are affected by the drug misuse problem (the prevalence)?

Health Risks

This refers to the seriousness of the risk related to irrational use of drugs by consumers. For example, misuse of antibiotics can contribute to bacterial resistance which has negative consequences at individual and community levels.

Costs

The costs attributed to irrational drug use. For example, inappropriate self-medication can have negative health outcomes that lead to hospitalisation, which is expensive for both the individual and the community.

Appropriateness of a Community Intervention to Deal with the Problem

This criterion addresses the feasibility of starting a community intervention to deal with the problem.

Rating the problems

The problems are ranked according to the four criteria listed above. For each criterion, the problems are rated from 1 to 5 (with 1 being the lowest and 5 being the highest priority) to enable a quantitative comparison to be made for priority-setting, as shown in Table 1.1. The problem with the highest total rating is the most important one to address (Hardon et al., 2004). Based on the finding of the main survey (see Section 4.7 in Chapter Four), four main types of irrational drug use were identified as listed in the table below.

Table1.1 Severity Rating matrix of Identified issues in Self-medication

Criterion (rated 1–5)	Incautious drug use	Inappropriate drug use	Using antibiotics without prescriptions	Polypharmacy
Scale of the problem	3	1	5	4
Health risks	3	4	5	2
Costs	1	4	4	5
Appropriateness of an intervention	3	3	5	3
Total	10	12	19	14

1.6.3. Study Two: Student Interviews

The findings from the survey study informed the research decisions taken for the second study. Based on the findings of the survey study and the rating matrix (Table1), the riskiest type of irrational drug use among students is using antibiotics without a prescription. The survey study identified nine new risk factors for using antibiotics without prescription (see chapter 4, section 4.9.3). The findings presented from the quantitative study regarding the misuse of antibiotics demonstrated a need to understand the factors and circumstances that influence students' use of antibiotics without prescription within the context of the UAE. Thus, the second study employed students from a purposefully selected sample in an effort to further explore common themes related to their knowledge and awareness of as well as attitudes, views, and perceptions relating to the misuse of antibiotics in UAE. Purposeful criteria for selection included first-year healthcare students, having used antibiotics without prescription and previously or currently engaging in self-medication practice. Furthermore, the predictive power of the model used is modest (Nagelkerke R^2 = 0.298, p-value= 0.688) indicating that the reasons for using antibiotics without prescription extend beyond those risk factors identified from the quantitative study. Therefore, the study was required to investigate whether there were other reason(s) for using antibiotics without prescriptions. Moreover, some of the risk factors which were identified from the survey study are new factors and cannot be fully explained by a quantitative study. Because of this, another qualitative interview study was required to elaborate on the findings of the quantitative study.

In order to develop an effective educational intervention towards limiting individuals' irrational use of antibiotics, there is a need to explore and understand how people talk and think about antibiotics, symptoms and bacterial resistance (Edgar et al., 2009; Norris et al., 2013). These include motivators for irrational demand and use of antibiotics, perceptions of the negative consequences of irrational use of antibiotics and strategies to avoid irrational use of the drugs (Eng et al., 2003; Norris et al., 2013; Norris et al., 2010; Norris et al., 2009a; Norris et al., 2009b). This strategy could form a useful approach for developing an educational intervention suitable for and applicable to the target population (Norris et al., 2013). Therefore, to satisfy the aim of this thesis, there was a need to conduct an interview study to facilitate the creation and development of an effective intervention in study three (below). The aim of this qualitative study was to understand why first-year healthcare students use antibiotics without a physician's prescription.

1.6.3.1. Research Question of the Interview Study

What are the factors that contribute to the use of antibiotics without prescriptions among first-year healthcare students and how can these be addressed?

1.6.3.1.1. Objectives

(1) To explore students' knowledge, awareness, attitude, experience and behaviour regarding using antibiotics without prescription;

(2) To explore students' opinions about the role of healthcare professionals in tackling the problem of antibiotic misuse and the potential role the university might play in raising students' awareness about the risks associated with the use of antibiotics without prescriptions;

(3) To enhance creation, development, and implementation of the educational intervention in study three by providing rich descriptions about the topics that should be covered in the intervention and to learn the best approaches for delivering the educational intervention among the target population from participants' own perspectives and views.

1.6.4. Study Three: Interventional Study

The findings of the main survey study show that the prevalence of using antibiotics without prescription among university study was the highest in relation to other types of irrational drug use (see chapter 4, section 4.9.3, and p.135). Furthermore, the survey study identified that first-year healthcare students are at high risk of using antibiotics without prescription. Therefore, an intervention is required to decrease the practice of using antibiotics without prescription among students at high risk. Previous studies concluded that educational Interventions about rational use of antibiotics should be primarily directed at healthcare students (Lee et al., 2015; Dy, 1997; Sharif et al., 2012; Sharif and Sharif, 2013). As a result, the significance of the intervention is that it will target healthcare students while they are in their medical college before being future antibiotics' prescriber.

The survey study identifies nine risk factors for using antibiotics without prescription (see chapter 4, section 4.9.3, and p.122). Moreover, the interview study determines six subthemes for using antibiotics without prescription among healthcare students in particular in addition to three subthemes about the best approaches to deliver the educational materials (see chapter five, section 5.8.). According to WHO guidelines for developing an effective intervention, the researcher should analyse the factors that contribute to irrational drug use by consumers and try to identify possible solutions (WHO, 2004, p.5). Therefore, based on available time and resources, the intervention study will focus on three risk factors and four subthemes identified from the main survey study and the interview study respectively to decrease the practice of using antibiotics without prescription. The factors to be addressed, which have been extracted based on the thematic analysis are: being first-year students; being healthcare students; good medication knowledge about the use of ONPD; having previous successful experience with the use of antibiotics; holding leftover antibiotics; facing some sort of an emergency; insufficient knowledge about indication of antibiotics and antibiotic resistance as well a failure to understand the importance of completing a course of antibiotics.

The survey study one measures the medication knowledge, beliefs, and attitudes of the participating students in relation to NPD, but it is not specifically focused on antibiotics. Therefore, in order to develop a successful intervention for students at high risk of misusing antibiotics, it is necessary to make a baseline assessment for students' knowledge and awareness of and attitudes towards using antibiotics without a prescription. Development of the educational intervention was guided by the findings of the survey study, interview study and baseline assessment of the intervention study in addition to the core components of educational interventions employed in previous studies for improving public and students' knowledge, awareness and practices about using antibiotics (Azevedo et al., 2013; Shehadeh et al., 2015; Rodis et al., 2004; Trepka et al. 2001). Further, our intervention also focused on traditional strategies for symptoms management [WHO, 2013; National Prescribing Service (NPS), 2016]. Moreover, based on the findings of the survey and interview studies our intervention worked to build a positive behaviour for self-management of common and urgent symptom in which participants previously used antibiotics for alleviating the symptoms (Mainous et al., 2008).

Evidence suggested that that patients' knowledge about the rational use of antibiotics and their understanding of antibiotics resistance improved significantly following a pharmacist-initiated educational intervention (Rodis et al., 2004; Shehadeh et al., 2015). Therefore, the researcher who is a pharmacist and has experience in community pharmacies within the context of the UAE, will create, develop and deliver by himself the educational materials to the participants of the study three through face-to-face communication which is crucial for boosting behaviour change (WHO, 2007, p.25). Finally, baseline assessment of the intervention study (pre-test measure) allows some of data triangulation of the interview study (see chapter six, section 6.7 results,). In this way, the findings of study three will be integrated with that of interview study two.

1.6.4.1. *Research Questions of the Interventional Study*

Research Question 1

What are the baseline levels of knowledge, awareness, attitude, and practice as related to antibiotic use without prescription in the intervention and control group?

Research Question 2

What is the efficacy of the educational-behavioural intervention in improving levels of knowledge, awareness, attitude, and practice of antibiotic use with prescription (rational use) in the intervention group?

Research Question 3

To what extent do the knowledge, awareness, attitudes, and practice of antibiotics use vary in the intervention group with respect to their demographic characteristics?

1.6.4.1.1. Objectives

(1) To measure the baseline knowledge, awareness, attitude and practice of the intervention and control groups regarding the use of antibiotics without a prescription;

(2) To create, develop and evaluate an intervention consisting of educational materials;

(3) To measure the efficacy of the intervention by comparatively assessing baseline measures and post intervention measures of knowledge, awareness, attitude and practice of antibiotic use in the intervention versus control groups.

1.7. Scope of the Study

This study investigated the use of ONPD among university students in the United Arab Emirates (UAE). There are many different types of NPD dosage forms (oral, inhalational, parenteral, topical and suppository). Because of this, it is not feasible for the present investigation to include all forms. The oral dosage form was selected because it is the easiest and the most common route of drug administration (Taha, 2014). Furthermore, oral dosage is also considered the safest, least expensive, most convenient form, and is therefore the most common route of drug administration when compared to other dosage forms (Le, 2012).

This research investigated the most commonly used ONPD categories among students in the UAE (Sharif et al., 2012; Sharif and Sharif, 2014), through a quantitative survey study. Three more oral over-the-counter drug categories were added to the most commonly used ONPD categories on the basis of conversations with community pharmacists regarding the most commonly purchased ONP drug categories in the UAE (Ellen et al., 1998). These three drug categories are used for stomach and abdominal spasm, coughs and colds, and pain relief. Accordingly, the present study investigated oral anti-allergic drugs/anti-histamines, analgesics/antipyretics, antacids/acid reducers, anti-diarrheal drugs, anti-nausea/antiemetic drugs, cough and cold medications, laxatives, pain relievers (non-steroidal anti-inflammatory drugs) and antispasmodic drugs.

Additionally, antibiotics were included in the present study for five main reasons. Firstly, antibiotics are sold with and without a prescription in the UAE (Abasaeed et al., 2009; Al Akshar et al., 2014). Secondly, previous research investigating drug use among students in the UAE included antibiotics on the top of the list of drug categories (Sharif et al., 2012; Shehnaz et al., 2013; Sharif and Sharif, 2014). Thirdly, previous research identified that a considerable proportion of undergraduate students in the UAE use antibiotics without prescriptions (Sharif and Sharif, 2013; Sharif and Sharif, 2014). Fourthly, antibiotic resistance is a well-established serious and growing threat to the lives of people worldwide (Berzanskyte et al., 2009; Landers et al., 2010; Pruden et al., 2013) and the prevalence of bacterial resistance to antibiotics is significantly increasing in the UAE (Al-Dhaheri et al., 2009). Finally, the general trend of previous research investigating self-medication practices among university students in the Middle East was to include antibiotics on the list of drug categories studied as long as they are also sold with and without prescription (Adnan et al, 2015; Ibrahim et al., 2015; Sharif and Sharif, 2013; James et al., 2006; James et al., 2008; Sawalha, 2008).

The survey study also identified antibiotics to be the most commonly used ONPD drugs among university students in the UAE, thus the qualitative interview was focused on the rationalization students apply when making the decision to self-medicate, and their opinions about self-medication with antibiotics, sources of procurement and knowledge of antibiotic resistance. Based on the findings of the first two studies, and educational intervention was developed, aiming at using education to determine a decrease in self-medication using antibiotics.

1.8. Summary

This chapter presented the background, justification, as well as the aims and research questions for the investigations carried out in this thesis. The aim of this thesis is to measure the prevalence of irrational use of ONPD by university students in the UAE and identify the reasons for this irrational drug use. To do so, three studies were carried out. The survey study aims to assess the prevalence and rational use of ONPD in students in the UAE. Prevalence and irrational use were found to be high in the selected sample. Consequently, the second study seeks to explore these issues in more depth. Finally, in the third study, an intervention was created, developed and conducted to address a critical aspect of irrational use which was identified to be antibiotic use.

This section elaborated on the contexts in which the use of NPD is problematic and the reasons for which this self-care practice can result in health problems for people engaging in self-medication. This chapter also provided a summary of the three studies carried out for the scope of this thesis along with descriptions of findings and inter-relations between the three investigations. The following chapter will present an assessment of the literature on the use of NPD and its implications for health, especially for UAE students in the context of the UAE legislation on the use of NPD.

Chapter Two: Programme of Work

2.1. Introduction

The aim of this chapter is to provide a discussion and justification of the epistemological and ontological approaches employed in this thesis. The chapter takes a step-by-step approach in explaining the philosophical and epistemological perspectives, with arguments concerning the conceptual research design deemed appropriate for this study. However, a more in-depth analysis of the methodological procedures employed in each of the studies of this research will be provided in the following chapters. As discussed in Chapter One, several risks are associated with irrational use of NPD. Because of the complex ways in which irrational use of NPD can affect human health, different types of methodologies will be employed in this study. Firstly, this investigation will consider the prevalence of NPD use in the UAE. Most importantly, to determine if the increased use of NPD is an actual issue, the users' rational use of medication will also be tested. Finally, the type of irrational use which will be identified as most problematic based on WHO (2000) criteria will be addressed in an intervention study.

2.1.1. The post-positivist research methodology

The axiology of post-positivism requires selecting the most appropriate method for answering a particular question (Killam, 2013). This involves establishing potential cause and effect relations concerning the phenomenon. The post-positivism ontology relies on notions of critical realism. This thought current claims that even though reality can be objectively measured, this cannot be achieved through a single methodological approach, but through a multitude of approaches, that enable more complex analyses of a particular phenomenon (Killam, 2013). This view is shared by Cortina (2014), who argues that post-positivism, although reliant on the view that reality is measurable, it also claims that phenomena are probabilistic, not deterministic. Hence the research process should involve identifying the phenomenon, making it operational and measuring key variables, followed by determining how the variables are related to each other.

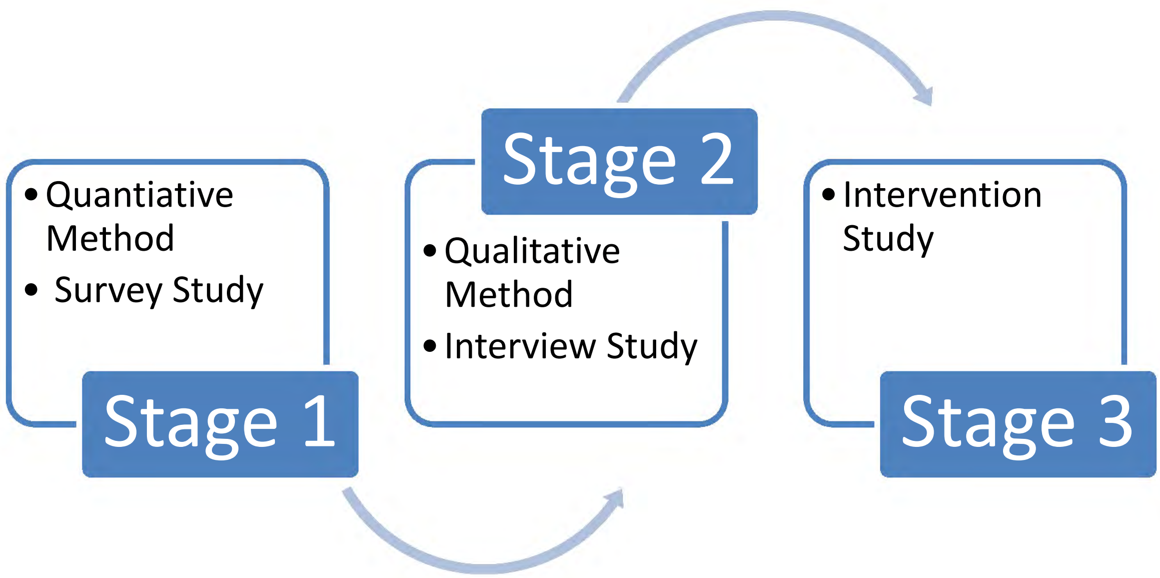
Moreover, Baran and Jones (2016) consider that post-positivism is focused on addressing fundamental variables concerning a phenomenon and should, therefore, be a paradigm of choice for explanatory research. Thus, in the post-positivist view, questions of why a phenomenon occurs in an observed manner or what determines the variations of a certain phenomenon need to be answered. To achieve this, Killam (2013) argues that a mixture of qualitative and quantitative research is needed. The main difference between traditional positivism and post-positivism is that instead of proving hypotheses, it works on falsifying hypotheses, which are tested using quasi-experimental methods, qualitative methods being used to determine meaning. This is an approach which was deemed appropriate considering the aims of this study. The engagement in qualitative research using a positivist belief system is, according to Creswell (2015) known as a post-positivist approach. Killam (2013) explains that post-positivism came into existence as a response to criticisms made of positivism, particularly regarding its limitations in answering why a certain phenomenon occurs.

2.1.2. Research design

This thesis uses mixed methods, meaning that both quantitative and qualitative approaches are employed for the primary data collection. Padgett (2012) explains the rise in the use of mixed methods in public health research by arguing that it emerged from the researchers' need to have to maximise their understanding of particular problems. Padgett (2012) argues that the use of mixed methods may be challenging because each phase of the research must be conducted in a clear manner, to improve rigour. Tashakkori and Teddie (2010) claim that the data analysis can also be challenging, as the researcher may encounter issues in finding the appropriate tool for the integration of the data. Guest and Namey (2015) also argue that the manner in which the qualitative component and the quantitative component are employed can also be challenging. The authors recommend the use of qualitative data to explain the quantitative results. In other words, the recommendation given by Guest and Namey (2015) is to collect and analyse the quantitative data first, using the findings as a basis for the qualitative design. This approach will be used in the present investigation.

As previously discussed, the thesis consists of three studies. The first study uses a quantitative design, being based on a cross-sectional survey. The findings from the cross-sectional survey are then used to create the interview instrument for the second study. The data from the survey study is also used in the development of the third part of the research. This is a quantitative quasi-experimental study, aimed at measuring the effects of an intervention on 140 users of antibiotics without prescriptions. The following scheme presents the overall design of the data collection element of the thesis.

Figure 2.1. Study Design



Author, The overall design of the data collection element of the thesis

2.2. Justification for a mixed-method research design

2.2.1. Research philosophies and paradigms

Epistemology is "the philosophy of knowledge" (Jonker and Pennink, 2010, p. 61). Thus, epistemology is concerned with the basis of knowledge and the conditions for gaining knowledge. Ontology, according to Jonker and Pennink (2010), refers to the conceptualisation of a field of knowledge, being related to the assumptions held about reality. Since what is known in a particular field is difficult to define, it can only be demonstrated in philosophical interactions which created the two fundamental research traditions, constructionism and positivism (Jonker and Pennink, 2010).

As explained by Onuf (2013), on one hand, constructionism is a complex paradigm associated with qualitative research. Through an ontological turn, the constructionism theory argues that there is a relational explanation for social phenomena. Thus, reality is built on social perspectives, which implies that the epistemological truth is subjected to the interpretation of the researcher in accordance with the information they hold.

Positivism, on the other hand, presents a more empirical approach to epistemology and ontology (Collins, 2010). According to this paradigm, knowledge stems from human experimentation, the ontological view being that the world consists of observable and measurable phenomena. Unlike constructivism, reality and scientific truth is not dependant on the perception of the researcher, but on empirical and measurable data (Ritchie and Lewis, 2014). The general laws of nature, for example determined by observation, are theorised using a positivist paradigm, associating positivism with quantitative research designs. From a historical point of view, according to Yang, Lee and Tzeng (2008) the positivist philosophy has been associated with quantitative research. However, by looking at the manner in which grounded theory and phenomenology are built as research methods, Yang, Lee and Tzeng (2008) concluded that positivism may also have a significant influence on qualitative methodologies. A clearer philosophical context for such a phenomenon is defined by other theorists through the post-positivist epistemology.

2.2.2. Method justification

As previously stated, the aim of this study is to measure the prevalence of irrational drug use among undergraduate students in the UAE and to identify the reason for this drug use, in order to develop an effective intervention plan. The complexity of the research process falls under the justification of post-positivism. This is because the research will employ both qualitative as quantitative methods to investigate a phenomenon (Cortina et al., 2014).Thus, under the post-positivist paradigm and according to Killam (2013) a combination of quantitative and qualitative methods have been employed, namely a cross-sectional study, semi-structured interviews and a quasi-experimental intervention study.

According to Creswell and Clark (2011), although using mixed methods in a research study can be challenging, following a clear set of rules can make the process clearer. Thus, it is first necessary to determine if the research design is fixed or emergent. Considering that the design of the three studies in this research is predetermined, as explained in the first chapter, the research design in this case is fixed. Creswell and Clark (2011) explain that a fixed mixed methods design involves use of qualitative and quantitative methodologies, as it has been done in this research, whereas emergent mixed methods designs occur when issues with the research methodology arise in the implementation process (e.g. significant limitations due to the interpretivism of a qualitative methodology).

2.2.2.1. Quantitative methods

Two quantitative methods were chosen. First, a cross-sectional survey is used to measure the prevalence of four types of irrational drug use among undergraduate students in the UAE, identify the risks associated with them and then create, develop and deliver appropriate educational intervention for students at high risk of a particular type of irrational drug use. Thurston (2014) explains that cross-sectional studies allow researchers to measure multiple outcomes simultaneously. Kaura (2013) argues that such a design is able to provide useful information for resource allocation and for health services planning. The main advantages of this type of study include the ease of administration (as a self-administered survey was used), the fact that it allows the measurement of multiple outcomes at the same time, the relatively large sample it permits for the analysis and the fact that it provides information useful in planning health services (Kaura, 2013).

Nevertheless, Magnus (2016) also mentions several limitations of cross-sectional studies. Because cross-sectional studies offer a snapshot of a population in a specific period of time, it is difficult to make an accurate cause and effect assessment. The exposure and outcome are measured at the same time, thus determining the temporal sequencing between the two is difficult. A detailed description of the study design, the survey instrument, and the method of survey administration, sampling, participants and data analysis is presented in chapter four.

The second quantitative approach is the quasi-experimental interventional study, an approach that lacks the randomisation of a true experiment. Killam (2013) argued that quasi-experiments are often used in post-positivist epistemologies in combination with other types of research to test falsified hypotheses or specific plans that aim for an outcome, such as an intervention plan. Quasi-experimental design is often used in order to evaluate an intervention without randomisation (Lautenbach, Woeltje and Malani, 2010). A basic quasi-experiment involves collecting pre-intervention data, implementing the intervention and collecting the same data after the implementation, without the randomisation element common to regular experiments. More complex studies can involve collecting post-intervention data from two similar groups, one of which was not subjected to the intervention (Lautenbach, Woeltje and Malani, 2010). Dependent variables are measured in each group in order to facilitate the analysis process of the intervention for determining the expected outcome.

Houser (2015) argues that the main advantage of quasi-experimental designs is their feasibility in comparison to actual experiments because it does not have the logistical and temporary constraints of actual experiments. However, Houser (2012) explains that there are certain limitations of quasi-experiments, as it may be difficult to draw cause and effect conclusions without randomly assigning the intervention in a group. Furthermore, there is a probability of sampling error, which could impact on the measurement of the outcome.

2.2.2.2. The choice of semi-structured interviews

In order to achieve the aim of determining a justification for irrational drug use among undergraduate students in the UAE and respond to the difficulty a cross-sectional study can have in accomplishing that, qualitative semi-structured interviews were also conducted during this study. Holloway and Galvin (2017) explain that the main advantage of semi-structured interviews is that it allows the interviewees to provide responses of their chosen complexity, while also ensuring the researcher maintains control of the interview and steers the responder towards predetermined areas of interest. Thus, using semi-structured interviews offers the opportunity to obtain rich data which is later investigated using thematic analysis methods.

However, as explained by Hersen (2006), there are certain disadvantages of semi-structured interviews. The first disadvantage is the difficulty of the data analysis. If the researcher does not maintain the focus of the interview in control, the identification of specific themes in a thematic analysis may prove to be difficult. For this reason, the researcher needs to ensure the key questions are answered and the discussion remains focused. At the same time, the researcher's control over the discussion may also limit the data collection and not allow the participant to fully express information that may be relevant to the research. Moreover, the honesty of participants is not guaranteed, which can increase the level of bias in the study. The semi-structured interview focuses on the perception of the responders concerning a certain topic, which may not reflect scientific reality.

As Smith and McGannon (2017) explain, there are multiple methods to ensure the reliability of the qualitative data, such as member checking or inter-rater reliability. However, they alone do not ensure that the results are trustworthy and reliable. Thus, the researcher must use universal criteria to ensure each marker of rigour is met such as previously validated measures (Smith and McGannon, 2017). The purpose of this method in the current study is to provide a justification for irrational drug use among undergraduate students in the UAE.

2.3. Conclusion

To summarise, the aim of this chapter was to provide the epistemological and ontological justification for the research design employed in this thesis. As discussed, the study is based on a post-positivist paradigm, using a combination of quantitative and qualitative methods aimed at attaining its complex goals. Two quantitative methods were used, namely a cross-sectional survey study and a quasi-experimental intervention study, accompanied by qualitative semi-structured interviews. The details of each study are discussed in Chapters four to six.

Chapter Three: Literature Review

3.1. Introduction

The aim of this chapter is to review the current literature on the prevalence of self-medication and cautious and appropriate use of drugs, using a narrative literature review approach. Narrative reviews are effective tools for summarising and critiquing the available literature on a topic of interest (Onwuegbuzie and Frels, 2016). Unlike systematic reviews, traditional or narrative reviews do not require a research protocol for elaborating the literature extraction process. Because of this, replicating studies using this methodology is not possible (Booth et al., 2016; Aveyard, 2014)

To minimise the weaknesses of narrative reviews, information in regards to the literature extraction process will be presented. This will enable an evaluation of the quality of the sources used in the review. Several databases have been searched for relevant studies. These include MedLine, EBSCO, Cochrane, Ovid, Science Direct, SAGE journals, Elsevier, PlosOne and home pages of medical journals and pharmaceutical sciences. Keywords used in searching these databases were derived from the main objectives and research questions of this study. Hence keyword phrases were developed based on natural vocabulary (Jesson et al., 2011). A time-limit has not been imposed as an exclusion criterion in order to ensure a clear view of changes through time of NPD use.

The main extracted topics of discussion from the literature are: development of independence for medication use, interventions, legal availability of substances in the UAE, student access to healthcare in the UAE, prevalence and characteristics of self-medication practice and cautions, and appropriate use in self-medication. Subthemes identified focus on self-care and self-medication, choice-making regarding the use of NPD by consumers, categories of drugs used in self-medication, prevalence of self-medication. Additional subthemes identified include: cautious and appropriate NPD use, polypharmacy behaviour, antibiotic use in self-medication and educational interventions for improving appropriate antibiotic use.

3.2. How young people develop independence in medicine use

According to Gray and Wood (2017), various health problems lead young people to use and access prescribed medications. The discussion initiated by these authors relies on a series of case studies in which the implications for medical practitioners and patient effects are discussed. Although the situations presented may not be transferable to other young people given the qualitative nature of the study, the investigation presents some significant implications resulted from using medication systematically from a young age. Based on the analysis of these case studies, Gray and Wood (2017) observed that medications intended for the treatment of both common health problems and long-term health needs in adolescence can significantly impact on the emotional well-being of these young people. These pronounced effects can be explained by the fact that during childhood and adolescence, the developing brain may be influenced in negative ways by the excessive use of medication.

Regarding this aspect Winter and Arria's (2011) note that during the adolescent period, the human brain is undergoing maturation, which may explain why young people are more willing to take risky decisions that can compromise their health or safety. An important aspect pointed out by Winter and Arria (2011) refers to parental observed behaviour as related to the use of prescription drugs. As noted by these authors, children and/or adolescents are more likely to use illegal or legal drugs if their parents tend to engage in this type of behaviour. This indicates that parents may have a substantial influence on the habits of medication consumption of their children. Another factor that could be cited for the development of independence in drug use among young people is the increasing prevalence of NPD use among them, which was found to be generally higher than the prevalence of illegal drug use, except for marijuana (Ford, 2009). Havens et al. (2011) affirmed this in their study as they claimed that the prevalence of prescription pain reliever among young people is second to marijuana. One limitation that can be pointed out from this study is that generalisability may be limited even though a large sample size was used, because of the cross-sectional design applied. However, Ford (2009) reports similar findings. The author examined the influence of family-and-school bonds on young people's use of nonmedical prescription, drawing support for social control theory. It was further revealed that young people with strong bonds to family and school tend not to engage in nonmedical prescription drug use. Hence, the opposite of this could be claimed for those with weak social bonds to family and school. This was also supported by the findings of Guo et al. (2015), where they found that students with difficult family relationships and whose parents or peers use nonmedical prescription drugs were more likely to use these drugs. Considering the argument set by Winter and Arria's (2011) on the importance of revising prevention strategies for a more effective drug use, prevention strategies can also be directed towards the importance of social bonds.

In his other study, Ford (2008a) stated that sociological research cites adolescents' use of substances as an important area; however, research on nonmedical prescription drug use is scant. This is despite the negatively increased prevalence of use among this population group, alongside the radically increasing use of nonmedical prescription drugs in recent years and the possible negative impact of drug misuse. Drawing on social learning theory, Ford's (2008a) study found that young people with pro-substance use - whose friends use drugs and whose families and peers have a lenient attitude towards substance use - tend to use nonmedical prescription drugs. This is related to Ford's (2009) conclusion that social bonds to family and school tend to draw young people away from the use of NPD. At the same time, if applying the social learning theory principles, if young people observe this behaviour in their peers or their family, they are more likely to engage in this practice themselves.

Similarly, Havens et al. (2011) pointed out that NPD use is problematic among young people, considering its connection to the usage of other illegal drugs and involvement in problematic behaviour, such as gambling and promiscuous behaviour. Furthermore, those who have been using prescription drugs at an early stage tend to develop dependence in these drugs as they mature (Havens et al., 2011).

Another factor that could be cited for young people's developing independence in medicine use is the growing recognition of the increasing burden of NPD, which could be attributed to a variety of distinctive social, economic, and structural factors, which can exacerbate the consequences of drug use. An important point to be considered is that young people's self-reliance in medicine use can have a negative impact on self-care seeking behaviour (Havens et al., 2011).

Contrary to the high prevalence of the use of NPD among young people, Thorell et al. (2012) mentioned that this is not the case with older female individuals with low socioeconomic status who tend to use licit prescription drugs more. According to the authors, the use of illicitly prescribed drugs in the population and among patients greatly varies. They concluded that age, gender, and socioeconomic status play an important role in the use of licit prescription drugs. On the contrary, this was negated by Guo et al. (2015) who found a negative correlation between low economic status and nonmedical use of prescription drugs. In contrast to Thorell et al. (2012), McCabe et al. (2005) found that male college students who were white, fraternity members, and with lower grade averages had higher nonmedical use. This was based on their self-administered mail survey of 119 colleges in the US. Rates were even higher for those enrolled in colleges with higher admission standards. An inference that can be drawn is that while Thorell et al. (2012) claimed that older female individuals with low socioeconomic status were likely to use licit prescription drugs more, McCabe et al. (2005) found that nonmedical use was higher in male college students who were white, fraternity members, and with lower grade averages. These findings are worthy of consideration with regard to how young people develop independence in medicine use.

Similarly, in their study on the pattern of self-medication use among young people in Kuwait, Abahussain et al. (2005) looked at age and gender differences as factors. A cross-sectional survey of 1,110 students aged 14 to 21 was held, leading to the findings that age served as a factor for the increase in prevalence - noting that those aged 14 had 87% prevalence while those aged 18 had 95% prevalence. Therefore, the findings tend to conclude that as age increases, self-medication use likewise increases. Parents were also cited as the most common source of self-medication among young people in Kuwait. The conclusion drawn was that self-medication was likely to increase with age and differed between the sexes, supporting findings from McCabe et al. (2005) and Thorell et al. (2012). Moreover, Abahussain et al. (2005) noted that only a few students in Kuwait turned to pharmacists to get information on drugs. The authors drew attention to the need for image promotion of pharmacists as providers of medical information.

Alternatively, Arria et al. (2010) gave a different focus on the use of nonmedical prescription drugs among young people as an association between energy drink use and nonmedical prescription drug use was revealed in their longitudinal study involving more than 1,000 college students. In contrast, non-users of energy drinks were found to have lower usage of nonmedical prescription drug use. In contrast, Ford (2008b) found that athletes were less likely to use nonmedical prescription drugs, although it was not mentioned whether they used energy drinks. Arria et al. (2010) however stressed the need for additional research on health risks associated with the use of energy drinks among young people, including the potential role of these drinks to the development of substance use.

At the other end of the spectrum, Teter et al. (2006) found a different reason for which young people use nonprescription drugs. Using a sample of 4,580 university students, they explored the use of prescription drugs to provide an understanding of the factors that contribute to the use of these drugs among this group of people. The authors found that college students commonly used illicit drugs in order to help them concentrate on their study and increase alertness. Oral administration of these drugs among this group of people was recorded at 95.3% while snorting was 38.1%.

As it can be observed from the above literature, student populations are presented as high risk of using self-medication practices. The majority of the studies do quote students as the main risk population; however other populations with different characteristics are also seen as at high risk of engaging in this behaviour. The main feature of these studies is the use of a cross-sectional or qualitative design, which thus limits the generalisability and respectively the transferability of results. Because of this, what the authors present in these cases are reflections of a particular group of people living in certain conditions, having a specific age and a specific socio-economic status. This may indicate that in different countries, and in different setting, the population which most engages in self-medication practice will differ according to gender and socio-economic status. Because the focus of this study is UAE students, the literature will be further assessed considering UAE or other similar populations. Thus, based on this review, how young people develop independence in medicine use is due to the following factors:

(1) Various health problems that lead young people to use and access prescribed medications (Gray and Wood, 2017)

(2) Availability and ease of access to nonmedical prescription drugs, e.g. prescription pain relievers (Ford, 2009);

(3) Difficult family relationships and lack of family-and-school bonds among young people, which were found to influence the use of nonmedical prescription drugs (Ford, 2008 & 2009; Guo et al., 2015)

(4) Lenient attitude of parents towards nonmedical prescription drugs (Ford, 2008& 2009; Guo et al., 2015)

(5) Parents' and peers' use of nonmedical prescription drugs (Guo et al., 2015)

(6) Parents being the most common source of self-medication among young people (Abahussain et al., 2005)

(7) Use of prescription drugs at an early stage, which can influence the development of dependence on prescription drugs at a later age (Havens et al., 2011)

(8) The growing recognition of the increasing burden of nonmedical prescription drug use (Havens et al., 2011)

(9) Age, gender, and socioeconomic status as factors for nonmedical prescription drug use (Abahussain et al., 2005; McCabe et al., 2005; Thorell et al., 2012)

(10) Lack of attention given to pharmacists as providers of medical information (Abahussain et al., 2005)

(11) Use of energy drinks which can lead to the development of nonmedical prescription drug use (Arria et al., 2010)

(12) Concentration on study and increase of alertness (Teter et al., 2006)

3.3. Legal availability of medicines in the Emirates

This section aims to present the legal availability of medicines in the Emirates. A new Medical Liability Law was introduced in the UAE in 2016, requiring a medical liability committee to examine all medical malpractice claims before they are reviewed by judicial authorities. This law also prohibits physician' arrest, investigation, and imprisonment until a final report is issued by the committee (US-UAE Business Council, 2018). This legal framework allows the population to receive good health services since physicians and other health practitioners are protected in their conduct of duties and do not have to be afraid of potential adversarial situations every time a lack of medical liability is claimed against them.

The Ministry of Health and Prevention (MOHAP) is responsible for licencing and control of the prices of drugs and medical devices in UAE. Federal Law No. 5 of 1984 deals with the practice of some medical profession by persons who are not physicians and pharmacists. If a person who is not a physician or a pharmacist prescribes certain drugs to another person or group of persons, he or she is facing a violation of this law. Therefore, the Emirates, intends for all its population to receive good healthcare services by restricting the practice of medical profession only to people who are qualified to do so. Federal Law No. 4 of 2016 is about medical liability, which states that medical practitioners should observe utmost responsibility in the conduct of their practice (US-UAE Business Council, 2018). In effect, the recipients will be assured of the good quality of the healthcare services as an effect of this legal framework. Moreover, the Emirates introduced a “law on medicines and preparations developed from natural sources”, called the Federal Law No. 20 of 1995. This law mandates that medicines and preparations developed from natural sources be registered at the Ministry of Health (US-UAE Business Council, 2018). Based on this, it is evident that the UAE ensures the legal availability of medicines within its domain.

There are four basic spheres of pharmacy practice In UAE: (1) mastering the pharmaceutical sciences through necessary knowledge and intellectual capabilities; (2) the presence of national association that represents all pharmacy practitioners; (3)

professional code of conduct and ethics guiding all pharmacy practitioners; (4) practitioners' requirement to provide appropriate advice and carry out uniform professional services, including supply of medicines to the public (Rayes et al., 2014). Medication which is normally available without a prescription can be bought in the UAE also. This includes anti-inflammatory medication, antipyretics and other cold or pain related medication that is available for the public in regulated dosages (Rayes et al., 2014).

These spheres of pharmacy practice support the existing legal framework of healthcare provision in the Emirates. The availability of medicines in the UAE is apparently guided by legal policies that aim to further improve pharmacy practice. Furthermore, several organisations in UAE, including Mubadala Healthcare, are pursuing partnerships in personalised medicine, health awareness, and treatment, among others, giving due consideration to intellectual property rights (IPR) (US-UAE Business Council, 2018). This consideration promotes respect for intellectual property rights in healthcare collaboration-seeking, which in turn can benefit the population who are the receiving parties of these partnerships. It is observed that even in collaborative pursuits, the UAE provides a legal mandate.

Another point worthy of mention is that the increasing immigrant population in the UAE makes the country further strive in order to meet its growing healthcare needs through its major regulatory bodies, such as the MOH and Health Authority of Abu Dhabi (HAAD), among others. These are in charge of developing pharmaceutical legislation and policies on the availability, accessibility, and quality of medicines (Hassan et al, 2017). Additionally, the MOH is aware of the misuse of medicines and medical services and hence announced new policies on dispensing medical prescriptions and on revising medical charges in state hospitals, clinics, and health centres. In relation to the provision of medical prescriptions, a policy took effect on April 1, 2001, stating that visitors to the country without updated health cards should shoulder fully their hospital beds and surgical operations. In this case, students who come from other countries to study in the UAE, and lack medical insurance, need to pay for their medical consultations themselves. This policy, along with other related ones, is in fact directed towards increased private sector involvement in healthcare and allowing the government to save. At the same time, this may also contribute to the practice of self-medication and the development of independence from medical practice of medication consumers.

In terms of system functionality as related to the quality of the medicines available, no specific issues have been reported. The pharmaceuticals involve different departments and sections under the Pharmacy and supplies, whose function is to provide all MOH institutions with their needs of medicines and other supplies which have been checked for safety and superior quality. The department is electronically connected to MOH hospitals, clinics, and health centres to ensure that pharmaceuticals are closely monitored and accurate (UAE Response Progress Report, 2014). However, this cannot ensure that the consumers use the medication correction. Based on this information, there is therefore an orderly and organised dispensing of medicines in UAE before they become readily available, yet this process does not involve consumer education at this stage.

A more stringent approach is in place for narcotic medication which is only available with prescription or for scientific research. The UAE government does not allow that these substances be used for illicit purposes. Federal Law No. 4 of 1983 outlines the prescribing requirements and supply of prescription drugs. In the UAE, the control of narcotic and psychotropic substances is carried out as they are potentially addictive. Most drugs used worldwide can be accessed in the Emirates' hospitals and pharmacies. The country implements the banning of recreational drugs as well as the control of narcotic and psychotropic drugs (Government.ae, 2018). From this viewpoint and in consideration of the laws mentioned earlier, the UAE mandates a strict facilitation of drugs in the country and provides a scenario of the legal availability of medicines.

3.4. How students would access health services in the UAE

Considering the discussion above, it is worthwhile to discuss how students would access health services in the Emirates. Establishing a world-class health system to enhance healthcare quality and improve the health outcomes of its people is the aim of the UAE government (Koomneef et al., 2017). Achieving this led to its implementation of improved health system reforms. In this sense, an extensive literature review was conducted by Koomneef et al. (2017) and included empirical investigations of the effects of new healthcare reforms in the UAE. The study extracted a total of 17 investigations, yet it failed to make a definitive conclusion to whether or not the reforms applied have improved the healthcare system. Overall, Koomneef et al. (2017) concluded that opinions in the field are divided, albeit some significant progress was observed in decreasing neonatal mortality and chronic disease management. Conclusively, while this study may present a comprehensive assessment of the reforms currently applied in the UAE, the review fails to address how these reforms impacted on self-medication and public awareness of medication available without a prescription. In this sense, the Ministry of Health (MOH) pays important attention to promotive and preventive health by the strategies it implements which are intended for various groups, including mothers, school children, children below five, and other groups facing health problems. The Ministry also promotes awareness and healthy behaviour among the population. It focuses on health education as a way to effectively change unfavourable attitudes and behaviour that can negatively impact on individuals' and communities' health and wellbeing in general. In order to fulfil this purpose, a department of health education has been set up by the Ministry, representing all medical districts. In addition, the department is in charge of developing national plans to promote awareness on matters relating to health and wellbeing. It also supervises the implementation of programs and activities to ensure that these plans are being carried out (UAE Response Progress Report, 2014).

From this discussion, it may be concluded that the Emirates has an established blueprint by which healthcare services can be implemented effectively. This is consistent with the conclusion of Koomneef et al. (2017) in which high patient satisfaction with the UAE's healthcare services was revealed. A limitation in this sense is observed in the fact that although several studies quote students as a high-risk population for engaging in dangerous self-medication practices, clear policies in this sense have not been identified. Furthermore, accessing healthcare services can be expensive, especially for students who are not UAE residents and who are not registered with a physician. The costs of consultations may render these students to use self-medication as a strategy for treatment in the absence of financial resources to seek professional advice. However, findings in the study of Ameri et al. (2013) showed a lack of awareness of some patients on certain medicines, such as on branded and generic medicines. In their study involving 188 patients in UAE, the authors found that 70% of patients had awareness of generic medicines; 60% had an understanding of the difference between generic medicines and branded medicines and 64% were mindful of generic medicines' substitution practice. On the other hand, 32% were not cognizant of whether they were, in fact, taking generic medicines, and 31% believed that generics did not have the same effect as branded medicines. This led Ameri et al. (2013) to conclude that random generic medicine substitution should not be carried out in UAE because of lack of certainty and knowledge about generic medicines among some patients. Their study is relevant to this research report as it shows an actual and practical investigation of the extent of knowledge that patients have regarding these sets of medicine. It can be used in evaluating the extent to which the Emirates promotes healthcare awareness and in determining the potential pattern of students' access to health services.

These studies point to the fact that regulating medication sales alone is not sufficient to avoid issues related to excessive or misuse of medication. The public must also be educated in relation to medication use, specifically in relation to what type of medication is recommended for common symptoms. Additionally, more emphasis should be set on the risks associated with excessive medication use. Since people lack a general awareness of side effects, this may result in them engaging in irrational use of medication while being oblivious to the risks.

Educating patients in relation to medication use also falls under the responsibility of pharmacists. It is important to note that advancements in pharmacy practice in the UAE had been going on over the past few years, alongside changes in the traditional criteria required of pharmacists who serve as patient-centred healthcare professionals (Rayes et al., 2015). This worldwide transition is giving pressure to pharmacists in the UAE to provide improved service provisions, with increasing demand for interpersonal skills and intellectual competence. The continuation of education in social and administrative techniques for pharmacists can be undertaken to accomplish this, which can help elevate the standard of pharmacy practice in UAE. The literature mentioned the need to pay attention to pharmacists as providers of medical information (Abahussain et al., 2005; Kelly et al., 2013). Rayes et al. (2015) presented an alternative scenario by which improvements in pharmacy practice can shift NPD use in the UAE towards better access to health services. The authors did not tackle the legal grounds on how this improvement could be carried out, but their study served as evidence of better pharmacy practice in the Emirates, which can lead to students' better access of medicines and health services.

It is also worthy to mention that Julphar Gulf Pharmaceutical Industries leads the country's pharmaceutical manufacturing industry and has 13 manufacturing facilities in the UAE, producing more than one million boxes of medicines each day. Other drug companies operating in UAE are Globalpharma, which produces up to 300 million tablets and 150 million capsules per year, and Medpharma, which earned $30-$40 million per year before being acquired by another company. Further, smart pharmacists in the form of robots, which can hand out 12 prescriptions in less than a minute, had been introduced by Dubai Health Authority (DHA) (US-UAE Business Council, 2018). These smart pharmacists therefore quicken the process of drug prescriptions, allowing students to have easy access to these drugs. It may be inferred that given the legal frameworks of dispensing drugs in the Emirates, these robotic pharmacists prescribe medicines in accordance to legal mandates and that their introduction is only to speed up the process of drug prescription.

Conversely, self-treatment as an aspect of self-care was discussed in Hasan et al. (2016); highlighting the fact that it is one of the most important topics of debate in healthcare. Investigating the patterns of self-medication among individuals in the UAE, focusing on age, gender, economic status, educational level, and health-related behaviours, the authors conducted face-to-face interviews and found that the participants sought self-medication. Findings from Hasan et al. (2016) revealed that self-medication was common among people in the UAE due to a number of reasons: It is cheaper compared to visiting a physician; visiting a pharmacy is more convenient than visiting a physician; and the health condition involved is simple. Further, pharmacists and medication leaflets were viewed as main sources of information for health conditions. Factors that led young people to buy medicines without prescriptions were: previous use, role of the family, and uses of medicines. Hasan et al. (2016) stressed that evidence of unsuitable self-medication practices may negatively affect patient care outcomes; however, pharmacists play an important role in optimizing patient education on self-care and medication use (Hasan et al, 2016). Its impact on how students would access health services in UAE is that they can potentially have the same stance as the participants in the study. This is considering earlier findings in this review about the high prevalence of the use of NPD among them (Abahussain et al., 2005; Ford, 2008a; Ford, 2009; Havens et al., 2011; Thorell et al., 2012).

According to Zaghloul et al. (2014), student's access to health services in UAE involves the accessibility of and ease of acquisition of NPD medications. Apart from the fact that NPD medications are a cheap alternative to the treatment of common illnesses, serious consequences accompany this behaviour. These consequences include harmful drug reactions and increased resistance to pathogens, among others. Using a cross-sectional method, Zaghloul et al. (2014) revealed that expatriate households in UAE used NPD medications more frequently than native households. The demographic factors for availing NPD medications were income, number of family members, and age of children. Furthermore, it was revealed that expatriate households buy medicines over the counter upon the advice of relatives. The common medicines purchased by both expatriates and native households were those related to illnesses of the ear, nose, throat, and stomach. The impact of these findings could be that students in expatriate households are more likely to avail of NPD medicines based on the advice of their parents or relatives compared to students in native households. However, further research on this topic should be carried out to validate this inference.

3.5. Prevalence and Characteristics of Self-Medication Practice

Several studies have been carried out to establish how prevalent the phenomenon of self-medication is. These include Sawalha (2008), Sharif & Sharif (2012) and Sarahroodi et al. (2012). Many of these researchers have assessed this phenomenon using quantitative methodologies and have applied surveys and statistical analysis to examine this prevalence. The consistency in these studies is that a majority of the respondents self-medicate. In a study conducted by Sawalha's (2008), 98% of the students were found to be engaging in self-medication. These findings can be generalised to the wider student and youth population in the country. Self-medication among these students falls into different categories as discussed below.

3.5.1. Self-care and Self-medication

Self-care can be defined as behaviour oriented towards maintaining health, preventing illness and managing disease when it is present (WSMI, 2010). The notion of self-care as is inclusive of the concept of self-medication because medication plays a major role in keeping the symptoms of the condition in check (Stearns et al., 2000; 2010; Pandya et al., 2013). As established by several researchers such as Adedap et al. (2011), Sharif (2012) and Al Rasheed et al. (2016), self-medication as a form of self-care is a common practice across various countries, regardless of economic development status but widely dependent upon poor regulation of prescription drugs.

Hughes et al. (2001) argue that there are several benefits of self-medication practice, including patient empowerment for managing minor illnesses, increased access to medication and promotion of development and competitiveness for the pharmaceutical industry as well as cost reduction of prescription drugs. These are corroborated Stearns et al. (2000) and more recently by Jain (2011). Even with these benefits, there are also challenges that are associated with self-care medication. These include the fact that there are often several cases of misdiagnosis in self-care and therefore, the treatment or medication used may be ineffective. There are also possibilities of using higher dosages than the indicated limit and having a prolonged duration of treatment. Polypharmacy and drug interactions may also occur, and this leads to a situation where the effectiveness of one medication is hampered by another (Hughes et al., 2001; ACPM, 2011; Boardman and Heeley 2015). Stearns et al. (2000) further notes that there is also a possibility of delaying needed medical treatment as NPD can treat symptoms, but there may be more severe underlying conditions. It can be deduced from the publication dates of the aforementioned studies that the risks and benefits of self-medication have been consistent through time.

Some studies (Sharif, 2012; Sharif et al., 2015) investigating the prevalence of self-medication also looked into reasons that trigger this phenomenon. There are several causes of self-medication among young people across the world. These include the high cost of healthcare, unavailability of accessible clinical facilities, lack of time and long waiting times at clinics which make it difficult to access and consult professionals (Badiger et al., 2012). Whilst it could be argued that the better alternative to self-medication relying on the prescriptions of physicians, there are several incidents that have led to a drop in the level of trust in them. These include previous experiences of misdiagnosis of patients leading to incurring of expenditures on wrong medications (Shill & Das, 2011). There is also a high tendency of people with medical or pharmaceutical knowledge to engage in self-medication. This was proven in a study by Sharif et al. (2015) where about 168 pharmacy practitioners were surveyed and it was established that previous drug use and medical knowledge influenced the likelihood of self-medication. Therefore, it is necessary for pharmacy students to be encouraged to seek advice as patients and thus minimise self-medication behaviour.

As it can be observed from the aforementioned studies two main paradigms dominate the self-medication behaviour in research. Firstly, some authors (Stearns et al., 2000; Hughes et al., 2001) note that this behaviour can significantly reduce the burden on healthcare and empower patients to treat themselves for minor conditions. The second perspective taken on self-medication reflects the risks associated with this behaviour (Jain, 2011). A common point of intersection that can be reasonably deduced from these perspectives is consumer behaviour. This logical deduction can be understood if applying “if/then” clauses. Therefore, if NPD are used as indicated, then potential adverse reactions are limited. Secondly, if NPD are not used as indicated, then potential adverse reactions are very likely to occur. Both these clauses have a common domain, which as previously mentioned is consumer behaviour. This leads to another logical conclusion, which is that self-medication is a safe practice as long as the consumer is educated enough to engage in adequate NPD use. Furthermore, the consumer must also be educated enough to understand that NPD treat symptoms of minor illness, and that in the eventuality that symptoms re-emerge or do not subside, a medical health-check is mandatory.

However, the responsibility of self-medication cannot fully be placed on the consumer. It is also the responsibility of the government through its regulatory bodies and legislation, as well as the responsibility of the companies who sell NPD. In this context, the government has a responsibility to regulate potential harmful NPD while at the same time educate the public through awareness campaigns on how to use NPD rationally. Finally, producers have the responsibility of making the instructions for use clear and readable by the consumer in order to facilitate rational use. At the present time in the UAE, both these issues are not addressed. Firstly, while legislation against selling antibiotics without prescription exists, this is not enforced. Secondly, producers are not obligated to print on the NPD box the correct dosages, time of administration and symptoms for which the NPD is intended. This signifies that the consumer has to read through the entire leaflet in order to understand how the NPD is to be used. Most of the time, this may not happen simply because of superficiality or lack of time to read the whole leaflet. In these circumstances, the consumer remains unaware of potential interactions, of the symptoms the medication may treat and of the adequate dosages to be used.

3.5.2. Choice-making Regarding the Use of NPD by Consumers

Choice making is crucial when it comes to NPD drugs. Unlike prescribed drugs where the physician's influence plays an important role in consumer purchasing patterns, the decision to use NPD drugs is determined by several factors. Social, psychological and economic factors (price) and family support are regarded as being among the main factors that impact the choice of NPD drug purchase and use (Gray et al., 2002). Several studies have been carried out focusing on how consumers select their medication. Hanna and Hughes (2011) argue that consumers tend to buy drugs which they perceive to be safer and effective. Similarly, the price of the NPD also determines the choices that consumers make. Consumers would prefer to pay less for effective drugs as opposed to paying more for specific brands that are thought to be more effective (Kohli and Buller 2013). It has however also been established that more expensive drugs are considered as being more effective in addressing their symptoms, even though many opt for the cheaper ones because of their price sensitivity (Linde et al., 2015).

In some instances, the opinions and attitudes of consumers towards certain NPD also affect their decision-making. Before NPD purchase, consultations are made and people share opinions about different options of drugs available. Many of those consulted share opinions about how drugs worked on their symptoms how effective they were on people they knew. These opinions then play a major role in making of the final decision about the drugs that are to be purchased even though there may not be enough medical evidence to support their beliefs (Hanna and Hughes, 2011). Worse still, there could be similarities in symptoms among different people and as such, drugs that were effective on one individual may not be equally effective on another. In a study by NCPIE (2003), it was also established that the community pharmacist's advice also plays a major role in the choice of NPDdrugs since 80% of the surveyed sample in the conducted research agreed that they comply with this advice.

Boardman et al. (2005) also established that the absence of health literacy contributes to an increase in the likelihood of NPD misuse. Health education is referred to as the extent to which patients have the capacity to access, process and comprehend basic health information to help them make important health decisions. These arguments are also in line with those presented by Lee et al. (2015) who mentioned that advertisement of drugs has a great influence on the perception of those whose health literacy is low and as such, can act as risk factors for ineffective consumption. Advertisement in particular, may encourage excessive use of medication. Considering that Sharif et al. (2015) established that there is also a high tendency of people with medical or pharmaceutical knowledge to engage in self-medication and purchase of NPD drugs which may also be ineffective in addressing their symptoms, it can be deduced that both extreme ends of health literacy increase the likelihood of misuse of NPD drugs.

The cognitive or mental function of the consumer is another important aspect of NPD choice as established by Boardman and Heeley (2015). This assesses whether the patients have the right skills necessary to make appropriate health decisions. Consumers also encounter challenges in choosing between different products, brands, and ingredients when selecting the right NPD. Most consumers rely on their past experience with certain drugs based on their symptoms before making their choice and this predisposes them to different problems because they may select the wrong medication as a result of misinterpreting their symptoms (Hanna and Hughes, 2011). Therefore, consumers may in some cases misuse or abuse drugs unintentionally. These unintentional mistakes may include taking doses that are below or above the recommended dosage, errors in timing and using different products with similar ingredients (Jariangprasert et al., 2007). The result of this may be as severe as developing more serious symptoms that would lead them to visit healthcare professionals, which was being avoided in the first place.

The source from which the drugs are purchased has also been identified as a key factor that determines the choice of NPD. Several studies that have been carried out have proven these. Among these are Sarahroodi et al. (2012); da Silva et al. (2012); Alzahrani et al. (2015), and Sharif & Sharif (2014) and they indicate that the most common sources of acquiring medication are community pharmacies, street markets, herbal stores and relatives or friends with leftover drugs. In addition to the risk that is associated with taking self-prescription drugs, there is an additional risk of taking contaminated or expired drugs when they are obtained from street markets, herbal stores or from friends' or families' stock of leftover medication. In line with this, the importance of verifying the expiration date on drugs ought to be taken. Information that is related to these non-prescription over the counter drugs is also obtained from different sources including the pharmacists and physicians, previous experience, friends, the internet, the media, textbooks and related materials, as well as the drug informational leaflets (Da Silva et al., 2012; Al-Qallaf, 2015). Moreover, Al Rasheed, et al. (2016) notes that friends' advice on antibiotics use and past experience of antibiotics were the main predictors for self-medication with antibiotics. Regardless of the information these sources provide, it is impossible to overlook the fact that they are provided without an initial diagnosis of a medical or healthcare professional and as such, they cannot be considered as being accurate.

3.5.3. Categories of NPD used in self-medication

In an effort to determine which category of drugs is most often used in self-medication, researchers also usually put into consideration the types of medication taken by participants. The identified studies included those carried out by Sawalha (2008); Klemenc-Ketis et al. (2010); Zafar et al. (2008); Sarahroodi et al. (2012) and Sharif (2012). Given that types and categories of these NPD greatly vary ranging from vitamins to antibiotics, it was difficult to get a consensus over the specific class of medication mostly used as participants in these studies self-medicated with various categories of drugs, from vitamins to antibiotics.

In a study carried out in Iran by Sarahroodi et al. (2012) only one category of NPD (analgesics) was used. In another study conducted by Da Silva et al. (2012), 2348 active ingredients of the drugs used for self-medication were utilised to produce a classification. On a broad perspective, different types of drugs used for self-medication by participants in these studies were. Whilst they could not be effectively ranked from the most to least used, the mostly used ones were established as being food-supplements (vitamins, minerals), cold and flu medicine (lozenges, nasal decongestants, cough remedies), pain relievers (NSAIDs), allergy drugs, gastric drugs and skin preparations. An important category that emerged from studies carried out by Adedap et al. (2011) and Sharif (2012) was the use of antibiotics without prescription, which could pose risks to users. This can be attributed to the absence of enforced regulations to curb this.

Therefore, this literature indicates that the categories of NPD used are diverse albeit these NPD may cause some severe adverse effects when taken irrationally. For example, medication as harmless as vitamins can produce a condition known as hypervitaminosis when taken in excess. The symptoms caused by the condition, such as blurred vision, nausea, and vomiting, are similar to other conditions resulted from ingesting toxic substances. Untreated, the condition can lead to severe and debilitating illness. Secondly, homeopathic remedies have not only been proven ineffective and mostly improving patients through placebo effects, but are also less regulated by contrast with tested medicines. This creates a proper environment for companies who sell these NPD to produce and sell medication that has potential unknown harmful effects. Other NPD, such as the NSAID ibuprofen has been shown to cause severe allergic reactions when taken in high dosages and for prolonged periods of time. It is to be considered that warnings in relation to use are issued all al ibuprofen leaflets, yet this does not automatically imply that consumers would actually read these.

The most significant danger identified in this subtheme as related to categories of NPD is antibiotic use. Antibiotics began to be regulated based on WHO warnings of microbial resistance and issued for sale only via a medical prescription. However, the legislation that prohibits use without prescription is not uniformly applied in all countries, including the UAE. This type of irrational medication use is not only problematic for the person who consumes the antibiotics but also for other people who do not necessarily have to form part of the consumer's. In the first instance, the person taking antibiotics without prescription is subjecting himself/herself to a potential risk of side effects and microbiota alterations without drawing an actual benefit from the use. In the second instance, the person may take antibiotics improperly which results in antibiotic resistant bacteria that can further contaminate other people. It is to be pointed out that antibiotics should not be referred to as NPD as these should be sold only based on medical prescription. However, since regulations are not enforced, antibiotics are sold as NPD. Because of this, this class of medication is a significant risk to global health.

3.5.4. Prevalence of self-medication

This subtheme focuses on the prevalence of self-medication among university students. From the literature used in this review, this is the most comprehensive theme that has been investigated. Sawalha (2008), for instance, found that 98% of the university students examined in his research self-medicated at some point in their life, with 37.7% having self-medicated in a span of 1 month. Sharif and Sharif (2012) established that about 86% of pharmacy students at Sharjah University in UAE self-medicated. Furthermore, Sarahroodi et al. (2012) found that 76.6% of students in four universities in Qom included in the study sample had self-medicated within the past three months. This indicates that the prevalence of self-medication among university students is significantly high. There were however different patterns of self-medication among students that varied with their years of study with finalists having a higher degree of self-medication that the freshmen.

Although the studies used similar methodologies (self-reporting questionnaires), data in relation to the prevalence substantially differ among these investigations. Three main factors can provide an explanation for this difference. First, it is to be considered that the three studies (Sawalha, 2008; Sarahroodi et al., 2012; Sarahroodi et al., 2012) were carried out in different locations and with participants who had different backgrounds (non-healthcare students, healthcare students and pharmacy students). Secondly, as mentioned in the previous subtheme, the medication investigated for self-treatment differs among the samples: Sarahroodi et al. (2012) used only analgesics to test the rates of self-medication while Sharif and Sharif (2012) used only antibiotics as a medication for reported self-treatment. Additionally, Sawalha (2008) used various classes of medicine to assess the prevalence of self-medication within his sample. Therefore, it is possible that while a smaller rate of participants may have taken antibiotics, a higher rate of participants may have taken painkillers or other forms of medication.

The third, and possibly the most relevant distinction in the methodologies of these studies, refers to the recall period used for self-reported medication use. The recall period varied in between one year and one month. In the study conducted by Sawalha (2008) the influence of the recall period is most evident, with a substantial decline in self-medication directly proportional with the recall time (98% at one year recall versus 37.7% at one month recall). This difference points to two main aspects. First, the recall period used for self-reporting can substantially influence the results by expanding or minimising the time frame in which self-medicating behaviour may have occurred. Secondly, Cleland and Durning (2015) argue that one of the main limitations of self-reporting tools refers to the issue of participant recall bias. As indicated by Sharif and Sharif (2014), when the recall period is expanded, the probability of misinformation also increases. This is due to the fact that the longer the time passed from the event of self-medication to the recall; the less likely it is for participants to remember accurately when, what and how much medication they had taken. Sharif and Sharif (2014) argue that a period of three to a maximum of six months should be used as recall time to minimise the possibility of recall bias among respondents.

Recall among the research subjects is one of the factors that determine the accuracy of the research findings because when asking them about their recent history with NPD drugs, it relies mainly on their memory. Limitations in the accuracy and completeness of recollections lead to the recall bias phenomenon, and this is brought about by several factors. These include the time over which the recollections are to be made, the seriousness of the condition that required medication and the general abilities of the participants (Malone et al., 2014). In a survey experiment conducted by Kjellsson et al. (2014) the authors found that the recall period used is largely dependent on the topic investigated in addition to the period over which they were requested to recall. To extract this data, the authors used a sample of 6999 participants who were asked to recall how many nights they had spent in a hospital. Participants were assigned to four groups, each with a different recall period (one month, three months, six months and 12 months). Data collected from the participants was set against hospital records on admission and discharge. The authors concluded that for aggregated data, which does not focus on specific characteristics, longer periods of time are less likely to affect recall. Nonetheless, for micro-analysis longer recall periods may increase the volume of data but also boost the possibility of recall bias. Similar study findings have been reported by Bhandari and Wagner (2006). For the literature assessing self-medication behaviour this aspect seems to be particularly relevant as reporting on self-medication is a personal characteristic, hence highly susceptible to recall bias. Conclusively, for the present study, an optimal recall period of 3 months (approximately one academic term) is to be considered.

3.5.5. Cautious and appropriate use in self-medication

Several aspects are connected with cautious and appropriate use of drugs when referring to the practice of self-medication. These aspects are connected with both administrative forces, such as regulatory bodies, but also with the behaviour of consumers. This theme and its subthemes will look into what is considered to be cautious and appropriate use of drugs in self-medication, examine negative behaviour as listed by past research and determine possible factors related to cautions and appropriate medication use.

The evaluation of literature in regards to the concept of cautious use determined that there is no clear consensus over how cautious use should be defied. Several studies and guidelines (WHO, 2000; James et al., 2006; James et al., 2008; Ruiz, 2010; Sharif and Sharif, 2013; Sharif and Sharif, 2014; Sarahroodi et al, 2012) describe safe and effective use of NPD as “careful”, “appropriate”, “rational”, “proper”, “good” and “correct” use. These terms are used as synonyms across these reports. This implies that their underlying concepts define similar characteristics which makes these terms interchangeable.

In respect to cautious drug use, as indicated by the Federal Drug Administration (FDA) (2015), reading the information leaflet is regarded as a crucial element in the use of OTCs drugs. Considering that this information is meant for the general public, several regulations issued by the FDA in 1999 (also known as Drug Facts) promoted a standardisation in the way that this information is delivered. These regulations are now internationally applied (Rodríguez-Pérez, 2014). For safe and effective use of NPD, users need to read and understand the NPD leaflet or drug fact label (Bolaños, 2005; Nathan et al., 2007; Consumer Healthcare Products Association (CHPA), 2013; Calamusa et al., 2012; Food Drug Administration (FDA), 2015). By using a standardised form of information, drug leaflets are easier to understand and to follow thus minimising the risk on irrational use (Motauk and Rheinsteun 2002; Brass and Weintraub, 2003; Al-Aqeel, 2012; FDA, 2014). The research identified (Ruiz, 2010) suggests that drug information leaflets of medication intended for older adults should use pictograms, graphic displays, and larger print as well as use a simpler language . Some leaflets even include bilingual information in order to minimise potential risks associated with language barriers (Sansgiry et al., 2007). Similar recommendations have been made by WHO (2000). In guidelines for rational NPD use issued by this institution, the emphasis is set on the importance of accurate drug labelling and clarity of information presented in drug leaflets. In light of these recommendations, pharmaceutical companies have invested substantial funds in creating appropriate drug labels for facilitating consumer rational use (Brass and Weintraub, 2003).

In the UAE, the Dubai Health Authority (2013) dictates that all drug information leaflets must use bilingual information (English and Arabic). Furthermore, consumers who purchase only a part of the original package of medication must be given (free of charge) the drug information leaflet (Dubai Health Authority, 2013, p.19). A regional study conducted across eight countries in Latin America recognised NPD users in self-medication practices as “careful/cautious” users if they read the NPD label before the first-time use (Bolaños, 2005, p.104-105). Hence, for the purpose of the present research, cautious NPD users are defined as those who read the NPD information leaflet before using the NPD for the first time.

Several quality assessments conducted for this study indicate that this measure is sufficiently strong to be employed in our study. An initial strength to consider is the multi-centred design as the study conducted by Bolaños (2005) included eight countries across Latin America. This implies that a vast number of individual characteristics have been accounted for within the sample, which thus expands the study’s generalisability. However, it has to be noted that the countries included in the study are from a specific region, which may imply that they share a similar culture. This further signifies that generalisability of the behaviour noted as cautious use may not apply to other regions. Consequently, the tool may be also applied in the UAE. Another strong quality indicator of this study refers to the duration of the study, which encompassed all four seasons present in these countries to minimize seasonal bias in the use of OTC-drugs (Hardon et al., 2004). The study also comes from a peer-reviewed source, the Drug Information Journal, formerly known as the official journal of Drug Innovate Advance (DIA) (DIA, 2016).

Some limitations of this study include lack of criteria for the section of the pharmacies included in the study and lack of information on participant demographics. For this reason, statistical analysis was kept simple, under the form of percentages and variations. The absence of demographic data also impeded the correlation of cautious behaviour with other variables, such as age, gender or education. Furthermore, since the study used interviewers from each location, there is a possibility that different skills and approaches may have interfered with the results (Phellas et al., 2011). Another limitation refers to the tool used for data collection as the questionnaires used were not verified for validity and reliability. The research did not account for potential language barriers which may have interfered with the level of participant understanding of the questionnaire.

Research (Albsoul-Younes et al., 2013. p.186) suggests that cautious drug use should be assessed individually for each person involved in a study sample, as a single characteristic is not likely to comprise the entire complexity of what is regarded as cautious use. On one side of the spectrum, this implies that studies which assess cautious use of NPD should not use predetermined characterisations of cautious behaviour as this would force participants to choose only from the provided options. For example, participants may only chose from “reading the expiration date” and/or “reading the information leaflet”. Other options of cautious behaviour could be represented by seeking pharmacist advice, or not taking left-over medication from friends and family. A viable option in this case would be to survey participants through qualitative designs (interviews) to determine what precautions they take when self-medicating. Results would paint a clear picture of what this behaviour means for participants as well as how this behaviour contrasts with other identified cautious behaviours when self-medicating. Moreover, such data could potentially produce a more comprehensive assessment of cautious behaviour. To the best of the author’s knowledge, no studies assessed thus far had used this method. However, several studies identified (Sclafer et al., 1997; Ellen et al., 1998; Bolanos, 2005; Brass and Weintraub, 2003; Covington et al., 2006; Nathan et al., 2007; Sansgiry et al., 2007; Al-Aqeel, 2012; Calamusa et al., 2012) only assessed the influence of medical information in OTC-drugs information leaflets for rational drug use. These studies note that OTC-drugs information leaflets assist consumers in using their OTC-drugs safely and effectively. No other characteristics of cautious use were assessed such as verifying the expiration date or acquiring medication from a reliable source. Boardman et al. (2005) argue that the absence of health literacy is likely to cause drug misuse.

The literature on self-medication and cautious use patterns produced several contrasting results, with rates of reading the information leaflet varying from approximately 30% to 79% (James et al. 2006; Nathan et al., 2007; James et al., 2008; Al-malak et al., 2013). It is to be noted that in this case different populations have been used, including UAE residents and USA residents. UAE residents tended to exhibit higher rates of cautious use as judged by reading the information leaflet but this has to be considered in the context of the fact that UAE companies print use instructions only on the leaflet and not on the package. In the USA, this information is also available on the package which could explain why the rates of cautious use are so reduced in this population. At the same time, this element denotes that reading the information leaflet may be a behaviour that is coerced by the regulations on information printing on NPD in the UAE.

Other studies looked at cautious consumption of medication by differentiating between different demographic variables such as age, gender and the level of education of participants. For example, James et al. (2006) reported that females were more likely to read the information leaflet by contrast with males. This data is corroborated by the authors with additional research (Obermeyer et al., 2004 and Stewart, 1996 cited by James et al., 2006, p.247) arguing that females exhibit higher levels of health-seeking behaviour by contrast with their male counterparties. However, other studies (Sawalha, 2008; Abay and Amelo 2010; Klemenc-Ketis et al., 2010) did not find any connections between gender and cautious behaviour in their samples.

At the same time, Al Rasheed et al. (2016) and Khalil (2016) argue that self-medication patterns vary among different populations and are usually influenced by multiple factors. These include gender, age, income, education level, medical knowledge, availability of drugs, advertisements and perception of illnesses. This may indicate that when studying the patterns and prevalence of self-medication, these variables need to be considered in a nuanced research. Studies conducted by Abahussain et al. (2005), James (2006), Da Silva et al. (2012), Osemene and

Lamikanra (2012), Al-Hussaini (2014) and Ibrahim et al. (2015) found a positive correlation between age and self-medication. These studies note that as age increases so does self-medication practice. Authors attribute this phenomenon to the acquisition of more knowledge on medication and an increase in confidence for self-treatment.

For safe and effective use of NPD, a number of functions must be performed by drug consumers that are usually carried out by physicians. These include an accurate diagnostic based on the symptoms, appropriate selection of a drug and an appropriate dosage and dosage schedule, taking into consideration multiple drug use (WHO, 2000). To achieve an operational definition of NPD for this thesis, the researcher conducted a review of relevant literature to identify currently used criteria for the operational definition of appropriate drug use (Awad and Eltayeb, 2007; James et al., 2006; James et al., 2008; Sclafer et al., 1997).

Studies (Sclafer et al., 1997; Hardon et al., 2004; Lechevallier-Michel et al., 2005; Koh et al., 2005; Awad and Eltayeb, 2007; Sharif et al. 2012; Sharif and Sharif, 2013; Sharif and Sharif, 2014) looking into what is appropriate drug use focus on distinctive methodologies to identify this behaviour. James et al. (2006) measure appropriate drugs' use based on four assessment criteria: "drug dose, dosage form, and frequency of administration and duration of treatment" (p. 273). In relation to antibiotic use, Awad and Eltayeb (2007) note that:

"*Self-medication was considered inappropriate if an antibiotic and/or antimalarial was used without medical consultation; in insufficient or excessive dosages (i.e., short or long duration); unnecessarily in conditions such as coughs, common cold, and sore - throat; or was stopped after a noticeable improvement without completing the course of treatment*" (p.1250).

One of the recommendations to reduce errors and harm from drug use is to use the "five rights of drug administration, (the five rights)": the right patient, the right drug, the right dose, the right route and the right time (Federico, 2016; Grissinger, 2010). Accordingly, five assessment criteria were identified. These are: appropriate self-diagnosis, appropriate self-selection of NPD, appropriate dose, appropriate frequency of use and appropriate food–drug administration.

The assessment criteria for measuring appropriate drug use can be summarised as follows: Firstly, appropriate self-diagnosis criterion. The WHO defines self-medication as the use of drugs to treat self-diagnosed symptoms or disorders and stresses that for using NPD safely and effectively, the user should first make “accurate recognition of the symptom” WHO (2000, p. 10). The assessment of appropriate self-diagnosis was based on the “self-reported symptoms approach” (Sclafer et al., 1997; Sarahroodi et al., 2012; Pinheiro, 2011; WHO, 1998). Therefore, appropriate self-diagnosis involved acute “minor” symptoms that can be self-treated with NPD drugs, such as cough and cold symptoms, indigestion, diarrhoea, constipation, headache, toothache, muscular aches, backache and occasional pain, along with fever, sore throat, allergies, nausea and vomiting, skin rash and itching (U.S. National Library of Medicine; 2013). Nevertheless, there are serious symptoms which cannot be self-diagnosed. These require a greater level of intervention. For example, a symptom of shortness of breath is usually connected with a heart or lung disease. These symptoms require complex differential diagnosis techniques, which are unlikely to be known by the general public. Other conditions that are under “referral criteria” include a cough that is associated with one or more of the following symptoms: bloodstained or coloured mucus, a rash, neck stiffness (risk of meningitis) and earache (Buttercups Training, 2011, p.6). Consequently, only after the symptom of the illness is self-diagnosed correctly an NPD can be appropriately selected (Brass and Weintraub, 2003).

Appropriate self-selection of the drug is the second criterion used to assess the appropriateness of the drug used for the identified symptom. WHO identified that appropriate selection of the drug for self-medication is a function that must be performed by the consumer appropriately to achieve safe and effective use (WHO, 2000, p 10). In Sudan, Awad and Eltayeb surveyed (2007) 1300 Sudanese university students randomly selected from five universities in Khartoum State to estimate the prevalence of appropriate antibiotic and/or antimalarial use in self-medication. “Self-medication was considered inappropriate if an antibiotic and/or antimalarial was used for unnecessary conditions such as coughs, common cold, and sore-throat''. Furthermore, in Indonesia, Sclafer and colleagues measured appropriate drug use based on the evaluation of the efficacy and the risks of the medications used (pharmacological indicators of drugs). For example, paracetamol is considered an "appropriate" drug for self-treating fever, headache, general body pain, arthralgia, toothache and sore throat, but is considered as "unnecessary" for other conditions (Sclafer et al., 1997, p.264). Prescribed drugs such as lopramide, salbutamol, theophylline and antibiotics were considered as "harmful" for self-medication. Furthermore, the use of antibiotics without a prescription was recognised as inappropriate (Hardon et al., 2004; Awad and Eltayeb, 2007; Sclafer et al., 1997; Sharif et al. 2012; Sharif and Sharif, 2013; Sharif and Sharif, 2014).

The third and fourth criteria are appropriate dosage and appropriate frequency of the drug. For safe and effective use of NPD, the WHO (2000) reported that the consumer must be able to determine the appropriate dosage and dosage schedule for the selected drug. Furthermore, in Bahrain, James et al. (2006, p. 273) measured appropriate drug use based on several assessment criteria, such as correct drug dose and frequency of administration. In addition, in Sudan, Awad and Eltayeb (2007) considered insufficient or excessive dosages as a determinant of inappropriate antibiotic and/or antimalarial use. Importantly, calculating the correct dosage of a drug includes both the dose of a drug and the frequency of administration so as not to exceed both the maximum recommended dose of the drug and the maximum recommended dose per day. The dose of a drug is the number of doses per time and the frequency of a drug's use is the number of times the drug can be taken per day. For example, the maximum recommended dose of paracetamol (non-prescription analgesic) by mouth is 1 gram every 4 to 6 hours to a maximum of 4 grams daily. Moreover, the US Food and Drug Administration (FDA) concluded that an overdose of paracetamol could irreversibly damage the liver (FDA, 2013)

The fifth assessment criterion is the appropriate manner of administration (food–drug administration). Foods can interfere with the action of drugs by decreasing drug absorption (e.g., amoxicillin and penicillin), which in turn decreases the blood concentration of a particular drug, thereby making the drug less effective (Bobroff et al., 2009). For safe use of some NPD, such as Ibuprofen and other non-steroidal anti-inflammatory drugs, it is important to take the drug after food to avoid stomach irritation and gastric upset (Bobroff et al., 2009; FDA and NCL, 2013). Therefore, the US-FDA in collaboration with the National Consumers League has strived to raise consumer awareness about potential food–drug interactions and has published a guide called "Avoid Food–Drug Interactions" to help consumers learning how to take their drugs appropriately concerning food FDA and NCL, 2013).

To sum up, there are five assessment criteria that are commonly used for measuring appropriate use of NPD, namely appropriate self-diagnosis, appropriate selection of the drug, appropriate dosage, appropriate frequency of use and appropriate food–drug interactions. Consequently, in the present thesis, appropriate NPD use was operationally defined as the behaviour of an NPD user who selects the appropriate NPD based on appropriate self-diagnosis and appropriate selection of a drug, follows the appropriate dosage, frequency and food–drug administration, including all the five assessment criteria. Further, inappropriate drug use was sub-divided according to the number of incorrect assessment criteria into the least inappropriate use (only one to two assessment criteria is incorrect), moderate inappropriate use (only three to four assessment criteria are incorrect), and the most inappropriate use (all five assessment criteria are incorrect). Assessing the validity and reliability of the tool for these assessment criteria is discussed in the methodology chapter of the survey study (chapter four, section 4.6)

3.5.6. Polypharmacy Behaviour

Considering the aforementioned evidence, polypharmacy behaviour was also considered as a subtheme noted in the literature. There is no consensual definition of polypharmacy in the analysed literature (WHO, 2000; Pinheiro, 2011; Rambhade et al., 2012) but the evidence seems to indicate that this term is defined as taking more than one medication to treat a symptom. The term has also been contrasted with monopharmacy, which is defined as taking one drug to treat a symptom (Pinheiro, 2011). Taking more than one drug when this is not necessary is also seen as polypharmacy behaviour, especially if taking different versions of the same medication. As indicated by the literature (Bartlett et al., 2013; Spellberg et al., 2013) polypharmacy behaviour which includes the use of antibiotics, leads to antibiotic resistance, drug-resistant infections, greater illness severity and prolonged recovery.

Some studies (Viktil et al., 2006; Stuck et al., 1994) argue that polypharmacy behaviour significantly increases the risk of adverse effects or inappropriate use. Loya et al. (2009) also found that from a sample of 130 older adults exhibiting polypharmacy behaviour, 46.2% were at risk of at least one drug-drug interaction. In the retrospective study conducted by Rambhade et al. (2012), the authors found that drug-drug interactions can be prevented by avoiding polypharmacy. Two additional studies (Pinheiro, 2007; Frazier, 2005) proposed polypharmacy as a possible independent risk factor for adverse effects. However, data in this sense could not be retrieved from research looking into rational self-medication (Awad and Eltayeb, 2007; James et al., 2006; James et al., 2008; Sclafer et al., 1997) as the authors did not consider the number of drugs taken by an individual.

It is to be noted however that the studies assessed prevalence through a method that is highly susceptible to recall bias. This indicates that prevalence reports from the countries investigated by these studies may be considered as highly susceptible to error. Another approach through which the prevalence of use could be assessed would be thorough NPD sales reports. This would provide a much more accurate representation of use. Nevertheless, this approach may also be problematic, since the dosages sold are generally more than the dosages needed to treat a symptom.

As described in Chapter One, for the purpose of this investigation, polypharmacy behaviour will be described as the behaviour of taking more than one medication to treat a single symptom within a 24 hours span. As described by the above literature, this can be regarded as a form of irrational medication use, especially when corroborated by the fact that the consumer does not read the information leaflet. For example, by not reading the information leaflet may led a person to take less or more than the recommended dose at improper frequencies. Since incorrect drug use may not ameliorate the symptom, the person may perceive the medication as ineffective and take another medication instead. This can result in the accumulation of a high concentration of a single substance which results in toxic effects. The probability of this event is significantly increased if considering that different companies market medication with the same active substance under different names (e.g. Nurofen, Ibuprofen).

3.5.7. Antibiotic Use in Self-Medication

Bacteria have specific genetic characteristics which enable these microorganisms to develop antibiotic resistance. Misuse and overuse of antibiotics can increase the speed of this process (WHO, 2016). Consequently, the lack of awareness on antibiotic use and self-medication with antibiotics has been identified as a major factor for the development of antibiotic resistance (Bennadi, 2014; WHO 2001). Nevertheless, antibiotic use is highly prevalent, with statistics (Shehadeh et al., 2016) estimating a 66% global rate of antibiotic use. This signifies that over half of the global diseases are treated with antibiotics. In this context, microbial resistance is a significant issue. If over half of the global diseases are treated with antibiotics, either as a preventive strategy (for example in cystic fibrosis) or to treat primary infections and secondary infections, antibiotic resistance implies that these conditions would have no cure. This would through medicine back over a hundred years, where bacteria could decimate entire populations. Preventing misuse and thus avoiding microbial resistance is thus an element of significant global importance.

However, around 50% of antibiotic purchase worldwide are purchased without a prescription (O. Cars and L. Högberg, 2007), which thus implies that users are self-medicating and are likely to misuse these products. As a result, the use of non-prescribed antibiotics is a major global public health problem (Togoobaatar, et al., 2010). This contributes to the spread of antimicrobial resistance, cross-resistance and treatment failure on a global level (WHO 2001; Franchi, et al. 2011). The results of these effects can be seen in bacteria which is no longer affected by superior classes of antibiotics and patient deaths due to infections which were previously treatable (Tapsall 2005; Lee et al., 2007).

In Saudi Arabia, estimations of the prevalence rate of antibiotic use without prescription is as high as 78.7% (Al Rasheed et al., 2016), surpassing data registered on the global level of consumption. In UAE, Sharif et al. (2015) estimated this rate at 68.4% among university students while Belkina et al., (2014) and Shehnaz et al. (2014) estimate a rate 79.5% for Sudan and 78.0% for Yemen respectively. Sharif et al. (2015) argue that high rates of antibiotic without prescriptions use in UAE are due to the lack of enforcement of laws and regulations which would most likely prohibit this practice. A similar study (Al Rasheed et al., 2016) integrated more variables as factors contributing to the use of antibiotics without prescription. Authors of this survey argued that the vast majority of non-prescribed antibiotics are systemic antibiotics, such as amoxicillin, ciprofloxacin and penicillin. Demographics were found to be influential as male participants and older participants were more likely to self-medicate with antibiotics, in contrast with female participants and younger participants. The available data on the use of antibiotics without prescription, therefore, indicates that in the UAE, this is a significant problem, especially among the student population. Considering that using antibiotics irrationally results in microbial resistance, this issue represents a threat to the UAE in terms of national health.

3.5.8. Educational Interventions for Improving Appropriate Antibiotic Use

Considering the significant global threat posed by antibiotic resistance, various studies (Welschen et al., 2004; Ashe et al., 2006; Martens et al., 2006; Francis et al., 2009; Cals et al., 2009; Monette et al., 2007; Le Corvoisier et al, 2013; Gjelstad et al., 2013 Lee et al., 2015) have assessed the efficiency of educational interventions for minimising the use of antibiotics without prescription. However, how effective these educational interventions are at changing or improving the use of antibiotics among different populations is still controversial. Firstly, the aforementioned studies report different rates of success in terms of proper antibiotic use (with prescription). Secondly, this may be explained by the fact that the authors used different types of interventions and different types of populations. This may be an indicator of the fact that some interventions may be more or less successful depending not only on their content but also on the population to which the intervention is being administered.

Several studies have shown that lack of knowledge and misconception on the part of the general public, were the main causes of irrational use of antibiotics (Macfarlane et al., 1997; Butler et al., 1998; Lee et al., 2015; Shehadeh et al., 2016). Numerous educational techniques have been used, including interactive seminars (Le Corvoisier et al, 2013), mailing campaigns (Monette et al., 2007), small-group education (Welschen et al., 2004; Cals et al., 2009), educational outreach visit (Seager et al., 2006; Enriquez-Puga et al., 2009), guidelines and leaflets(Martens et al., 2006; Francis et al., 2009), and a combination of these educational strategies (Gjelstad et al., 2013). By analysing this literature it became evident that the smaller the sample, the more effective the intervention was in terms of knowledge on antibiotics and reduced or eliminated use of antibiotics without prescription. This may be due to the fact that smaller groups achieve more focused attention and communication with smaller groups is simpler.

According to the International Forum on Antibiotic Resistance Colloquium (2002), educational campaigns are more likely to be effective if their aim is to change community behaviour, rather than provide information. Moreover, they should target all relevant groups, especially parents, children, day-care staff and healthcare professionals. Campaigns should use a range of communications rather than one single intervention, demonstrating the power of multifaceted interventions in improving antibiotic prescribing (Finch et al., 2004). Strengthening this idea, Pinder and colleagues noted that most of the national campaigns do not focus on behaviour change theory, even though they use elements of Knowledge, Attitude and Practice as measurement outcomes (Pinder et al., 2015). Thus, the author highlighted that most of the educational interventions do not always use concrete scientific evidence and do not sufficiently evaluate the campaign outcomes. Furthermore, because each campaign is so different from the next, it is hard to determine if the social and educational interventions are productive overall (Pinder et al., 2015).

While mailing campaigns have shown the least effectiveness (Lee et al., 2015) other research (Pulcini and Gyssens, 2013; Lee et al., 2015) argues that interactive learning with case vignettes was an effective technique in improving knowledge on antibiotic use among students. At the other end of the spectrum, various authors (Dollman, 2005; Wutzke et al., 2007; Bauraind et al., 2004; Formoso et al., 2013; McNulty et al., 2010) argue that annual social marketing campaigns in relation to reduction of antibiotic use is a successful strategy to reduce antibiotic consumption among the general population.

Previous work has shown that videos are an effective and easily replicable educational medium for improving patient knowledge about various health-related issues (Mullen et al., 1985; Nielsen and Sheppard 1988). However, Bauchner et al. showed that the use of videos would only modestly affect parental knowledge, behaviour and beliefs, and they recommended that using multifaceted approaches and targeting physicians and parents would be the most effective strategy for enhancing proper utilisation of antibiotics (Bauchner et al., 2001). Although the article came up with reasonable recommendations and examined a previously ignored issue, the use of only one video seems rather limited. Indeed, questions regarding the content of the video should have been discussed and different videos with varying graphics should have been used to determine whether the ineffectiveness had something to do with the content. It has previously been acknowledged that graphic content often elicits more attention and action compared to mere words. On the same note, incorporating information on applicable techniques for distinctive groups is required.

Waiting room posters are another education intervention that has been suggested to educate patients about antibiotic use. Nevertheless, Ash et al. determined that the use of waiting room posters to educate individuals regarding the judicious use of antibiotics was extremely ineffective especially if on the premises NPD were sold (Ashe et al., 2006). As much as the article could have played a key role in the determination of a commonly used tool, the utilisation of a poster that had more detailed information compared to the government-sponsored educational posters reduced the efficacy of the results. More often than not, the efficacy of posters revolves around providing precise information using the least words possible and extensive graphics in order to enhance their effectiveness. Nevertheless, the article provided fundamental recommendations on how the effectiveness of the poster could be enhanced. Strategies such as narrowing the educational message, incorporation of additional dissemination vehicles and improving the interaction of the parents with the poster are recommended (Ashe et al., 2006).

It has been assumed that nearly all previous interventions have been based on an information-intensive health education method that relies upon changing knowledge; and hypothesized that knowledge will directly result in behavioural changes (Edgar et al., 2009). The hypothesis that knowledge results in behavioural change should be referred to as profoundly-complex in itself, and even if it does, this sort of change will definitely be short-term —unless motivators together with values turn to be completely embedded standards that maintain lasting change are recognized within the target population (Edgar et al., 2009). Several approaches employed in Health promotion emphases the engaging target groups in the process of undergoing behavioural changes (Fresle et al., 1997). The approaches that have been employed in both social marketing and health promotion emphasis on listening to and understanding views and perceptions of individuals and how they talk about antibiotics and infections before designing educational campaigns to alter people's behaviour (Norris et al., 2013). It is believed that change in behaviour regarding the use of antibiotics is unlikely to happen unless people possess a clear sense of the significance of the change and its vital contributions (Hawkings et al., 2007). Campaigns aiming to engage the public in the fight against bacterial resistance could focus on three key elements: improving public understanding of the causes and consequences of resistance infections; raising the importance of bacterial resistance as a community issue and convincing individuals, with specific messages, that they can feasibly make a valuable positive contribution (Hawkings et al., 2007).

Several studies (Simpson et al., 2007; Heaton et al., 2008; Abbo et al., 2013; Dyar et al., 2014) suggested that it is difficult to change self-medicating behaviour among people who are professionals in their field, including physicians and pharmacists. Therefore, interventions should target healthcare students in order to implement safe behaviour in the usage, as well as in the future responsible prescription of antibiotics. In this sense, a study conducted in the USA by Abbo et al., (2013) argues that healthcare students expressed their desire to receive more education on adequate antibiotic prescribing. Furthermore, previous research (Edgar et al., 2009; Hawkings et al., 2007; Fresle et al., 1997; Norris et al., 2013) argues that a change in behaviour can only be produced with the acquisition of knowledge. Hence this would allow people to understand the causes, effects and consequences of their behaviours, which can then after be subjected to change. However, other data (Sharif et al., 2015) suggests that knowledge is actually a perpetrator of irrational NPD use, as well as of the use of antibiotic without prescription. This may indicate that vague, superficial knowledge of medication use may result in irrational use. Furthermore, this suggests that simple interventions, such as posters or brief informative sessions are insufficient to elicit a behavioural change in NPD consumers. These could only generate superficial understanding, which in return is not effective at addressing irrational use of NPD.

3.5.9. Interventions to address NPD irrational use

As mentioned in Abahussain et al. (2005), there is a need for image promotion of pharmacists as providers of medical information. Revision of prevention strategies to make them more effective was another intervention suggested by Winter and Arria (2011) to address nonmedical prescription drug use. Further research and programs to target prevention and intervention for nonmedical use of prescription drugs was highlighted in Guo et al. (2015). In his findings on athletes being less likely to use nonmedical prescription drugs, Ford (2008b) concluded that being involved in athletics, especially for women, can protect college students from substance use.

The literature discussed thus far used samples from the US and other nations, which indicates that the issue of accessing medication without prescription and excessive use by young people is a global issue. Although several factors have been cited, the implications for pharmacists and regulations in preventing this phenomenon were also addressed as the main potential interventions. Therefore, a more stringent approach based on these two directions is generally recommended. At the same time, minimal consideration has been given to approaches that focus on affordable healthcare. For example, several studies (Abahussain et al., 2005; McCabe et al., 2005; Thorell et al., 2012) note that young people of low socio-economic status tend to engage in self-medication more that young people from other social classes. In this case, it may be argued that financial necessities as related to healthcare led to the development of interdependence in medication use because this allows this group to avoid costs related to consultations. Indications into how this issue may be addressed have not been identified.

3.6. Summary

This chapter presented a narrative literature review in relation to the prevalence and cautious use of drugs in self-medication. Two main themes were debated within the literature with each presenting four subthemes. By looking at sources from 1997 to the present day it has been noted that there are no substantial changes in the trends of self-medication. This includes the use of antibiotics and polypharmacy behaviour.

Several gaps have been noted in the research assessed. To the best of the author's knowledge no previous studies have included the full range of proper self-diagnosis, proper choice of an effective OTC-drug use to treat a specific symptom, proper dosage, proper frequency of use and proper use with or without food within their operational definition of appropriate drug use. Additionally, the majority of studies simply assessed the rate of self-medication providing plain results. For this reason, these studies simply showed prevalence rates without focusing on other areas related to self – medication, such as cautious behaviour elements or appropriateness of use. This produced isolated results, in which some studies simply assessed prevalence or antibiotic use or the types of medication used. Therefore, comprehensive results have not been located.

Chapter Four: Survey Study One

4.1. Introduction

This chapter presents the main survey study. The research design used was a cross-sectional design, using a sample of university students in the UAE. Data was collected between January 2014 and April 2014 using an anonymous self-administered questionnaire that was distributed to 2875 eligible students in three randomly selected UAE universities. This survey study was the foundation of the interview study and the intervention study. The first section presents the research questions and objectives of this investigation, followed by the methodology selected and a description of the variables to be tested, corresponding to each of the research questions. The third section presents the pilot study carried out to validate the instrument used for data collection. The fourth section will present the results of the survey followed by a discussion and conclusion of this investigation.

4.2. Research Questions and Objectives

4.2.1. Research Questions

Research Question 1

What is the current status of Oral Non-Prescription Drug (ONPD) use among university students in the UAE in terms of:

a) The prevalence of ONPD use;

b) The prevalence of cautious ONPD use;

c) The prevalence of appropriate ONPD use for the most recent symptoms;

d) The prevalence of incautious and inappropriate ONPD use;

e) The prevalence of using antibiotics without a physician's prescription;

f) The prevalence of polypharmacy

Research Question 2

What are the risk factors for incautious ONPD use among university students in the UAE?

Research Question 3

What are the risk factors for inappropriate ONPD use among university students in the UAE?

Research Question 4

What are the risk factors for using antibiotics without a prescription among university students in the UAE?

Research Question 5

What are the risk factors for polypharmacy among university students in the UAE?

Research Question 6

What are the reasons for ONPD use; the sources of ONPD information; the sources of ONPD acquisition; and the therapeutic categories of commonly used ONPD among university students in the UAE?

4.2.2. Objectives

(1) To measure the prevalence of four types of irrational drug use among university students in the UAE, namely: incautious ONPD use, inappropriate ONPD use, use of antibiotics without a prescription and polypharmacy;

(2) To identify the risk factors for the incautious ONPD use, inappropriate ONPD use, use of antibiotics without a prescription and polypharmacy among university students in the UAE;

(3) To develop an appropriate educational intervention for students at higher risk of a particular type of irrational drug use.

4.3. Methodology

The purpose of this section is to provide a clear understanding and justification for the research methodology used in the main survey of the present study.

4.3.1. Justification for the use of a quantitative approach

Quantitative research is usually employed when attempting to quantify a phenomenon by generating data that can be analysed through statistical procedures (Bryman, 2006). Quantitative methods rely on numerical and measurable data, which is then sought to be generalised to a population (Creswell, 2013). Quantitative methods allow the researcher to test a theory on a large sample size using a questionnaire in a survey approach. The findings of the quantitative survey can be compared to findings of other studies. The sample size in quantitative research needs to be large enough to capture the attributes of the surveyed population (Sarandakos, 2005).

This study used several explanatory variables and examined the relationships between them, reflecting how a quantitative method captures reality in terms of the relationships between variables. Surveys that examine relationships between variables tend to be more reliable in academic projects than those that examine just the distribution of variables (Keith, 2003).

4.3.2. Choice of the Type of Observational Study

Once the research was established to be quantitative in nature, a further step in the methodology decision-making relates to the selection of the type of observational study (Saunders, 2011). Observational studies are studies in which participants are not randomised to groups while external conditions to which groups are exposed cannot be manipulated (Rosenbaum, 2002). Thus, instead of employing the experimental method, observational studies rely on participant observations for determining the outcomes of the exposure to natural. The choice of the type of observational study, on the other hand, involves the appropriate selection of the research design. Observational studies can be cross-sectional, longitudinal, case-control or cohort. . Depending on the research question to be addressed, the research design selection process is carried out. Broadly, a cross-sectional study refers to an investigation in which data is collected from a representative sample at a specific point of time, whereas a longitudinal study encompasses repeated observations over a longer period (Rindfleisch, et al., 2008). A case-control study encompasses the investigation of two groups of participants that differ on an outcome variable and are compared based on a proposed casual attribute (Rosenbaum, 2002). Finally, a cohort study refers to a specific form of longitudinal study where a group of individuals, generally patients, is monitored over a prolonged period (Schelesselman, 1992).

For the purpose of this study, a cross-sectional design seemed to be a more suitable method by contrast with a case-control study. The reason for this is that the latter type of observational study involves two groups of participants (i.e., cases and controls), which was deemed as inappropriate for the present aims, which sought to explore the prevalence of use and associated risk factors without making a comparison with any other group. Identifying risk factors in cases (i.e., students with inappropriate drug) versus controls (i.e., students without inappropriate drug and medicine use) was not feasible because there was a lack of access to students' health records. This would have allowed for a classification of participants in different groups based on whether they had any adverse effects from irrational use of ONPD.

The cross-sectional design also seemed more suitable than a cohort study. Even though a cohort study is commonly employed in health settings when attempting to analyse risk factors for certain behaviours or conditions, this type of study is exclusively longitudinal in nature—meaning that a group of people is observed over a prolonged period, usually several years (Schelesselman, 1992). Moreover, such a study assesses potential risk factors for an outcome before an outcome has occurred, all for the reason of establishing that a cause of an outcome occurred before the actual outcome and can thus be attributed to it. If one wanted to assess risk factors for inappropriate drug use by relying on a cohort study, one would need to start with the assessment of risk factors before individuals exhibit these side effects, further following them to establish whether the outcomes are related to certain self-medication behaviours. This was not feasible for the present research purposes because there were no prospects for longitudinal research as the current study sought to investigate the behaviour of young adults in relation to ONPD use and the prevalence of use at a specific point in time, without assessing this behaviour through time.

Longitudinal or cohort designs imply a long period over which data is collected, time in which behaviour is very likely to change. The choice of the present research was to employ a cross-sectional method. The first reason is that cross-sectional studies are often employed when assessing the prevalence of investigated outcomes within the health sector at a certain point in time (Coutinho, et al., 2008). It is an appropriate method when attempting to assess the burden of specific health-related behaviours in a given population so as to arrive at recommendations for planning and the allocation of health resources (Rindfleisch et al., 2008). This is in accordance with the goal of the present research - investigating the prevalence of inappropriate drug and medicine use among university students for the purpose of informing the practice. Moreover, cross-sectional studies are commonly relied on when assessing multiple outcomes and the risk factors for given health behaviours (Busk, 2005), which the present study likewise aims to achieve.

4.3.3. Choice of the Type of Data Collection Method

Once the research was established to be quantitative and cross-sectional in nature, the final step in the decision-making process relates to the choice of the data collection technique (Saunders, 2011). This step is important because reliable data collection tools help ensure the validity of the obtained data and the yielded conclusions (Delport, 2005). For the purposes of cross-sectional studies, the most appropriate data collection method is the surveying method, where information is gathered through standardised questions and procedures (Creswell, 2013). This method is also commonly employed when investigating prevalence and risk factors for various health-related behaviours (Morgan, 1998).

A survey is an appropriate means of engaging with individuals and getting them to report their experiences, focusing on features like attitudes, behaviours, beliefs, opinion and knowledge (Hagan, 2006; Neuman, 2004). A survey is also a practical way of identifying and describing the characteristics of a large sample size within the targeted population in a time-efficient way. Furthermore, surveys can determine the nature of the relations established between the variables tested (Polit and Beck, 2010).

One of the benefits of surveys is that they can be administered to many people and used in various research domains. The questions used in surveys can assess individuals' skills, behaviours and intelligence, as well as more subjective attributes, such as attitude, values and beliefs. Surveys can be answered individually without a researcher present or can be conducted in an interview where the interviewer poses questions to the subject(s). The respondent needs to possess a certain level of intelligence to complete the surveys accurately and completely (Polit and Beck, 2010). Health surveys serve as "a critical resource" to measure the health behaviours, health status and risk factors of the population of interest (Cohen, 2006, p. xi). Furthermore, Sclafer and colleagues identified that the survey methodology is particularly suitable for gathering information about drug use in self-medication practices in countries where prescription drugs, such as antibiotics, are sold without a physician's prescription (Sclafer et al., 1997).

Using a survey is the best way to collect information and to meet the goals of the current research. The decision to utilise the survey method in the first phase of this study was based on the research aims. While surveys are generally effective at collecting data, there is a threat to external validity in the form of generalisability and internal validity owing to the risk of a low response rate (Tashakorri and Teddlie 2003). When using surveys, it is also possible that the sample population does not adequately represent the broader population in question (Tashakorri and Teddlie 1998; Tashakorri and Teddlie 2003). To address this issue, students from several universities were used and a large sample size was included for this investigation. However, there is also a concern that surveys tend to result in incorrect inferences from correlations in the data and thus are considered less reliable than other tools, such as observation (Tashakorri and Teddlie 2003).

The most common types of surveying methods that a researcher can rely on are self-administered, interview, online, post and telephone surveys (Trochim, 2006). Self-administered surveys are those that participants complete on their own, either on paper or in an online form. When conducted within the context of interviews, surveys are administered by the researcher and questions are read to the participants, who then indicate their answers; this is usually done for illiterate participants. Finally, telephone surveys are conducted by trained interviewers who call potential respondents and gather relevant information during the phone call (Hoinville and Jowell, 1998). Out of these common types of surveys, the one that seemed the most suitable for the present research purposes is the self-administered survey.

The first reason for this is that self-administered surveys in comparison to interview and telephone surveys, allow for fast data collection from a high number of participants in a short period (Trochim, 2006). Moreover, self-administered surveys are rather inexpensive, and they are most likely to be employed when the goal is to estimate the prevalence of health-related outcomes and risk factors (Morgan, 1998). Additionally, the researcher had no access to the phone numbers of all the students in question and had no possibility of personally obtaining the data through interviews. Avoiding using names and addresses is also useful for protecting participant privacy and confidentiality in relation to incautious or inappropriate use of drugs, using antibiotics without a prescription and polypharmacy (Gladden et al., 2014). An anonymous self-administered questionnaire has been commonly used to explore the use of NPD among university students in the Gulf region and worldwide (Al-Malak et al., 2013; Ibrahim et al., 2015; Sharif and Sharif, 2014; Shehnaz et al., 2013; Sharif and Sharif, 2013; Sarahroodi et al., 2012; Sawalha, 2008).

It is to be noted that none of the aforementioned studies sought to research the topic that is investigated through this survey. Furthermore, none of these studies applied Andersen’s model of healthcare utilisation, which is used in this survey to determine why students engage in this behaviour. As a result, a new instrument had to be developed that would satisfy the type of data collection instrument needed to conduct this investigation.

The survey was completed in a paper-and-pencil form instead of online. The main reason for using a self-administered paper-and-pencil questionnaire rather than online is that participants could fill out the surveys in a controlled environment (no distractions). (Polit and Beck, 2013).The advantage of distributing the questionnaire in classes over a postal questionnaire is that it is much cheaper, easier, and usually has a higher response rate. However, the main disadvantages of this method include the amount of time needed to process the data collected, as well as costs involved in printing copies of the questionnaire to be distributed to participants.

4.3.4. Questionnaire Design

Bryman described a questionnaire as a written enquiry to gain information by asking respondents to reply personally to a sequence of predetermined questions (Bryman, 2006). Research objectives, respondents, resources and methods of analysis are factors that determine the size or length of the questionnaire. A self-administered questionnaire was used in this study. The questionnaire was constructed in English because the items of the questionnaire were extracted from English-based instruments. Translating these items could have resulted in issues in interpretation and therefore diminished the internal validity and reliability of the study. The majority of the participants spoke Arabic, however, based on admission criteria, they had to have a proficiency level of English for admission [(C2 Cambridge Proficiency; International English Language Testing System (IELTS); Test of English as a Foreign Language (TOEFL)]. Therefore, this implies that students can fully comprehend the questionnaire developed in English.

The questionnaire items were constructed based on existing published instruments and modified to meet the goals of this study towards identifying risk factors for the four outcomes of interests in relation to drug use. The final survey questionnaire is displayed in Appendix 3. A cover page was attached to the questionnaire that included the title of the study, information about the researcher, the nature of the study, the purpose of the study, the expected time for completing the survey and informed consent (Appendix 1 and Appendix 2).

The questionnaire was constructed and developed based on the Andersen behavioural model, or Healthcare Utilisation Model (HUM), which guided the present study (Andersen, 1968; Andersen, 1995; Andersen et al., 2007). HUM was developed in 1968 and focused specifically on behaviours related to health care utilisation. The scope of the model was to extract the factors that result in people using or not using medical services. Andersen (1968) stipulated that the dynamic established by predisposing factors, enabling factors and need, can be used as a predictive model for the medical use behaviour of people. In this sense, predisposing factors have been defined as a series of elements that make some people more likely than others to use or not to use medical services. These factors include socio-demographic characteristics but also health beliefs.

As it may be intuited from the characterisation of predisposing factors, other series of elements are to be considered when conducting a behavioural analysis related to medication use (Janssen et al., 2014). If taking sociological factors alone, then matters of social class, education and living environment are considered. For example, it may be stated that people living in an environment with reduced pollution, healthy food available and the means to afford it, are less likely to use medical services when compared to people living in opposing conditions. Another example may relate to demographic factors; in this case, people of more advanced ages may be more likely than young people to use medical services. At the same time, health beliefs also play a part in medical service use, whereby negative beliefs related to the use of medical services may result in decreased access. Overall, according to Andersen (1968), the dynamics established between the aforementioned elements create predisposing factors for healthcare utilisation.

Enabling factors refer to the totality of factors that support the person to access medical care. This may comprise access to healthcare insurance, the cost of the health service needed, the healthcare services available within the community in which the person lives, as well as support for healthcare from family and friends (Mullner, 2009). To exemplify this situation, a person may have predisposing factors that lead to him/her requiring certain medical services. For example, a person with a chronic condition such as cardiovascular disease would meet most predisposing criteria. However, if the person needs certain investigative medical services (i.e. angiogram, cholesterol testing etc.) that are not found within his/her community, and if the person does not have medical insurance and the medical tests' costs are significant, then the person would not have important enabling factors for accessing the service.

Finally, 'need' in HUM is divided into *perceived need* and *actual need*. Perceived need is defined as a subjective factor, related to medical care needs that are presumed by the user. Actual need refers to objective medical service requirements (Janssen et al., 2014). Dynamics established between these elements determine the likelihood that a person will or will access health care. For example, a person may experience minor symptoms for which he/she may use ONPD, hence subjectively assessing that accessing medical care services is not needed. The same person may decide to use medical care services and discover that symptoms may be related to a cold, for which medical care services may be needed considering predisposing factors (old age, weak immunity, virus capacity). This is a case in which the person does not perceive a need albeit objectively the need is present. Predisposing factors, enabling factors and need are also interconnected. If using the previous example, it may be observed that the person may have predisposing factors, may have a reduced perceived need and at the same time, may also lack enabling factors such as a medical insurance. Therefore, when applying HUM, it is important to consider the interactions that take place between predisposing, enabling and need categories, as well as the interactions that occur within these categories.

As it may be observed, a significant number of dynamics and interrelations can be established between these factors to predict healthcare utilisation. This aspect enables a detailed analysis of this behaviour albeit the model has been criticised (Wilson et al., 2005) for analysing health care utilisation as a binary element: present or absent. For the purpose of this study, this critique is not relevant. In this investigation, the actual scope is to see the range of ONPD use and whether students use healthcare services when experiencing certain symptoms. In this regard, the questionnaire used in this study is divided into three parts, each focused on one of the three elements from

Andersen’s model: predisposing factors, enabling factors and need. The questionnaire comprised three types of questions that were divided into three categories: predisposing factors, enabling factors and need factors. Accordingly, the survey ended up with more than 40 explanatory variables. Table 4.1 displays a summary of these factors.

Table 4.1 Summary of predisposing factors, enabling factors and need factors

Predisposing Factors	Enabling Factors	Need Factors
Age	*Education:* Colleges Year of study	Self-care orientation
Gender		
Marital status		
Nationality		
Attitude		
Effectiveness belief		
Price -effectiveness belief	*Knowledge:* ONPD knowledge Medication knowledge Source(s) of ONPD information	Perceivedhealth
Understandability belief of drug information leaflets		
Usefulness belief of drug information leaflets		
Safety concern belief		
Trust in ONPD information sources	ONPD acquisition	Reason (s) for ONPD use
Satisfaction with health care professional		
Polypharmacy behaviour	Income	
Frequency of use behavior		
Expiry date seeking behaviour	Employment	
Taking more than the recommended dose behaviour		
Respondent reading behaviour of drug information leaflet	Reasons that obstacle reading the ONPD –information leaflets	Commonly used ONPD
Leaflet keeping behaviour		
Respondent behaviour after reading the drug information leaflets		
Medical advice seeking behaviour		

Considering that there are several factors to be measured for each of the three categories in HUM, instruments that have been previously validated were integrated into the main questionnaire. Demographic characteristics focused on data regarding age, nationality and marital status which is the standard procedure for collecting data related to demographics. To measure other data, instruments were adapted from several researches as it will be detailed below.

Predisposing Factors

Predisposing factors are factors that exist before the appearance of illness that predispose individuals to use or not use ONPD. Predisposing factors include demographic characteristics, social structure characteristics and health belief characteristics.

Demographic Characteristics

Demographic characteristics include age, gender and marital status.

- Age: The age was considered as a scale.
- Gender: The gender of each respondent was coded as a binary variable: female = 1 and male = 0.
- Marital status: Marital status responses included single, married, divorced and other. Marital status was coded as a binary variable: married= 1, not married (others)= 0.

Social Structural Characteristics

- ➢ Nationality

Nationality responses options included UAE national, Arab, Asian and Iranian. Nationality was coded as a binary viable: UAE national= 1, others= 0.

Health Belief Characteristics

- ➢ Attitude:

Attitudes towards the use of drugs responses included harmful, necessary or helpful, adopted from the work by Isacson and Bingefors (2002). Participants chose only one answer. Attitude was coded as an ordinal variable: harmful = 1, necessary= 2 and helpful = 3.

- Effectiveness belief

Effectiveness belief refers to the belief regarding the effectiveness of the ONPD (Sharaideh, et al., 2013). Effectiveness belief was coded as an ordinal variable: ineffective or moderately ineffective= 1, moderately effective = 2 and effective = 3.

- Cost-effectiveness belief

Cost-effectiveness belief refers to the belief regarding whether more expensive ONPD are more effective than less expensive ONPD (Sharaideh, et al., 2013). Cost-effectiveness belief was coded as an ordinal variable: strongly disagree or disagree = 1, uncertain= 2 and agree or strongly agree = 3.

- Comprehensibility of drug information leaflet belief:

The respondents were asked to describe the comprehensibility of the information in the drug leaflets (Nathan et al., 2007). Comprehensibility was coded as an ordinal variable: very easy to understand = 1, easy to understand = 2, difficult to understand = 3 and very difficult to understand = 4.

- Usefulness of drug information leaflets belief:

Participants were asked how useful they think the information in the drug information leaflets is (Nathan et al., 2007). Usefulness belief was coded as an ordinal variable: useful = 1, not sure = 2 and not useful = 3.

- Safety concern belief:

Participants were asked whether they believe that ONPD are safe regardless of how frequently they are used (Sharaideh, et al., 2013). Safety concern belief was coded as an ordinal variable: strongly disagree or disagree = 1, uncertain = 2 and agree or strongly agree = 3.

- Trust in ONPD information sources:

The level of trust in ONPD information sources items were adopted and modified from a previously published instrument (Keshishian et al., 2008). Measurement of trust included three items: participants were asked to respond to how much they trust the medical information provided by (i) pharmacists, (ii) physicians and (iii) nurses. Possible answers were always, usually, sometimes, rarely and never. For each item, a response of always or usually earned one point, while a response of sometimes, rarely or never did not earn a point. Overall trustworthiness was calculated by summing the score for the three items, and then expressed as an ordinal variable. Participants with a total score of three points were considered to have a high level of trust in ONPD information provided by health personnel (coded as 3). A score of two was considered to be moderate trust (coded as 2), and a score of 1 or 0 was considered to be a low level of trust in ONPD information provided by health personnel (coded as 1).

- Satisfaction with healthcare professionals:

Satisfaction with healthcare professionals was assessed by three questions (Are you satisfied with the doctors (physician)? Are you satisfied with the pharmacists? Are you satisfied with the nurses?), with participants indicating that they are always, usually, sometimes, rarely or never satisfied with healthcare personnel (Keshishian et al., 2008). For each item, a response of always or usually earned one point, while a response of sometimes, rarely or never did not earn a point. Overall satisfaction was calculated by summing the points for the three items, which was then expressed as an ordinal variable. Participants with a total score of 3 points were considered to have a high level of satisfaction with healthcare personnel (coded as 3). A score of 2 was considered to be moderate satisfaction (coded as 2), and a score of 1 or 0 was considered to be a low level of satisfaction with healthcare personnel (coded as 1).

- Polypharmacy behaviour:

Polypharmacy was assessed by counting the number of ONPD used to self-treat a single symptom in a day (Pinheiro, 2011). Self-treating a single symptom with one ONPD was considered to be monotherapy, while using 2 to 4 ONPD to treat a single symptom in the span of one day was considered to be minor polypharmacy and using 5 or more drugs to treat a single symptom was considered to be major polypharmacy (Pinheiro, 2011). Polypharmacy data were originally coded as mono = 1, minor polypharmacy = 2 and major polypharmacy = 3.

- Frequency of use behaviour:

Frequency of ONPD use data were acquired as: daily use, weekly use, monthly use and yearly use (Sharaideh, et al., 2013). To create a frequency of use scale, responses were converted to a 365 day year: daily = 365, weekly = 52, monthly = 12 and yearly = 1.

- Expiration date seeking behaviour:

Expiry date seeking behaviour (Sharaideh, et al. 2013; NCPIE, 2002) was coded as a binary variable: always or often was coded as 1, while rarely or never was coded as 0.

- Taking more than the recommended dose behaviour:

Taking more than the recommended dose of ONPD was adopted and modified from a previously published instrument (NCPIE, 2002). Responses were limited to: yes, no and not sure. Data were coded as a binary variable: yes = 1, no or not sure= 0.

- Respondents' reading of drug information leaflet behaviour:

The survey questionnaire item for investigating what information respondents read in the drug information leaflet (Sharaideh, et al., 2013) included eight response categories: (1) indication, (2) dosage, (3) drug–drug interaction,(4) cautions, (5) adverse effects, (6) contraindications, (7) all of it/everything and (8) not sure. Data were coded as a binary variable: yes= 1 if the respondent reported reading all of it/everything and no = 0 for all other responses.

- Leaflet keeping behaviour:

The survey questionnaire item for retaining the ONPD package information leaflet they receive on the first time of use was adopted and modified from the previously published instrument used by Nathan et al. (2007). Data were coded as a binary variable: yes, I keep it= 1, no, I discard it or sometimes I keep it= 0.

- Respondent behaviour after reading the drug information leaflets:

Respondents were asked to identify if they have ever changed the way they take ONPD as a result of reading the drug information leaflet (Nathan et al., 2007). Data were coded on an ordinal scale: no= 1, sometimes = 2, yes= 3.

- Medical advice-seeking behaviour:

This item concerned asking pharmacists for medical advice when purchasing ONPD from private pharmacies (Lo, 2006). Medical advice-seeking behaviour was coded as a binary viable: always or often= 1, rarely or never= 0.

Enabling Factors

Enabling factors are logistical factors that ease or hinder the appropriate and cautious use of ONPD. These factors include education, knowledge, information sources, income and employment.

- Logistical Factors that Ease the Appropriate and Cautious use of ONPD
    - Education
        - *Colleges:*

Colleges were classified as healthcare or non-healthcare based on the presences of medical courses on the curriculum of study (Awad and Eltayeb, 2007; Sawalha, 2008; Suaifan et al., 2012; Sarahroodi et al., 2012). This was done because the aforementioned studies suggest that the prevalence of ONPD use tends to be increased in students who attend medically related colleges. Healthcare colleges included Medicine, Dentistry and Pharmacy. Non-healthcare colleges included Engineering, Science, Information Technology, Humanities and Social Science, Education, and Business Administration. Data were coded as a binary variable: medical = 1, non-medical= 0.

1- *Year of study:* Year of study was coded as an ordinal scale: 1st year= 1, 2nd year = 2, 3rd year = 3, 4th year = 4, 5th year = 5 and 6th year= 6.

2- *Knowledge:*

- ONPD knowledge:

ONPD knowledge comprised four survey items that were adopted and modified from previously published studies (Sharaideh, et. al. 2013; Parikh et al. 2013). This item was selected because this literature indicates that knowledge is either a protective factor against irrational use of medication or a factor that entices the irrational use. It included drug strength, drug–drug interaction, food–drug interactions and contra-indications of drug use with some medical conditions. One point was earned for each correct answer. The sum of the scores of these four items then was coded as a good, moderate or poor ordinal variable. One point was earned for each correct answer. Respondents who scored 3 or 4 items correct were considered to have good ONPD knowledge (coded as 3). Respondents who scored 1 or 2 items correct were considered to have moderate ONPD knowledge (coded as 2). Respondents who scored zero items correct were considered to have poor ONPD knowledge (coded as 1).

- Medication knowledge

Medication knowledge was coded as an ordinal variable based on six survey items in a good, moderate or poor (Isacson and Bingefors, 2002). One point was earned for each correct answer. Respondents who scored 4, 5 or 6 items were considered to have good medication knowledge (coded as 3). Respondents who scored 1, 2 or 3 items were considered to have moderate medication knowledge (coded as 2). Respondents who scored zero items were considered to have poor medication knowledge (coded as 1).

- Source(s) of ONPD information

Participants were asked to indicate their source(s) of ONPD information: (1) Professional sources, including physician, nurse, drug information leaflet and pharmacist; (2) informal sources, including friends/neighbours and previous experience;

(3) radio or TV; (4) newspaper or magazine; and (5) reading (medical books, internet). The response to each item was coded as: 1 = present (obtained from that source), 0 = absent (not obtained from that source). Participants could include more than one response for this item. This question was adopted and modified from previous instruments (Kim, 2005; Sharaideh, et. al. 2013).

- Source of ONPD Acquisition

This question was adapted from a previously published instrument (Meauri et. al., 2006). Participants were asked to indicate their source(s) of ONPD, categorised as: (1) purchase (pharmacy and supermarket); (2) leftover from previous use; and (3) informal source (family, friends, or neighbours). Participants could include more than one response for this item. Response for each category was coded as yes = 1, no = 0.

- Income

The overall family average income categories in United Arab Emirates Dirham (AED) were: below 10,000 (AED), 10,000–20000 AED, 20,000–50,000 AED, above 50000 AED, and “do not know”.

  - Employment Status

The employment of the respondents was coded as a binary variable: job = 1, no job = 0.

➢ Obstacles for Reading the Drug Information Leaflets

Respondents who indicated that they do not read the drug information leaflet before first-time use of ONPD were also asked to identify the reasons (Nathan et al., 2007). Responses included nine categories: too difficult to understand, too long, print is too small, feel that the information is not important, I get information from my doctor (physician), I get information from my pharmacist, I get information from my family/friends, the information provided worries me, common knowledge, and other to be specified. Participants could include more than one response for this item. Responses in each category were coded as a binary variable: yes = 1 and no = 0.

Need Factors

Need factors are the reason(s) that create the need for the use of ONPD. Perceived need refers to the individual's view of his/her own health and wellbeing, the way he/she experiences symptoms of illness, and the way he/she assesses the significance of seeking professional help in response to his/her illness (Andersen, 1968).

- Self-care Orientation

This question was adopted and modified from a previously published instrument (Boateng, 2009). Participants were presented with a list of 12 illnesses and for each illness, respondents chose between one of three options *as a first action of coping with the illness*: ignore the symptoms/rest, self-treat with ONPD only, and consult a doctor. Scoring was based on the total number of illnesses participants would self-treat with ONPD. This question was adopted and developed from a previously published questionnaire (Meauri, 2006; Widayati et al., 2011). Student's self-care orientation was assessed using the criteria of Isaacson and Bingefors (2002). Respondents who indicated that they would self-treat five or more conditions with ONPD were considered to have a high self-care orientation (coded as 1), while respondents who indicated that they would self-treat less than five conditions with ONPD were considered to have a low self-care orientation (coded as 0), as identified by Isaacson and Bingefors (2002).

- Perceived Health

The perceived health status of respondents was measured using a previously published instrument that assesses how students view their own general health on a five-point scale: very good, good, average, poor and very poor (NCPIE, 2002). Perceived need was coded as an ordinal scale: very good = 5, good = 4, average = 3, poor = 2 and very poor = 1.

- Reason (s) for ONPD Use

This question was adopted and modified from previously published instruments (James et al., 2006; James et al., 2008; Meauri et. al., 2006; Sharif et al., 2012; Sharif and Sharif, 2014). Reasons included: it saves money, it saves time (waiting time/transportation time). General waiting times in the UAE can exceed 48 hours, from the request of medical service to the appointment date (The National, 2018). Other reasons included: my illness is not serious enough to require seeing the physician (minor illness), for prevention of diseases, my previous experience of treating illness, emergency, and ONPD are just as effective as prescription drugs. Participants could choose more than one response. The response to each reason for ONPD use was coded as a binary variable: yes = 1, no = 0.

Other Factors

- Most commonly used ONPD

Participants were asked to indicate the category (or categories) of ONPD they have most commonly used by choosing from a list of ONPD as described in Chapter One (scope of the study). The list included cough and cold drugs analgesic/antipyretics, antacids, antibiotics, anti-diarrheal, anti-nausea and vomiting, anti-allergic, laxatives, pain relief and spasmolytic drugs. Participants could choose more than one response. Responses to indicate usage of that specific drug were coded as a binary variable: yes = 1, no = 0.

Dependent Variable for Research Questions Two

- Cautious ONPD use

A cautious ONPD user was operationally defined as an individual that reads the drug information label before use for the first time (Bolaños, 2005). The word “leaflet” was used instead of “label” because Bolaños identified that his definition has been originated from the idea that consumers do not read labels or leaflets of NPD (Bolaños, 2005).

Furthermore, all drugs that are sold in the pharmaceutical markets of UAE should have drug information leaflets according to health authority laws and regulations. Furthermore, if part packs of the original packs are required then the consumer should be given (free of charge) a copy of the original drug’s leaflet from the pharmacy (Dubai

Health Authority, 2013). The assessment of incautious use was adopted and modified from an existing published instrument (Lo, 2006). Participants were asked whether they read the ONPD leaflet before first use and could choose between four responses: always, often, rarely or never. Participants were considered as cautious ONPD users if they reported that they always or often read the ONPD information leaflet before the first-time use, while participants who reported that they rarely or never read the ONPD information leaflet before the first-time of use were considered to be incautious ONPD users. Incautious ONPD use was scored as a binary variable: always or often read = 1, rarely or never read = 0.

- Appropriate ONPD Use

Appropriate ONPD use was operationally defined as using ONPD correctly in terms of the following five assessment criteria: self-diagnosis, self-selection of ONPD, dose, frequency of use and food–drug administration. Furthermore, appropriate drug users were classified into three categories: "most appropriate users" if five assessment criteria were correct; moderate appropriate users if four or three assessment criteria were correct; and least appropriate users if one or two assessment criteria were correct.

Table 4.2 The tool used for assessing appropriate use of ONPD with an example

Symptom	Name of drug	Dosage form (tablet, capsule, syrup)	Dose (Number of doses per time)	Frequency (Number of times per day)	Drug-administration	
					Before food	After food
Headache	Panadol®	tablet	2 tablets	3 times		√

The operational definitions of the assessment criteria follow:

- Self-diagnosis

The assessment of appropriate self-diagnosis was based on the "reported symptoms approach" (Sclafer et al., 1997; Sarahroodi et al., 2012; Pinheiro, 2011;

WHO, 1998; Wilkinson et al.1987). Appropriate self-diagnosis included acute “minor” symptoms that can be self-treated with NPD drugs such as coughs, cold symptoms, indigestion, diarrhoea, constipation, headache, toothache, muscular aches, backache, and occasional pain, along with fever, sore throat, allergies, nausea and vomiting, skin rash and itching (National Health Services (NHS), 2014; U.S. National Library of Medicine; 2013). From the other side, inappropriate self-diagnosis included serious symptoms that cannot be self-treated with ONPD and required seeing a physician, such as shortness of breath, which is usually due to heart or lung disease or many other problems that require a differential diagnosis procedure to be carried out by a physician (NHS, 2014).

Other conditions that are under ‘Referral Criteria’ included a cough that is associated with one or more of the following symptoms: blood-stained or coloured mucus, a rash, neck stiffness (risk of meningitis) and earache (Buttercups Training, 2011, p.6).

- Self-selection of the Drug

Appropriate self-selection refers to any drug that is considered pharmacologically effective for treating the diagnosed symptoms based on drug monographs in the 63rd edition of the British National Formulary (BNF) (BNF, 2012). Inappropriate drug selection includes any drug that is considered not pharmacologically effective for treating the diagnosed symptoms, according to the BNF (2012) or antibiotics drugs because antibiotics drugs should be taken only with a physician’s prescription (Awad and Eltayeb, 2007: Sclafer et al., 1997).

- Dose

Doses of ONPD were considered appropriate only if they aligned with the dosage recommendations of the 63rd edition of the BNF (2012). Respondents who reported taking more than the maximum or less than the recommended dose were considered inappropriate ONPD users.

- Frequency

Drug frequency refers to the number of times ONPD were taken per day, either one time daily, two times daily, three times daily or four times daily. Any type of frequency of ONPD use that was not aligned with the frequency of use recommended by the 63rd edition of the BNF, was considered inappropriate use (BNF, 2012).

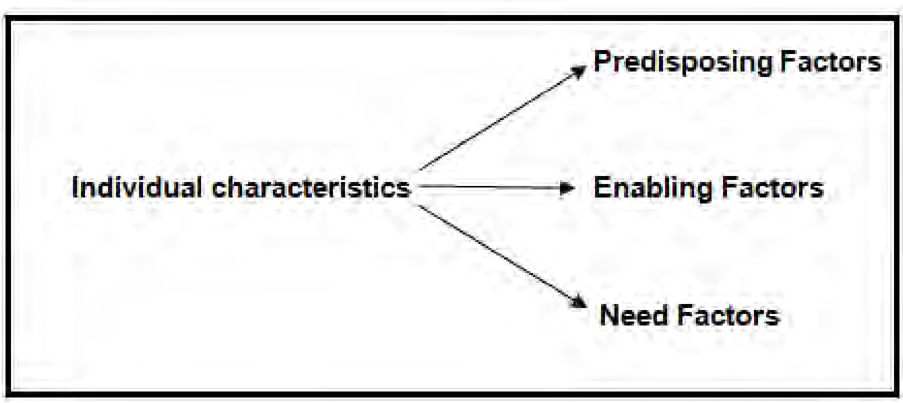
- Food–drug Administration

Any participant who failed to correctly identify whether their ONPD was to be taken before food or after food was considered an inappropriate ONPD user. Assessment of appropriate food–drug administration was based on drug monographs in the 63rd edition of the BNF, the published guideline of food–drug interaction and the published guideline on food–drug interactions and drug–nutrient interactions by the Institute of Food and Agricultural Sciences, University of Florida (BNF, 2012; FDA and NCL, 2013; Bobroff et al., 2009).

.43.5. HUM and Tested Variables

HUM (Andersen, 1968; Andersen, 1995; Andersen et al.2007; Andersen and Newman, 1973) was designed for investigating healthcare utilisation, where utilisation is defined as “the actual use of personal health services and everything that facilities or impedes their use” (Andersen et al., 2007, p.3). This model suggests that individual characteristics are determinants of access to healthcare services (Andersen, 1968; Andersen and Newman, 1973). These individual characteristics include predisposing factors, enabling factors and need factors (Andersen, 1968; Andersen, 1995; Andersen et al., 2007; Andersen and Newman, 1973) as shown in Figure 4.1.

Figure 4.1 Individual characteristics in the Andersen model



The Andersen model for health services utilisation is an appropriate choice for investigating potential determinants of ONPD use because this model has also been successfully used in previous research concerning drug usage (Linden et al., 2005; Wijesinghe et al., 2012; Varenne et al. 2006; Zyl-Shalekamp, 1993). Furthermore, the Andersen model's applicability for health services utilisation has been demonstrated by previous research on immigrants (Akresh, 2009; Guendelman and Wagner, 2000) which is relevant in this case because people living in the in the UAE are of different cultures and ethnicities. Furthermore, Brown-Orgodnick (2004) identified that university students have many characteristics that are common to the Andersen model for explaining the utilisation of health services. Conclusively, the variables investigated in the Anderson model were selected in the present study because of their relevance for answering the research questions.

4.3.6. Setting and Target Population

The target population for this study consisted of undergraduate university students in the UAE. This study was conducted in three academic universities in the UAE that offer healthcare and non-healthcare undergraduate programmes, as shown in Table 4.3.

Table 4.3 Universities offering both medical and non-medical undergraduate programs in the UAE during the academic year 2013–2014.

Emirate	Universities
Al-Ain	United Arab Emirates University (UAEU) Al Ain University of Science and Technology (AAU)
Dubai	Higher Colleges of Technology (HCT)
Sharjah	University of Sharjah (UOS)
Ajman	Ajman University of Science and Technology(AUST)

4.3.7 Sampling

4.3.7.1. Sampling Technique

A multistage sampling technique was used in the present study via a three-step cluster sample method (Ross, 2005). The five universities listed in Table 4.3 are homogenous as they all are accredited by the Ministry of Higher Education and Scientific Research in the UAE and are similar to each other in terms of the types of students (medical/non-medical, male/female, age and regions). In the first stage, a cluster random sample of universities was used. Three universities were selected out of the five UAE universities that offer medical and non-medical programs (listed in Table 4.3) by random sampling using a simple random number table. The sampling frame was drawn from a list of all eligible universities that offer both healthcare related and non-healthcare related undergraduate programs. The list was obtained from the UAE Ministry of Higher Education and Scientific Research website (MOHESR, 2013).

In the second stage, three healthcare and non-healthcare colleges from each university were selected by stratifying into healthcare and non-healthcare colleges. A simple random sampling technique was then used to select one healthcare college and two non-healthcare colleges within each university. The three colleges were randomly selected from the list of colleges published on the official website of each university by simple random sampling using a simple random number table. The randomly selected universities use a credit hour system, so any single classroom can potentially have students of different years of study (1^{st}, $2^{nd,}$ 3^{rd}, 4^{th}, 5^{th} and 6^{th} year of study), therefore years of study are mixed within the classes. In the third stage, a simple random sample of classes was selected from each randomly selected college using techniques described by Ross (2005, p.12) and Li, (2016, p.180). The sampling frame was based on the list of all the classes offered during the spring semester of the 2013/2014 academic year, obtained from the Deans' offices at the respective colleges within the universities. The researcher visited and invited all students within these classes to participate in the present study..

4.3.7.2. Sample Size Determination

A formula was used to estimate the sample size for this study. As the true value for the proportion of inappropriate use of ONPD was unknown, 50% was used as a sensible starting point. The desired level of confidence was set at 95% and the desired level of precision was set at 0.03 on either side, such that the estimated proportion of inappropriate use was within 3% (i.e. 47–53%). The following formula was applied (Ali et al., 2010; Awosanya et al., 2013; Berenson et al., 2009; Ott and Longnecker, 2010; Young, 2012):

$$\boldsymbol{n = (Z^2 \times P\ (1 - P))/e^2}$$

Where Z = value from standard normal distribution corresponding to desired confidence level [Z = 1.96 for 95% Confidence interval (CI)]

P = expected true proportion

e = desired precision (half-desired CI width).

Based on this formula, a sample size of at least 1068 ONPD users was needed. Assuming that the prevalence of ONPD use was 37.7% among students (Sawalha, 2008), to acquire 1068 ONPD users, a total of 2833 students would be required. The present study identified 2875 eligible participants and collected data from 2519, which included 1348 that used ONPD during the 90 days prior to the study data collection.

4.3.7.3. Inclusion and Exclusion Criteria

Participants were included if they were:

- Undergraduate students
- Aged 18 years or older
- Enrolled in spring academic semester 2013–2014
- Met the English proficiency admission requirements established by the University [Cambridge English Proficiency score for university C2, grade A, B, C; International English Language Testing System (IELTS); Test of English as a Foreign Language (TOEFL)]
- Had prior experience with the self-use of ONPD

- Had not previously taken the survey while attending other classes.

Participants were excluded if they were:

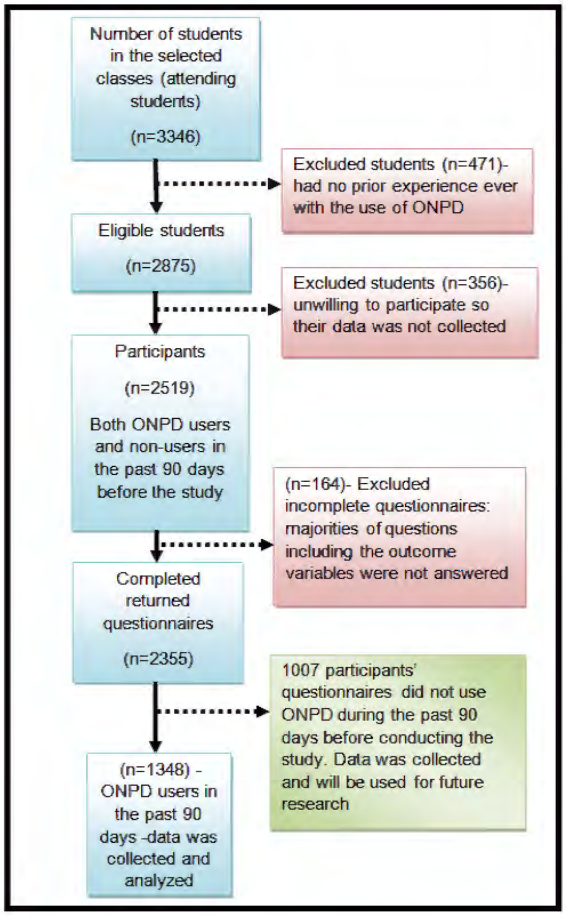
- Under 18 years of age
- Not a student (e.g., tutors, staff and employees)
- If they were postgraduate students (e.g., masters or doctoral students)
- If they had no prior experience ever with the self-use of ONPD
- If they had previously taken the survey while attending another class

Figure 4.2 shows the survey sample flow chart. As it can be observed from this figure, the total number of students that were attending the selected universities at the time of conducting this study was 3346. From this number, a total of 471 were excluded because they did not use ONPD. This exclusion was conducted because the scope of this study is to investigate ONPD use behaviour. Since the 471 students did not use ONPD, this behaviour in the sample could not be studied and the students were therefore eliminated.

The remaining number of eligible students based on the criteria of having used ONPD was 2875. From this number, a total of 356 did not agree to participate in the study, and they were also eliminated. A total number of 2519 students remained. This sample contained students that used ONPD at least once. From this sample, 164 were eliminated because they did not provide answers to all the questions of the instrument. A total of 2355 questionnaires were returned with complete answers.

To avoid participant recall bias, students that used ONPD medication over 90 days before the completion of the questionnaire were eliminated. Therefore, the study included only students that used ONPD within 90 days prior to completing the questionnaire. A total of 1007 participants were eliminated based on these criteria as over 90 days have elapsed since they last used ONPD to the completion of this questionnaire. Data collected for these participants was not discarded as this could potentially be useful in other research, such as determining causes for which the ONPD was used. Participants provided informed consent and were aware that the data collected could also be used in other research. Finally, the remaining number of participants was 1348 (n=1348).

Figure 4.2. Survey flowchart



A potential limitation derived from the selection process may refer to the 90 day period selected as a criterion for inclusion. It may be argued that recall bias can emerge much sooner than three months since the event. Recall bias has been reported to be present even after 24 hours (Shumaker et al., 2009). Another limitation of the selection process refers to excluding participants that did not use ONPD. Data from these participants could have been compared with data from those who did use ONPD. However, while this was beyond the scope of this survey, it could have also provided a deeper analysis of ONPD use behaviour.

4.3.8. Access and Permissions

Permissions and access were acquired from the office of the Vice Chancellor at each participating university and from the Dean of each participating college. Each Dean provided written approval for the researcher to have access to students within the college for survey data to be collected during classes at the college. Each Dean identified one administrative staff member to provide logistical support for this study.

4.3.9. Data Collection Procedures

Data were collected in a uniform manner across classrooms, colleges and universities. The researcher collected the data. When it was time for the class to begin, the class instructor, who had previously provided verbal consent for class participation to the researcher, introduced the researcher. All the class instructors were fully co-operative with the researcher. The researcher provided a personal introduction and briefing for the study, informing the students of the nature of the study, the purpose of the study and the expected time to complete the questionnaire.

An informational invitation letter was handed to each student by the researcher (Appendix 1) and an informed consent file was included in the cover page of the questionnaire (Appendix 2). Furthermore, a “visual aid” with coloured pictures of commonly sold ONPD in the UAE pharmaceutical market (seven pages) was handed to each participant with the questionnaire (Appendix 3) to make it easier for participants to remember the ONPD that they might have used for self-treatment of their most recent single symptom.

Students were informed (on the cover page of the questionnaire) that their participation is voluntary, that they were under no obligation to participate in this study, and that they were free to withdraw without giving a reason at any stage of the study before completing and submitting the survey. Furthermore, participant privacy and confidentiality were assured because no names were requested at any time. Students were asked to read the information sheet that was attached to each questionnaire and were informed that by completing the questionnaire they would agree to participate in the study. If they agreed to participate, students then turned to the next page and began the survey. The survey took approximately 20 minutes for most students. Students who did not meet the inclusion criteria or chose not to participate could leave the classroom for 20 minutes or until the survey was completed and all survey sheets were collected. The majority of the respondents showed an interest in the topic of the research and were therefore motivated to complete the questionnaire. When all students in the class had finished the survey, the surveys were collected by the researcher and immediately placed in an envelope. Each envelope was coded with the name of the class, college and university, and the time of the class. Finally, the instructor and the students were thanked for participating in this research.

4.3.10. Data Analysis

4.3.10.1. Data Screening

The data collected was analysed by using the IBM Statistical Package for the Social Sciences (SPSS). The accuracy of data entry was checked during an initial screening. Errors in data entry were minimised by employing cleaning and validation procedures and using frequency tables and random checks of data entry for the questions. The data was also rechecked after the completion of this process. Using frequency tables enabled the identification of data entry errors. For example, variables that were coded with two numbers (i.e. gender), thus having only two possible answers, were in some cases noted to display a third value. Manual location and correction of errors were conducted in this case.

4.3.10.2. Descriptive Statistics

All data were entered and analysed using SPSS version 20. Descriptive statistics were calculated for all variables. The two main types of variables generated from this survey study were categorical variables and continuous (interval) data. Continuous (interval) data were summarised by mean and ± Standard Deviation (SD); categorical data were summarised by frequency and percentage. Descriptive statistics served the purpose of determining specific sample characteristics that could be further used in applying Andersen's Model by focusing on the majority of predisposing factors, such as age and nationality.

4.3.10.3. Bivariate and Multivariate Statistical Analyses

The present study incorporated bivariate and multivariate statistical analysis techniques. In bivariate statistical analysis, the chi-square test of independence is appropriate for exploring the relationship between two variables in isolation, disregarding other variables (Agresti, 2002a; Agresti, 2002b; Howell, 2014; Tabachnick and Fidell, 2007). In the present study, it was important to use bivariate analysis because of the need explore the relationships between individual predisposing factors, enabling factors and need factors.

In contrast, multivariate statistical analysis, like Binary Logistic Regression (BLR), assesses the effects of multiple predictor variables simultaneously, therefore, all other included variables are accounted for (controlled for) when evaluating the effect of any individual variable on the measured outcome (Agresti, 2002a; Agresti, 2002b; Howell, 2014; Tabachnick and Fidell, 2007). Therefore, multivariate statistical analysis, in the form of BLR, was a necessary component of the analysis. Explanatory variables were considered statistically significant at a threshold of $p< 0.05$.

4.3.10.3.1. Binary Logistic Regression

"BLR is a statistical analysis that determines the value of variance, for a dependent variable, by a set of independent variables" (Hauke and Kossowski, 2011). Furthermore, this method eliminates the assumptions needed in linear regression analysis, particularly, linearity, normality, homoscedasticity and measurement level. However, other assumptions need to be considered:

Firstly, there should not be high inter-correlations (multi-collinearity) among the predictors. This can be assessed via correlation matrix among the predictors. The bivariate correlations among all independent variables were calculated using Pearson, Kendall's tau and Spearman's correlation coefficients to diagnose the multi-collinearity (Hauke and Kossowski, 2011). Pearson correlations can only indicate if two variables are linearly correlated. Spearman's correlation was also used to determine the rank of association between the tested variables. Kendall's Tau was used to test the similarity of ranks. Hence, these non-parametric tests were used to determine the degree to which certain variables related to one another and through these associations, explain ONPD use behaviours.

The BLR model was the appropriate statistical analysis method because the dependent variable for each analysis consisted of two non-overlapping categories. Furthermore, the goal of the analysis was to determine which of the 43 individual independent (predictor) variables were significantly predictive of the binary outcomes after accounting for all other predictors in the analysis (Agresti, 2002a; Agresti, 2002b; Tabachnick and Fidell, 2007).

4.3.10.3.2. Chi-square Test of Independence

The chi-square test of independence was the appropriate bivariate statistical analysis to test the bivariate relationship (independence) between each predictor and the given outcome variables in isolation of other variables. The chi-square test assumes that the data are frequency counts within non-overlapping categories, the data are drawn independently of other data in the analysis and the amount of data (sample size) is sufficiently large (Agresti, 2002a; Agresti, 2002b; Howell, 2014; Tabachnick and Fidell, 2007). This test was therefore used to determine if there is any significant association between two tested variables in certain groups that were determined based on specificity of behaviour (i.e. cautions vs. incautious use of ONPD).

4.4. Pilot Study

It was important to pilot test each self-administered questionnaire item prior to data collection. The present study validated the tool used for assessing appropriate ONPD use via a panel of ten experts and then tested it for inter-rater reliability. In addition, test-retest reliability was conducted for the tool of responsibility of ONPD use. Furthermore, the reliability of the initial questionnaire and the reliability of the modified questionnaire were measured. Self-administered questionnaire data were then objectively scored and analysed with quantitative statistical analysis, with the aim of generalising the results from the sample to all university students in the UAE.

4.4.1. Purpose of the Pilot Study

- To test the validity and the reliability of the tool assessing the appropriateness of ONPD use

- To measure the reliability of the tool assessing cautious ONPD uses
- To assess the clarity of the survey and the reliability of the modified questionnaire

4.4.2. Validity and Reliability of the Instrument for Assessing Appropriateness of ONPD Use

To assess the appropriateness of ONPD use, the researcher conducted a review of relevant literature to identify currently used criteria for assessing appropriate drug use (Awad and Eltayeb, 2007; James et al., 2006; James et al., 2008; Sclafer et al., 1997). Based on this review, five assessment criteria were identified, namely appropriate self-diagnosis, appropriate self-selection of ONPD, appropriate dose, appropriate frequency of use and appropriate food–drug administration. Face and content validity were evaluated by a panel of experts from the American Hospital Dubai (Turocy, 2002). The panel consisted of ten physicians, as it is unlikely that more than ten experts would be consulted to test the validity of a tool (Zamanzadeh et al., 2015, p.168).

Each participant was provided with an invitation letter and an informed consent letter (Appendices4 and 5). Three main questions were asked to test the validity of the tool. Firstly, is the tool valid for measuring appropriate drug use? Secondly, are there any other assessment criteria that can be added? Thirdly, are there any assessment criteria that can be deleted? For each question, panel members could choose one of the following answers: “yes”, “no” and “not applicable”; if the answer was yes, then they were asked to specify the assessment criteria (Appendix 6). Data were collected in a uniform manner across panel members in compliance with the ethical guidelines of Gloucestershire University.

The entire panel agreed that the tool is valid as they believed that the tool measures the appropriate use of ONPD (Turocy, 2002). Furthermore, six out of the ten members agreed that there is no other criterion that could be added (i.e. all the important criteria are included in the tool). This achieved tool validity. Nevertheless, one member suggested the inclusion of drug potency in the assessment tool because some ONPD drugs (for example Profen®) are available in multiple levels of potency, which is important for determining appropriate drug dosage per day. Based on this insight, the strength of the drug was added in the assessment tool. Two of the three remaining members identified that the “side effect” criterion should be added to see if the drugs cause allergy to the user. Therefore, one question was added: “what was the result of your self-treatment with ONPD?” (Parikh, et al., 2013). To determine the reliability of the survey for determining the appropriateness drug use, two physicians were selected to assess the responses of 50 university students. Informed consent was acquired from the participants (Appendix 7).

The agreement between the two physicians was measured using Cohen’s κ test. The overall agreement between the two raters was 94% (42+5/50 × 100%). There was substantial agreement between the two physicians’ judgments, $\kappa = 0.737$, (95% CI, 0.153 to 0.917), *p* <0 .0001 (Howell, 2011; Viera and Garrett, 2005). Accordingly, the assessment of appropriateness was sufficiently reliable to be used in data collection for this study. The results of the inter-rater reliability investigation are displayed in Table 4.4

Table 4.4 The number of correct and wrong scores measured by the two raters (n =50)

First rater	**Second rater**				**Total**		**Kappa**	***P*-value**	**No. of Valid Cases**
	Wrong		**Correct**						
	n	***%***	***n***	***%***	***n***	***%***	0.737	0.000	50
Wrong	5	100 %	3	6.7%	8	16.0%			
Correct	0	0.0%	42	93.3%	42	84.0%			
Total	5	100 %	45	100%	50	100%			

A second survey of 45 community pharmacists was selected to identify the number of assessment criteria required to consider the user as an inappropriate drug user. Invitation letters and informed consent were handed to the participants (Appendices 3 and 8). Three main questions were asked. Firstly, how many assessment criteria out of the five identified criteria are required to consider the user as an appropriate user? Secondly, can the inappropriate user be classified into one of the following categories: most, moderate and least appropriate user? If yes, then the participant must specify the number of criteria required for each category (Appendix 9). All participants agreed that the five assessment criteria are all required to be included in the tool to assess the appropriateness of the of the drug use. A total of 38 participants agreed that inappropriate drug users can be classified into the into three categories: most inappropriate users if all the five assessment criteria were incorrect, moderately inappropriate users if four to three assessment criteria were incorrect and least inappropriate users if one or two assessment criteria were incorrect.

4.4.3. Determining the Reliability of the survey for Assessing Cautious ONPD use

To determine the reliability of the survey for assessing cautious use of ONPD, 50 participants were asked; “when you use oral non-prescription drugs for the first time, do you read the oral non-prescription drug leaflets before use?” Possible responses were “always”, “often”, “rarely” or “never” (Lo, 2006). For examining cautious behaviour in a structured and concise manner, it was considered that the behaviour of reading the information leaflet is sufficient to indicate cautious use. Therefore, only this question was addressed to participants.

Participants were provided with Invitation letters and the questionnaire (Appendices10 and 11). Overall, 40 participants agreed to participate in the re-test survey. Forty participants were asked this question twice, 30 days apart, to determine the test–retest reliability of this tool using the intra-class correlation (ICC) statistical analysis (Howell, 2011). A good degree of reliability was found between the two assessments (Koo and Li, 2016); the single measure ICC was 0.760 with a 95% confidence interval from 0.590–0.865, $F(39, 39) = 7.327$, $p<0.0001$).

4.4.4. Determining the Clarity and Reliability of the Survey Questionnaire

The questionnaire used to collect the data was tested in the multi-phase pilot study. In the first phase, 80 students across colleges at one university were surveyed to determine the clarity and simplicity of questions and to identify questions or response options that required modification or removal (Appendix 12). To select the student participants for this investigation, one of the universities participating in this study was randomly selected. A convenient sample of 80 students was further selected to carry out the first phase of the pilot testing. To minimise recall bias, a seven-page booklet developed with the aid of community pharmacists (n=50) was provided to participants. The booklet contained the most commonly used ONPD and was intended to enable recall of the packaging in the eventuality that participants could not recall the brand name or the generic name.

From phase one of the study, the actual improvements to refine the study survey included improvements to the wording and design of the survey, clarifications in the wordings of questions and answers, and redundancy elimination. The modified version of the questionnaire was tested in phase two (*n* =20) of the pilot study. The final questionnaire contained 30 questions with six pages (Appendix 3). To measure the internal consistency (reliability) of the modified questionnaire, a reliability analysis was conducted and Cronbach's Alpha (α) was calculated for the pilot study (*n* =20 for phase two) after the questionnaire was adjusted based on feedback from phase one. The Cronbach's Alpha (α) of the modified questionnaire was 0.893; therefore, the modified questionnaire has good reliability (George and Mallery, 2003, p.231).

The pilot study therefore comprised three different categories of participants: physicians, pharmacists and students. Agreement between these mixed panels led to further improvements in the initial tool developed. A total number of 22 modifications have been made encompassed in 8 broad categories. These were:

- Reduction in the number of total pages used for the questionnaire; this modification resulted from the fact that participants found difficult to follow the initial version of the questionnaire;
- Full transcription of ONPD as oral non-prescription drugs to avoid misunderstandings; this modification resulted from the lack of familiarity with the term ONPD;
- Replacement of the words considered ambiguous (i.e. frequency);
- Questions considered to be incomplete were expanded;
- Redundant questions were removed;
- Exemplified ONPDs were replaced with the most commonly known brands;

- Arabic translations added for each symptom tested to avoid ambiguity;
- The initial 30 day period of ONPD use was changed to 90 days to encompass stress times (exams) in which students would be more likely to use ONPD.

4.5. Ethical Considerations

This study complied with all ethical requirements for scientific research outlined in the University Research Ethics Handbook. Study approval was provided from the respective Universities where the surveys and interviews took place (Appendix 13). The research ethics committees at the participating universities provided approval for the study (Appendices 14 and 15). All participants were 18 years of age or older. Participation was voluntary and anonymous. Prior to participation in the study, all potential participants were informed of the aim of the study and were informed of their right to refuse participation or withdraw from the study at any point without prejudice before completing the survey. Students were informed that by completing the questionnaire they agreed to participate in the study. Participation was anonymous in that no names or personally identifying information were collected from participants at any time. Data were kept confidential as data protection’s standards were observed at all times. All data were kept private and secure in a locked office so that only the researcher had access to the data. Data will be destroyed 5 years after the study is completed. Respondents were assured that the data will be used for the study purpose only. No incentives were provided for participation.

4.6. Summary of the Methods

This study utilised a quantitative, cross-sectional study design. A multi-stage pilot study was conducted before data collection. Data were collected on site with a self-administered questionnaire composed of three categories of independent variables. These included predisposing, need and enabling factors. Verbal consent was obtained from participating students. Appropriate statistical analyses were used. The present study met all ethical requirements to protect the rights of participants.

4.7. Results

4.7.1. Introduction

This chapter presents the main survey study, which was a cross-sectional design using a sample of university students in the UAE. Data were collected between January 2014 and April 2014 using an anonymous self-administered questionnaire that was distributed to 2875 eligible students in three randomly selected UAE universities. This survey study was the foundation of the interview and the intervention studies.

4.7.2. Survey Response Rate

A total of 3346 students were approached from different universities of UAE to be surveyed on their behaviours associated with ONPD use. A total of 2875 students were eligible for the survey based on the inclusion criteria established for this study. Out of the 2875 eligible students, 2519 agreed to participate in the study, reflecting an overall response rate of 75%. The total number of respondents that completed all sections of the survey (i.e. with no missing values) was 2355 respondents. The initial analysis of 2355 responses showed that about 57.2% (1348 of 2355) reported using ONPD in the past 90 days before conducting the study. "Since the association between individual characteristics and recall error increases with the length of the recall period" (Kjellsson et al., 2014.p.34) only the responses of 1348 participants were used for further analysis. Preferring shorter recall periods best suits the objective of this study to find out the relation between the outcome of interest and individual characteristics for micro-level analysis (i.e., regression analysis).

Demographic data from 3346 students registered with the participating Universities were collected based on the attendance sheet that was used to calculate the response rate. With this data, information on ONPD use in the past 90 days from the 1348 respondents was also collected for descriptive statistics. Analysis of groups showed that there was no significant difference concerning gender, nationality, year of study, college and the university, using chi-squares (Table 4.5). Furthermore, there was no significant difference in relation to age. This was determined using Two-Sample T-Test which is also known as independent T-Test (n=3346, Mean age=20.94±1.848) and users (n=1348, Mean age =20.94±1.838); t=-0.096, df=4695, p=0.923.

Table 4.5 illustrates the demographic data for the sample included in the study. The data is extracted from the questionnaires delivered. Variables tested included gender, year of study, nationality, university, and college. A chi-square test was conducted to determine if there were any significant differences between the participants included in the study (group 2) and the total number of participants available for the study (group 2). In this case, the null hypothesis states that there is no difference in terms of the tested demographic variables between the population selected to participate in the study and the total population available. The alternative hypothesis thus states that there is a difference between the two populations in terms of the variables tested. To confirm the null hypothesis, the statistical value of significance is set at $p<0.05$. This test is therefore conducted to ensure that the population selected for further assessment in the study does not present demographic characteristics different from the available population. Because HUM sets an emphasis on predisposing factors that include demographic elements, it was essential to remove any potential sampling errors derived from the inclusion criteria of using ONPD.

Table 4.5 Distribution of the demographic characteristics between total attending students (group 1 = 3346) and respondents who had used ONPD in the 90 days prior to conducting the study (group2 = 1348)

Variable	**Group 1** (n=3346)		**Group 2** (n=1348)		x^2	***p*-value**
	n	%	n	%		
Gender						
Female	2766	82.7	1100	81.6	0.784	0.376
Male	579	17.3	248	18.4		
Nationality						
UAE National	1493	44.6	646	47.9	5.075	0.280
Expatriate	1853	55.4	702	52.1		
Year of study						
1st year	199	5.9	100	7.4		
2nd year	699	20.9	301	22.3	8.110	0.150
3rd year	1055	31.5	391	29.0		
4th year	1082	32.3	416	30.9		
5th year	247	7.4	111	8.2		
6th year	63	1.9	29	2.2		
College						
Healthcare:						
Medicine	404	12.1	186	13.8		
Dentistry	372	11.5	155	11.5		
Pharmacy	488	14.6	151	11.2		
Non-Healthcare:					12.933	0.114
Science	290	8.7	114	8.5		
Engineering	467	14	193	14.3		
Information T.	125	3.7	51	3.8		
Humanity	588	8.7	226	16.8		
Education	268	17.6	122	9.1		
Business	343	10.3	150	11.1		
Universities						
Sharjah university	1121	33.5	415	30.8	3.335	0.188
UAE university	1260	37.7	534	39.6		
Ajman university	964	28.8	399	29.6		

The results of the descriptive statistics indicate that the majority of participants in the group to be tested are female (81.6%), with 47.9% being UAE nationals and 52.1% being expatriates. Most of the participants from the sample selected are 4th year students (30.9%), with 29% being 3rd year students and 22.3% being 2nd year students. 36.5% of students in the selected sample were in a healthcare related college (13.8% medicine, 11.5% dentistry and 11.2% pharmacy). No significant differences were found; this indicates that the selected sample is representative of the population.

4.7.3. Respondent Characteristics

4.7.3.1. Socio-demographic Characteristics of the Respondents (n = 1348)

Among the 1348 respondents which were further included in the study, the majority were females (1100; 81.6%), not married (1235; 91.6%), and not employed during the study period (1270; 94.2%). The age ranged from 18 to 35 years with a mean age of 21 years (SD = 2.0). UAE nationals were highly represented in the sample at47.9%, followed by Arabs (44.1%). The majority (82.2%) of the respondents were in their second, third and fourth year of study. Around one-third of the respondents (36.5%) were healthcare students. Below half of the respondents (47.0%) reported an average monthly family income between 10,000 and 50,000 Emirati Dirham (AED) and 35.8% did not know their monthly family income. With respect to the current health status, the majority (80.2%) of the sample reported very good to good health status. With reference to self-care orientation, two-thirds of the respondents (67.8%) had a high self-care orientation (treating five or more symptoms with ONPD as a first step in coping with health symptoms). Table 4.6 shows the distribution of socio-demographic variables among the respondents. Responses were collected for this data from point 30 of the questionnaire.

Table 4.6 Distribution of socio-demographic variables of the respondents (n =1348)

Socio-demographic Variables	Number	Percentage
Age		
18	83	6.2
19	198	14.7
20	289	21.4
21	335	24.9
22	224	16.6
23	125	9.3
≥24	94	7.0
Gender		
Female	1100	81.6
male	248	18.4
Marital Status		
Married	113	8.4
Not married	1235	91.6
Nationality		
UAE National	646	47.9
Expatriate:		
Arab	595	44.1
Asian	44	3.3
Iranian	45	3.3
Others	18	1.3
Sub-total	702	52.1
Universities		
Sharjah university	415	30.8
UAE university	534	39.6
Ajman university	399	29.6
Year of study		
1st year	100	7.4
2nd year	301	22.3
3rd year	391	29.0
4th year	416	30.9
5th year	111	8.2
6th year	29	2.2
College		
Medicine and Health	186	13.8
Dentistry	155	11.5
Pharmacy	151	11.2
Sub-total	492	36.5
Science	114	8.5
Engineering	193	14.3
Information Technology	51	3.8
Humanity	226	16.8
Education	122	9.1
Business Administration	150	11.1
Sub-total	856	63.6

Table 4.6 Continued

Socio-demographic Variables	Number	Percentages
Income Level		
Below 10,000	89	6.6
10,000-20,000	294	21.8
20,000-50,000	347	25.7
Above 50,000	136	10.1
Don't know	482	35.8
Employment status		
Yes	78	5.8
No	1270	94.2
Perceived health		
Very good	375	27.8
Good	706	52.4
Average	243	18.0
Poor	24	1.8
Self-care orientation		
Low self-care	434	32.3
High self-care	914	67.8

The table above illustrates in percentages and numbers the students that present certain demographic characteristic. For example, for the variable self-care oriented, from the total number of participants, 32.3%, corresponding to a total number of 434 students, had a low self-care orientation. The remaining of the sample was high self-care oriented. In relation to household income, no further explanations were provided to students. These were free to select the level of income that they or their parents have. Since they are in college, it is more likely that this selection would be done for parental income.

The socio-demographic variables tested in this case focused on assessing predisposing factors for medication used based on Andersen's model of healthcare utilisation. Noting that healthcare services are not tested in this case, but the use of ONPD, which was linked previously with self-care orientation, this variable was also tested, alongside with perceived health.

4.7.3.2. Health Belief Characteristics of the Respondents (n =1348)

With reference to the attitudes of the respondents, more than half (57.0%) believed that the use of ONPD is necessary. With respect to how respondents think about the effectiveness of ONPD, more than half of the respondents (58.6%) believed that ONPD are moderately effective. For cost-effectiveness belief, just above half of the respondents (53%) disagreed with the statement that more expensive ONPD are more effective. With reference to the belief in the safe use of ONPD, above half of the respondents (53%) reported that they disagreed with the statement that ONPD are safe regardless of how frequently they are used. Approximately two-thirds of the respondents (65.8%) were usually taking only one ONPD for self-medicating a single symptom daily (monopharmacy user). With respect to the frequency of ONPD use, more than half (57.8%) reported monthly use of ONPD and approximately half of the respondents (49.3%) reported “always” checking the drug expiry date before use. Regarding expiry date-seeking behaviour, nearly half of the respondents (49.3%) always checked the expiry date of the ONPD before use. With reference to respondents taking more than the recommended dose of ONPD, two third of the respondents (66.3%) reported that they usually do not take more than the recommended dose of ONPD during self-treatment of minor health symptoms (Table 4.7).

Table 4.7 Health beliefs and behaviour characteristics of the respondents (n =1348).

Variables	Number	Percentage
Attitude		
Helpful	544	40.4
Harmful	36	2.7
Necessary	768	57.0
Effectiveness Beliefs		
Effective	513	38.1
Moderately effective	790	58.6
Ineffective	45	3.3
Cost-effectiveness belief		
Agree	263	19.5
Uncertain	358	26.6
Disagree	727	53.9
Safety belief in the use of ONPD		
Agree	327	24.3
Uncertain	298	22.1
Disagree	723	53.6
Polypharmacy behaviour		
Monopharmacy user	887	65.8
Minor polypharmacy user (2-4 drugs)	455	33.8
Major polypharmacy user (>4 drugs)	6	0.4
Frequency of ONPD use behaviour		
Daily-use	129	9.6
Weekly-use	293	21.7
Monthly-use	779	57.8
Yearly-use	147	10.9
Expiry date-seeking behaviour		
Always	665	49.3
Often	364	27.0
Rarely	206	15.3
Never	113	8.4
Taking more than the recommended dose behaviour		
Yes	290	21.5
No	894	66.3
Not sure	164	12.2

Attitude was tested with Q19, through a series of three statements “Which of the following statements best expresses your personal views of medications? “. Available answers were “medications are helpful” corresponding to a positive attitude; “medications are harmful” corresponding to a negative attitude, and “medications are necessary” corresponding to a neutral attitude”. A similar approach was used to test the beliefs regarding ONPD effectiveness. This was evaluated though Q18. In this case, all variables were tested following this model, where a statement was provided for which a series of answers were available.

In line with HUM, health beliefs are a predisposing factor alongside with socio-demographic characteristics, for using medical services. Consequently, under the first section of the instrument developed, referring to predisposing factors, health beliefs and subsequent resulted behaviours were verified in this test. In line with the instrument developed, attitude was assessed. In this case, a little over 2% of participants believed that ONPD could be harmful, while the rest of the participants saw these as necessary or helpful. In terms of effectiveness, only 3.3% of participants did not believe that ONPD are effective, Cost-effectiveness and safety beliefs were more heterogeneous among the sample. However, as it can be observed from the above table the high positive values in attitude and effectiveness beliefs, result in over half of the sample using ONPD at least once a month, while 22% of them report taking more than the recommended dose. Also, around 15% rarely check the expiration date of the ONPD. Based on these results, it may be implied that the positive outlook held by participants in relation to the use of ONPD can result in irrational use of medication.

4.7.3.3. Trust, Knowledge and Satisfaction Characteristics of the Respondents

Question 28 of the questionnaire verified the level of trust that participants have in different health care professionals. With reference to the level of trust in ONPD information provided by healthcare professionals, more than half of the respondents (54.6%) reported that they “always” trust ONPD information from physicians, compared to one-quarter (25.4%) “always” trusting ONPD information from pharmacists and roughly one-tenth (9.9%) “always” trusting ONPD information from nurses. Just under two-fifths of the respondents (38.8%) had a good level of trust, as shown in Table 4.8.

Table 4.8 Trust of ONPD information sources and healthcare professionals (n = 1348)

Variables	Number	Percentage
Trust in ONPD information provided from Physicians		
Always	736	54.6
Usually	488	36.2
Sometimes	110	8.2
Rarely	14	1.0
Never	0.0	0.0
Trust in ONPD information provided from pharmacists		
Always	342	25.4
Usually	665	49.3
Sometimes	312	23.1
Rarely	23	1.7
Never	6	0.4
Trust in ONPD information provided from nurses		
Always	134	9.9
Usually	481	35.7
Sometimes	602	44.7
Rarely	105	7.8
Never	26	1.9
Overall level of trust in ONPD information provided from health care professionals.		
Good	523	38.8
Moderate	527	39.1
Poor	298	22.1

Although the level of trust in professional advice concerning ONPD use seems to be good, when calculating the overall level of trust, it can be observed that 22.1% of participants have a poor level of trust in advice received from healthcare professionals.

The other variable tested referred to the level of knowledge of ONPD that participants had. Questions 21 to 24 tested participant knowledge. This data is presented along with the three final statements of question 28, assessing the level of satisfaction with different healthcare professionals. Table 4.9 shows that 72.2% of the respondents had good ONPD knowledge. Nevertheless, just below a quarter of the respondents (23.7%) had good medication knowledge. Almost half of the respondents (49.3%) were "always" satisfied with physicians, while only one-quarter of the respondents (23.9%) were "always" satisfied with pharmacists and only one-eighth of the respondents (12.7%) were "always" satisfied with nurses. Regarding overall satisfaction with healthcare professionals, only one-third of the respondents (33.5%) had a "good" level of satisfaction.

Table 4.9 Distribution of knowledge, satisfaction and trust variables of the respondents (n =1348)

Variables	Number	Percentages
ONPD knowledge (ONPD only)		
Good	973	72.2
Moderate	266	19.7
Poor	109	8.1
Medication-knowledge (prescription and NPD)		
Good	320	23.7
Moderate	843	62.5
Poor	185	13.7
Satisfaction with physicians		
Always	664	49.3
Usually	426	31.6
Sometimes	208	15.4
Rarely	38	2.8
Never	12	0.9
Satisfaction with pharmacists		
Always	322	23.9
Usually	509	37.8
Sometimes	428	31.8
Rarely	66	4.9
Never	23	1.7
Satisfaction with nurses		
Always	171	12.7
Usually	407	30.2
Sometimes	556	41.2
Rarely	152	11.3
Never	62	4.6
Overall satisfaction with healthcare professionals		
Good	451	33.5
Moderate	421	31.2
Poor	476	35.3

As it can be observed from the above table, participants had good to moderate levels of ONPD knowledge, with only a few of the participants reporting poor knowledge. Satisfaction with healthcare professionals was however overall heterogeneous, with approximately 30% of responses corresponding to each tested category.

4.7.4. Results for Research Questions

The present study addressed three research questions (RQs) regarding ONPD usage (RQ1), risk factors of incautious ONPD use (RQ2) and risk factors of inappropriate ONPD use (RQ3) among undergraduate university students in the UAE.

4.7.4.1. Research Question 1

What is the current status of Oral Non-Prescription Drug (ONPD) use among university students in the UAE in terms of:

a) The prevalence of ONPD use;

b) The prevalence of cautious ONPD use;

c) The prevalence of appropriate ONPD use for the most recent symptoms;

d) The prevalence of incautious and inappropriate ONPD use;

e) The prevalence of using antibiotics without a physician's prescription;

f) The prevalence of polypharmacy

4.7.4.1.1. Prevalence of ONPD Users

More than half of the respondents (1348 of 2355; 57.2%) reported using ONPD in the 90 days prior to conducting the study. Data from participants that did not use ONPD was eliminated. As previously indicated, the scope of this study was to assess ONPD behaviour. This behaviour could not be examined in a sample that did not use ONPD, which therefore led to the decision to exclude data from students that reported never to have used ONPD. The elimination of this sample did not affect the result of the study in terms of sample size errors. Based on the sample size calculations presented in the "Sample size determination" section, a total of 1068 participants were necessary to produce statistically significant results, representative for the study population. Because after the elimination of data from students who had never used ONPD, the remaining sample was 1348, this indicates that the sample size was sufficient. Consequently, in the sample selected for further testing (n=1348), the prevalence of ONPD use was 100%. This was necessary to further explore this behaviour in the sample.

4.7.4.1.2. Prevalence of cautious ONPD use

Cautious ONPD user operationally defined as a user that reads the ONPD information leaflet (always or often) before the first time of use. More than three quarters of the respondents were cautious ONPD users (1049 of 1348, 77.8%).

Cautious respondents were further investigated to determine which section of the drug information leaflet, they usually read. Table 4.10 shows that 43.6% of the cautious respondents usually read only the indication (i.e. the use) of the drugs. Approximately one third of the cautious respondents (35.3%) usually read only the adverse effect of the drugs. Below one third of the cautious respondents (34.4%) reported reading only the dose of the drugs. Only 27.3% of the cautious respondents read everything of the drug information leaflet

Table 4.10 Drug Leaflet reading behaviour of the cautious respondents (n=1049)

Sections of the drug information leaflet	Number	Percentage
Indication	588	43.6
Adverse effects	476	35.3
Dosage	464	34.4
Contra-indications	375	27.8
Cautions	229	17.0
Drug-drug interaction	82	6.1
Everything	368	27.3

The data of those who were classified as cautious users was examined further to find out if the drug information leaflets are easy to understand. A total of 70% of the cautious respondents believed that the information in the drug leaflets is easy to understand and a very large majority of the cautious respondents (84.5%) reported that the information of the ONPD leaflet is useful. More than one-third of the cautious respondents (37.0%) reported keeping the drug information leaflet they receive on the first time of use and almost a third (32.3%) changed the way they use the drug because of reading drug information leaflet as shown in table 4.11

Table 4.11 The belief and behaviour of the cautious respondents (n=1049)

Variables	Number	Percentage
Very easy to understand Easy to understand Very difficult to understand Difficult to understand	233 735 12 69	22.2 70.0 1.1 6.5
Useful Not useful Not sure	887 12 150	84.5 1.1 14.2
Keeping of the leaflet Yes, I keep it No, I discard it Sometimes, I keep it	 389 253 407	 37.0 24.1 38.7
The outcome of reading the leaflet Yes, I have changed the way I use the drug No, I have not Sometimes	 339 381 329	 32.3 36.3 31.3

Therefore, this data indicates that the drug information leaflet is easy to understand, is useful in terms of indicating how to use the drug (diagnosis, dosage, frequency of use, potential interactions). A more heterogeneous response was received in terms of keeping the leaflet and in terms of behaviour change in ONPD use after reading the leaflet.

4.7.4.1.3. Prevalence of appropriate ONPD use for the last recent symptom

The overwhelming majority (1240 of 1348 - 91.9%) of respondents were appropriate ONPD users for self-treating the last recent symptom they experienced prior to the study. An appropriate ONPD user was operationally defined as using ONPD correctly according to five assessment criteria: appropriate self-diagnosis, appropriate self-selection of ONPD, appropriate dose, appropriate frequency of use, and appropriate food-drug administration. Table 4.12 shows the distribution of inappropriate criteria. The highest proportion of inappropriate ONPD users violated only one assessment criterion (90.9%), of which more than half (59.2%) selected inappropriate drugs. Few of the inappropriate ONPD users (1.8%) violated three assessment criteria.

Headache was the most commonly reported last recent symptom among the users (626 of 1348; 46.4%) followed by menstrual pain (203 of 1348, 15.1%) and common cold (145 of 1348, 10.8%). In this case, it is worth mentioning that the second most common cause for taking ONPD is directly correlated with the fact that the majority of the sample consisted of females. It is therefore unclear if for a male sample the second most common cause would be to treat the common cold.

From the other side, paracetamol (Panadol ®) was the most commonly used drug (894 of 1348; 66.3%), followed by, Ibuprofen, Brufen®, (141 of 1348; 10.5%). It is worth to mention that only a very small proportion of the respondents (55 of 1348; 4.1%) reported self-treating the last recent symptom used antibiotics. Furthermore, the overwhelming majority of users were “monopharmacy” users: used only one drug for self-treating the last recent symptom (1328 of 1348, 98.5%). Only 0.8% of the respondents reported suffering from a new problem because of self-medication practice.

Based on the assessment criteria, inappropriate users were categorized into three categories: most, moderate and the least inappropriate drugs’ users. These criteria focus on: inappropriate drugs, signifying the use of a medication that is not appropriate for treating the symptom experiences; inappropriate food-drug administration, focused on participants that are not aware of these interactions; inappropriate dose, focusing on a dose that is too high or too low in proportion with the recommended dosage; inappropriate frequency, focusing on taking medication too often or too rarely to meet the necessary recommended threshold (i.e. one every 8 hours); and inappropriate diagnosis. Most inappropriate drug users if all the five criteria are incorrect. Moderate inappropriate drug users have three to four incorrect criteria and finally, the least inappropriate drug users have only one to two incorrect criteria.

Accordingly, the overwhelming majority of the inappropriate users were the least inappropriate users (106).

Table 4.12 Distribution of the assessment criteria among inappropriate users (n=106)

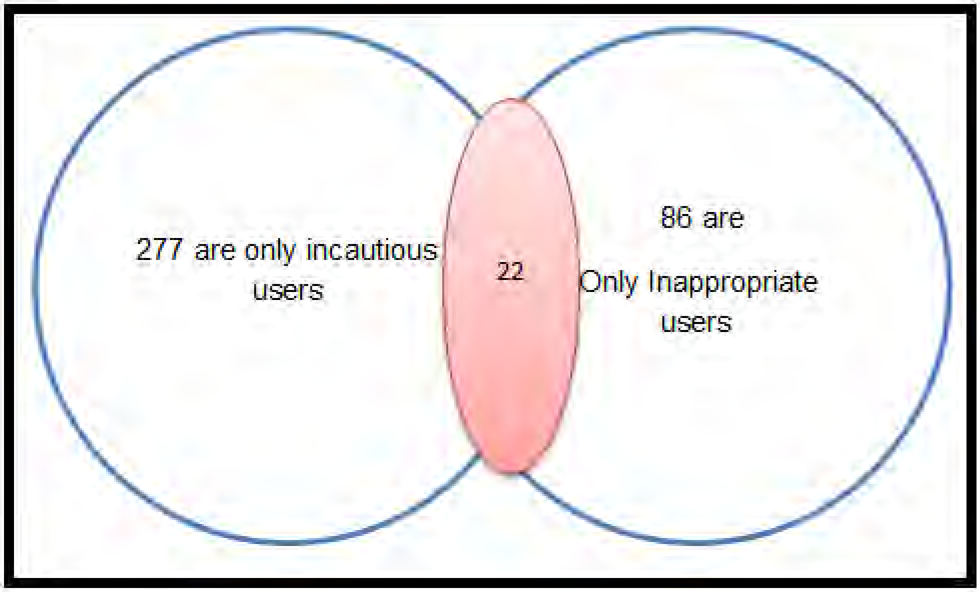
Assessment criteria	Description	Number	Percentage
Least inappropriate users	Inappropriate drugs	64	59.2
	Inappropriate food-drug administration	18	16.6
	Inappropriate dose	10	9.2
	Inappropriate frequency	6	5.5
	Inappropriate drug+ inappropriate food drug	3	2.7
	Inappropriate diagnosis + inappropriate drug	2	1.8
	Inappropriate dose+ inappropriate frequency	2	1.8
	Inappropriate dose+ inappropriate food-drug administration	1	0.9
Moderate inappropriate users	Inappropriate drug +inappropriate dose +inappropriate frequency	2	1.8
Total		106	99.5≈100%

Prevalence of ONPD users who are either incautious or inappropriate users:

- 270 (of 1348) were only incautious users;
- 86 (of 1348) were only inappropriate users;
- 22 (of 1348) users were both incautious and inappropriate ONPD users.

Therefore, 385 users (277 + 86 + 22= 385) were either incautious, inappropriate ONPD users or both as shown in Figure 4.3

Figure 4.3 Incautious, inappropriate and both incautious and inappropriate ONPD users



Incautious users (22.2% of 1348) were further questioned about the reasons for not reading the drug information leaflet before the first-time use of ONPD. Seven in ten incautious respondents (70.5%) reported that they “rarely or never” read the drug information leaflet because they think that the information in the leaflet is too long. More than two fifths of the incautious respondents (44.8%) stated that they get information about drug use from physicians and approximately a similar proportion of the incautious respondents reported getting their drug information from pharmacists. Getting information from my family and friends about the ONPD was an alternative for reading the drug information leaflets by more than a third of incautious respondents (38.1%). Table 4.13 shows the distribution of reasons for not reading drug information leaflets. Users could have reported more than a reason. Therefore, the sum is more than 100%.

Table 4.13 Obstacles of reading the drug information leaflets among those reporting rarely or never reading the information leaflet (n =299)

Reasons	**Number**	**Percentage**
Too long, it takes too much of time to read	211	70.5
I get the information from my doctor	134	44.8
I get the information from pharmacists	123	41.4
I get information from my family/friend	114	38.1
Common knowledge	101	33.7
Print is too small	100	33.4
Too difficult to understand	67	22.4
Feel that the information is not important	47	15.7
The information provided worries me	20	6.6

4.7.4.1.4. Prevalence of using antibiotics without prescription

More than one third of the respondents (484 of 1348, 35.9%) were reported using antibiotics without prescription during the 90 days prior to the present study. Of these participants, for healthcare respondents (n=492), more than a third (36.8%) reported using antibiotics without prescription. Furthermore, of those non-healthcare respondents (n=856), 35.4% of them were using the antibiotics without prescription, but the difference between healthcare and non-healthcare respondents was statistically not significant (*p*-value= 0.608).

4.7.4.1.5. Prevalence of polypharmacy

More than a third of the respondents (461 of 1348; 34.1%) used more than one drug for self-treating a single symptom a day (polypharmacy users) in the past 90 days before conducting the study as recognized in the survey question no.4.

4.7.4.2. Research Question Two: Risk factors for incautious ONPD

4.7.4.2.1. Binary Logistic Regression Analysis

Binary Logistic Regression (BLR) was conducted to assess the association of a number of factors on the likelihood that respondents would be incautious users (i.e., risk factors) and to estimate the individual probability of incautious use of ONPD as an outcome variable. All study variables were entered into the model. Prior to running the analysis for the BLR, important underlying assumptions were checked such as sample size and multicollinearity. Tabachnick and Fidell (1996) suggested that for each independent variable, there should be at least 50 cases (respondents) in each category. This assumption was checked prior to running the analysis. For each independent variable, there were 299 cases (incautious respondents) in each category. For the absence of multicollinearity, Variance Inflation Factor (VIF) should be less than 10.

The Hosmer and Lemeshow goodness of fit test was non-significant ($p = 0.551$), with x2=6.871, df= 8, x2 indicating a good model fit of the data. The statistically significant ($p < 0.001$) Cox and Snell R^2 (0. 153) and Nagelkerke R^2 (0. 235) suggest a modest power of prediction. The VIF using Cox and Snell R^2 (0.153) was 1.180 and VIF using Nagelkerke R^2 (0. 235) was 1.307. This indicates that the inflation of the standard error caused by collinearity, if it exists, is not a cause of concern and there is no collinearity problem (UCLA Institute for Digital Research and Education, Logistic Regression Diagnostics, p.9, n.d.). The bivariate correlations among all independent variables were calculated using Pearson, Kendall’s tau (τ) and Spearman’s correlation coefficients and presented in a correlation matrix. The magnitudes of the correlations among the independent variables were very low and the majority was not significant. This is an indicator that multicollinearity is not a problem in the model. The combination of 25 predictor variables resulted in 80.7% correct classification of cautious and incautious ONPD user.

The model explained 23% (Nagelkerke R^2) of the variance in incautious ONPD use and correctly classified 80.7% of cases. Sensitivity was 25.1%, specificity was 96.6%, the positive predictive value was 67.5% and the negative predictive value was 81.8%. Of the 25^{th} predictor variables only 11^{th} were statistically significant: age, Gender, expiry date checking behaviour, polypharmacy behaviour, trust in health care professionals, medical advice seeking behaviour, professional- source of ONPD information, informal- source of ONPD information, reading medical books/the internet -source of ONPD information, low level of self-care orientation, being healthcare students as displayed in Figure 4.4.

Figure 4.4 Associations with incautious ONPD use based on Andersen's Healthcare Utilisation Model

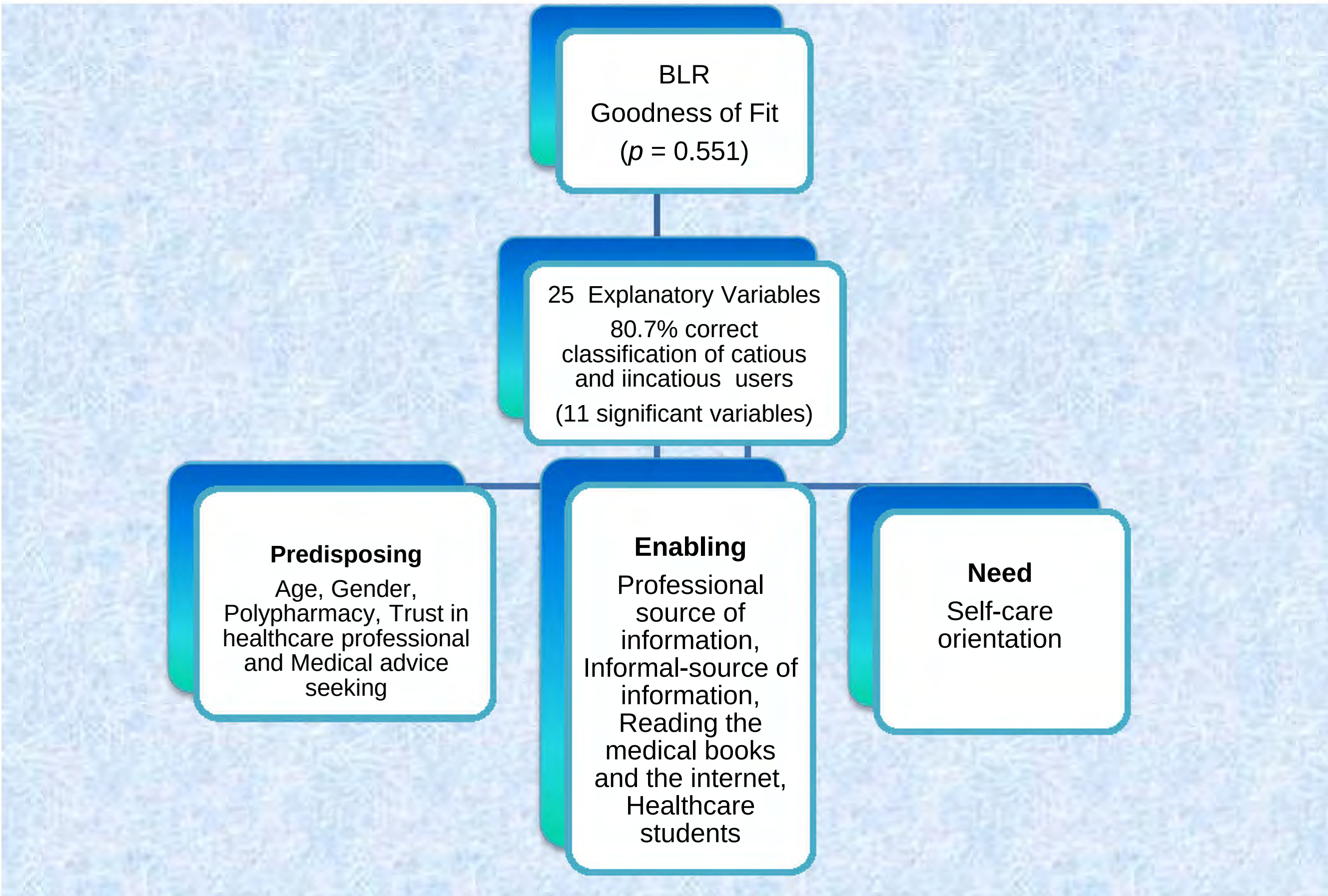


Table 4.14 shows that respondents 21 years and older have lower odds of being incautious ONPD user compared to those with lower age group (OR = 0.573, 95% CI: 0.384-0.855, $p \leq 0.01$). The *P-value* < 0.05 indicates a statistically significant difference between groups; specifically, between the responders of 21 years old and older group versus the reference 18-20 years old group (Table 4.14). As the OR is < 1, then the odds of being incautious ONPD user in the age group of 21 years and older are 57% less than in reference group of 18-20 years with the true population effect between 85% and 38%. This result was statistically significant ($p \leq 0.01$). Therefore, there is a negative relationship between both predictor and the outcome which means as age "increases," the odds of being incautious ONPD user decrease. Thus, older age might be a protective factor against the incautious ONPD use.

Gender was a significant predictor variable. The odds ratio for gender was below 1, which implies a negative relationship. Females had 34% lower odds of being incautious ONPD user than males (OR =0.344, 95% CI: 0. 244-0.486, $p \leq 0.001$). This means that being female correspond with a lower odd of being an incautious ONPD user (i.e. a protective factor). Furthermore, the odds of being an incautious ONPD user were 1.3 times higher among respondents that used more than one drug to treat a single illness (i.e. polypharmacy users) by contrast with monopharmacy users (OR =1. 36, 95% CI: 1.006-1.862, $p \leq 0.05$). Therefore, polypharmacy might be a risk factor of using ONPD incautiously.

Not checking the expiration date of the ONPD was also a significant predictor variable. Participants that did not usually check the expiry date of ONPD had 51% lower odds of being incautious ONPD users than those who did. Therefore, expiration date checking behaviour might be a protective factor against not reading the drug information leaflets (incautious use of ONPD). Moderate levels of trust in the drug information provided by healthcare professionals was a significant protective factor against the incautious ONPD use (OR<1). Participants who had moderate trust in ONPD information provided by healthcare professionals had lower odds of being incautious ONPD users compared to those who had good trust (OR =0. 798, 95% CI: 0.540-0.967, $p \leq 0.05$).

Medical-advice seeking behaviour was a significant predictor variable. The odds ratio for this predictor had been above 1, which implies a positive relationship. Furthermore, the smaller the p-value (i.e. <0.05), the lower the probability that we might observe such an association because of chance alone and the greater the chance that the predictor is related to the outcome. Therefore, the odds of being incautious ONPD user in the response group who do not ask the pharmacist for a medical advice are 2.2 times higher than those who did with the true population effect between 16% and 31%. This result was statistically significant ($p \leq 0.001$). Thus, not seeking medical advice might be a risk factor for incautious ONPD use.

The odds of being incautious users were 2.3 times higher for those not getting o ONPD information from professional sources compared to those getting ONPD information from professional sources (OR=2.399, 95% CI: 1.599-3.5598, $p \leq 0.001$). Therefore, not getting ONPD information from professional sources might be a risk factor for incautious ONPD use.

Informal sources of ONPD information were associated with an increased likelihood of being incautious users. Respondents who reported getting ONPD information from informal sources had significantly 1.4 times higher odds of being incautious users compared to those users who did not (OR = 1.48, 95% CI: 1.095-2.026, p-value=0.011). Furthermore, respondents that failed to get ONPD information from reading medical books or the internet had significantly (1.9 times higher odds) higher chances of being incautious ONPD users than users who did (OR = 1.914, 95% CI: 1.353-2.708, $p \leq 0.001$). Therefore, informal sources of ONPD information and not getting drug information from reading medical books or the internet might be risk factors of using ONPD incautiously. Being a healthcare student, was a significant predictor variable against the incautious ONPD use. Non-healthcare students had 1.5 times lower odds of being incautious users compared to healthcare students (OR = 1.561, 95% CI: 1.103-2.208, $p \leq 0.05$). Thus, being non-healthcare respondents might be a risk factor for incautious ONPD use.

Treating more than five symptoms with ONPD and high self-care orientation were both associated with an increase in the likelihood of being an incautious ONPD user. The odds of being incautious ONPD user among high self-care orientation's respondents are 1.3 times higher than among low self-care orientation respondents. The true population effect in this case was between 10% and 18%. This result was also statistically significant (OR = 1.369, 95% CI: 1.006-1.862, $p \leq 0.05$). Therefore, a high level of self-care orientation might be a risk factor for the incautious ONPD use.

Table 4.14 Multivariate model for associations with incautious ONPD use (n=1348)

Variables	***Response***	***OR***	***95% CI***		***p-value***
Age (ref-18-20 years)	21 years and older	0.573	0.384	0.855	0.006
Gender (ref-male)	Female	0.344	.244	.486	< 0.001
Expiry date checking behaviour (ref-check)	Do not check	0.512	0.373	0.702	< 0.001
Polypharmacy behaviour (ref-mono)	Poly	1.369	1.006	1.862	0.046
Trust in health care professionals (ref-good)	Moderate	0.695	0.500	0.967	0.031
	Poor	0.798	0.540	1.180	0.259
Medical advice seeking behaviour (ref-ask)	Do not seek medical advice	2.287	1.655	3.161	< 0.001
Professional- source of ONPD information (ref-yes)	No	2.399	1.599	3.598	< 0.001
Informal- source of ONPD information (ref-No)	Yes	1.489	1.095	2.026	0.011
Reading medical books/ the internet- source of ONPD information (ref-yes)	Not reading	1.914	1.353	2.708	< 0.001
Self-care orientation (ref-low)	High	0.696	0.513	0.946	0.020
Medical versus non-Medical (ref-Healthcare) students	Non-Healthcare	1.561	1.103	2.208	0.012

4.7.4.2.2. Bivariate analysis of the risk factors for incautious ONPD use

Table 4.15 shows the proportions of cautious and incautious users by the selected predictor variables, along with the chi-square test of independence. The chi-square test of independence showed that the proportion of incautious ONPD users was significantly ($p \le 0.001$) higher for males (38.3%) compared to females (18.5%). Therefore, there is enough evidence to suggest an association between the incautious ONPD use and gender ($p \le 0.001$). Furthermore, participants of age group between 18-20 years had significantly ($p \le 0.001$) higher proportion of being incautious users compared to older participants. Therefore, there is a statistically significant association age of the participant and incautious ONPD use *($p \le 0.05$).*

The association was statistically significant between polypharmacy behaviour and incautious ONPD use ($p \leq 0.001$). Monopharmacy users had a lower proportion of being incautious users than polypharmacy users. Furthermore, there is not enough evidence to suggest an association between the incautious ONPD use and the levels of the trust in drug information provided by health care professionals [X^2 *(2)* = 1.243, *p* =0.537). Since the *p*-value is greater than our chosen significance level ($\alpha = 0.05$), we do not reject the null hypothesis.

Participants who reported seeking medical advice from pharmacists had significantly ($p \leq 0.001$) lower proportion of incautious use (18.1%) than those who did not seek medical advice from pharmacists (35.0%). Therefore, there was a statistically significant association between the medical advice-seeking behaviour of the participants and their behaviour of not reading the drug information-leaflets. Then, we can reject the null hypothesis and accept the alternative hypothesis.

We observed a strong association between the professional sources of ONPD-information and the incautious ONPD use (X^2 (1) = 36.745, $p \leq 0.001$). The proportion of incautious ONPD users was significantly ($p < .001$) higher for those who did not gain ONPD information from professional sources compared to those who did (40.7% versus 19.6%). Furthermore, there was a significant association between expiry date checking behaviour and the incautious ONPD use (X^2 (1) = 55.370, $p \leq 0.001$). There is evidence to suggest an association between the informal source of drug information variable and incautious ONPD use ($p \leq 0.001$). Participants who acquired ONPD information from informal sources (26.9%) were significantly ($p \leq 0.001$) more likely to be incautious users than those who did not acquire ONPD information from informal sources (16.7%).

Participants who acquired ONPD information from reading medical books or the internet (14.8%) were less likely to be incautious users compared to those who did not (25.3%) and the association was statistically significant (*p*- ≤0.001). Furthermore, there was a statistically significant association between being non-healthcare students and incautious ONPD use. Therefore, we can reject the null hypothesis and accept the alternative hypothesis. Healthcare respondents had a lower proportion to be incautious users than non-healthcare participants and the association was statistically significant (*p*

≤0.001). The proportion of participants that were incautious users was significantly higher for those who had low self-care orientation (26.0%) than for those of high self-care orientation (20.4%). Therefore, there is enough evidence to suggest an association between incautious ONPD use and self –care orientation (*p ≤ 0.05*).

Table 4.15 The proportions of cautious and incautious ONPD users by associated factors (n =1348)

Associated factor	Cautious users		Incautious users		*p*-value	df	χ2
	Number	Percent	Number	Percent			
Age							
8-20	425	74.6%	145	25.4%	0.014	1	6.072
≥21	624	80.2%	154	19.8%			
Gender							
Female	896	81.5%	204	18.5%	*≤0.001*	1	45.783
Male	153	61.7%	95	38.3%			
Expiry date checking behaviour							
Check	200	62.7%	119	37.3%	*≤0.001*	1	55.370
Do not check	849	82.5%	180	17.5%			
Medical advice seeking behaviour							
Ask for advice	839	81.9%	186	18.1%	*≤0.001*	1	40.342
Don’t ask	210	65.0%	113	35.0%			
Trust in different health care professionals							
Good	400	76.5%	123	23.5%	0.537	2	1.243
Moderate	418	79.3%	109	20.7%			
Poor	231	77.5%	67	22.5%			
Professional source of ONPD							
Yes	953	80.4%	233	19.6%	*≤0.001*	1	36.745
No	96	59.3%	66	40.7%			
Informal source							
Yes	527	73.1%	194	26.9%	*≤0.001*	1	20.058
No	522	83.3%	105	16.7%			
Reading source							
Yes	345	85.2%	60	14.8%	*≤0.001*	1	18.199
No	704	74.7%	239	25.3%			
Polypharmacy behaviour							
Mono	714	80.5%	173	19.5%	*≤0.001*	1	10.769
Poly	335	72.7%	126	27.3%			

Table 4.15 Continued

Associated factor	Cautious users		Incautious users		*p*-value	df	χ2
	Number	Percent	Number	Percent			
Healthcare participants	417	84.8%	75	15.2%	*≤0.001*	1	21.601
Non-healthcare participants	632	73.8%	224	26.2%			
Self –care orientation					0.019	1	5.513
Low	321	74.0%	113	26.0%			
High	728	79.6%	186	20.4%			

Based on this evidence, it can be concluded that incautious use is more likely to occur in participants that are male, are healthcare students, engage in polypharmacy behaviour and do not seek medical advice from professionals while relying on informal sources of information. At the opposed pole, being female, not a student in healthcare and seeking medical information from professionals and formal sources, acted as protective factors against incautious use.

4.7.4.3. Research Question 3- Risk factors for the least inappropriate ONPD use

4.7.4.3.1. Binary Logistic Regression analysis

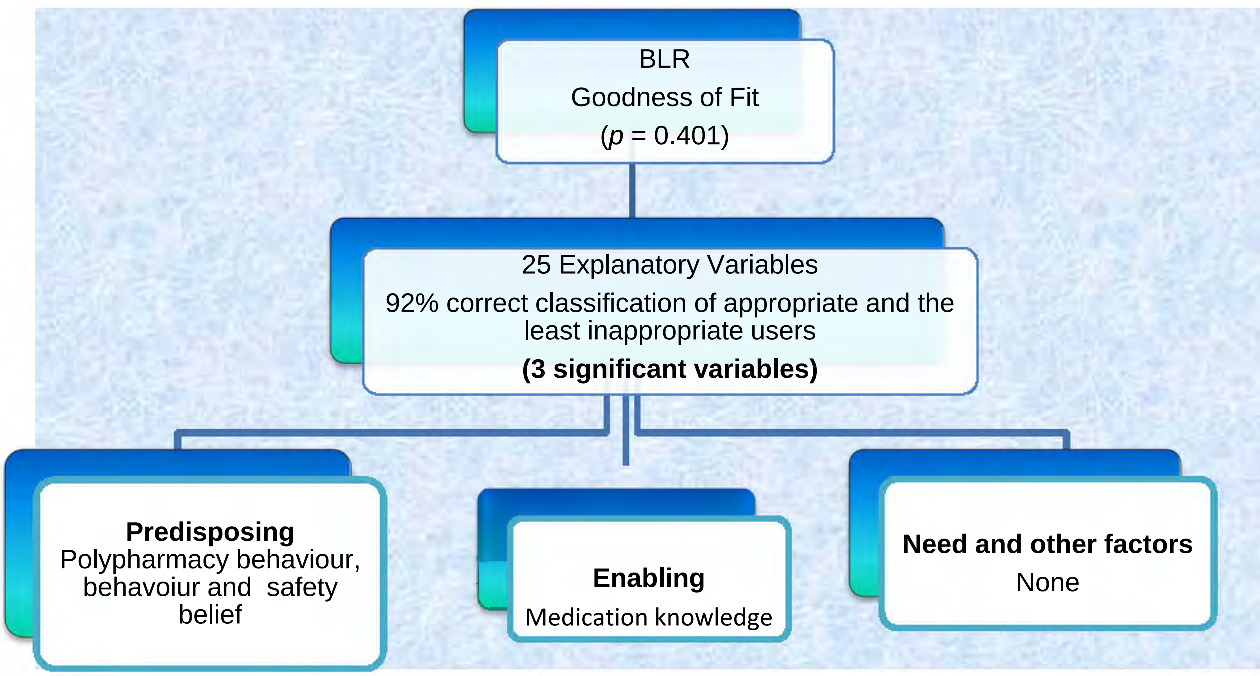
The overwhelming majority of the inappropriate users, identified based on Q1, are least inappropriate users (n=106) as they have only one or two incorrect assessment criteria out of five. Therefore, the study identified the associated factors for the least inappropriate ONPD users. Binary Logistic Regression (BLR) was conducted to assess the association of several factors on the likelihood that respondents would be the least inappropriate ONPD users and to estimate the individual probability of the least inappropriate use of ONPD as an outcome variable. All study variables were entered into the model. For each independent variable, there were 106 cases (least inappropriate respondents) in each category.

The Hosmer and Lemeshow goodness of fit test was non-significant ($p = 0.401$), indicating a good model fit of the data. The statistically significant ($p <0.001$) Cox and Snell R^2 (0.044) and Nagelkerke R^2 (0.102) suggesting that the predictive power of the model is modest. The VIF using Cox and Snell R^2 (0.044) was 1.04 and using

Nagelkerke R^2 (0. 102) was 1.11 which are both less than 10. This indicates that the inflation of the standard error caused by collinearity, if exists, is not a cause of concern and there is no collinearity problem. The Full BLR model resulted in a 92% correct classification of appropriate and the least inappropriate ONPD users.

All study variables were entered into the model; however, only three explanatory variables were statistically significant associated with inappropriate ONPD use. These were: polypharmacy behaviour, safety belief in the use of ONPD, and medication knowledge, as shown in Figure 4.5. Age and gender showed no specific association with inappropriate use and were therefore not included in the association model below.

Figure 4.5 Associations with the least inappropriate ONPD use



Polypharmacy behaviour was a significant predictor variable. The odds ratio for polypharmacy had been above 1, which implies a positive relationship. This means that as the number of drugs taken by participant increases, the odds of being the least inappropriate ONPD user increases. Therefore, participants who usually took more than one ONPD for self-treating a single symptom per day (polypharmacy behaviour) had 1.5 times higher odds of being least inappropriate users when compared to those who usually took only one ONPD a day (mono pharmacy) (OR = 2.457, 95% CI: 1.380-4.373, p=0.002).

The odds ratio for participants agreed that ONPD are safe regardless of who frequently they are used had been above 1 which implies a positive relationship. Therefore, the odds of being least inappropriate ONPD users among participants had this incorrect belief about the safety of ONPD are 1.7 times higher than participants who disagreed with the true population effect between 27% and 10%. This result was statistically significant (OR= 1.702, 95% CI: 1.070-2.709, $p \leq 0.05$). The odds of being least inappropriate ONPD users among participants reported that they were uncertain whether ONPD use are safe regardless how frequently they are used (OR=0.701) was not significant as the p-value was large (i.e. >0.05) and the larger p-value, the higher the probability that you might observe such an association as a result of chance alone.

Moderate level of medication knowledge was a protective factor against inappropriate ONPD use. The odds of being least inappropriate ONPD user among the response group of moderate medication knowledge are 60% less than in reference group of good medication knowledge with the true population effect between 97% and 38%. This result was statistically significant ($p \leq 0.05$). Incautious ONPD use was not associated with the inappropriate ONPD use; the odds were close to 1.0 and the p-value was high and not significant (OR= 0. 960, 95%, CI: 0. 555-1. 661, p =0.884).

Table 4.16 Logistic Regression model for associations with the least inappropriate ONPD use (n=106)

Variables	Response	OR	95% CI		p-value
Polypharmacy behaviour (ref-mono)	Poly	**1.589**	1.024	2.465	0.039
Safety belief in the use of ONPD (ref-disagree)	Agree	**1.702**	1.070	2.709	0.025
	Uncertain	**0.701**	0.701	0.384	0.246
Medication knowledge (ref-good)	Poor	**1.917**	0.489	7.511	0.350
	Moderate	**0.608**	0.380	0.972	0.038

4.7.4.3.2. Bivariate analysis

A chi-square test for independence showed that there is enough evidence to suggest an association between the least inappropriate ONPD use and polypharmacy behaviour ($p > 0.05$). The proportion of the least inappropriate ONPD users was significantly higher (10.4%) for participants who treated their symptoms with more than one ONPD a day (polypharmacy behaviour) compared to those who did not (6.8%) ($X^2 = 5.477$, p=0.019, df= 1). Moreover, medication knowledge was significantly associated with the least inappropriate drug use [$X^2(3) = 6.842$, p=0.033]. Therefore, we can reject the null hypothesis and accept the alternative hypothesis. Furthermore, we observed a strong association between the safety beliefs variable of ONPD use and the least inappropriate ONPD use [$X^2(2) = 11.386$, p=0.033]. *Since t*he *P*-value (0.003) of the safety beliefs variable is less than the significance level (0.05), thus we cannot accept the null hypothesis as shown in Table 4.17

Table 4.17 The proportions of appropriate and the least inappropriate ONPD users by associated factors (n =1348)

Associated factor	Appropriate users		The least inappropriate users		*p*-value	df	χ2
	Number	*Percent*	*Number*	*Percent*			
Polypharmacy behaviour							
Yes	413	89.6%	48	10.4%	0.019	1	5.477
No	827	93.2%	60	6.8%			
Medication knowledge							
Poor	17	85.0%	3	15.0%	0.033	2	6.842
Moderate	505	94.2%	31	5.8%			
Good	718	90.7%	74	9.3%			
Safety belief in the use of ONPD							
Agree							
Uncertain	287	87.8%	40	12.2%	0.003	2	
Disagree	282	94.6%	16	5.4%			11.386
	671	92.8%	671	92.8%			

4.7.4.4. *Research Question 4- Risk factors of using antibiotic without Prescription*

4.7.4.4.1. Binary Logistic Regression Analysis

Binary Logistic Regression (BLR) was conducted to assess the association of a number of factors on the likelihood that respondents would use antibiotics without prescription. This analysis was also used to estimate the individual probability of using antibiotics without prescription as an outcome variable. All study variables were entered into the model. For each independent variable, there were 484 cases (respondents) in each category.

The Hosmer and Lemeshow goodness of fit test was non-significant ($p = 0.688$), indicating a good model fit of the data. The statistically significant ($p <0.001$) Cox and Snell R^2 (0.186) and Nagelkerke R^2 (0.253) suggesting a modest power of prediction. The VIF using Cox and Snell R^2 (0.186) was 1.23 and using Nagelkerke R^2 (0.253) was 1.34 which are both less than 10. This indicates that the inflation of the standard error caused by collinearity, if exists, is not a cause of concern and there is no collinearity problem.

A BLR was performed to ascertain the effects of 41 potential predictors on the likelihood that participants using antibiotics without prescriptions. The logistic regression model was statistically significant, p=0 .688. The model explained 25% (Nagelkerke R^2) of the variance in using antibiotics without prescriptions and correctly classified 71.4% of cases. Sensitivity was 52.2%, specificity was 83.4%, the positive predictive value was 66.5% and the negative predictive value was 73.4%. From the total of the 41 predictor variables, only 9 were statistically significant: nationality, cost-influence behaviour, the belief in ONPD-effectiveness, year of study, medication knowledge, self-care orientation, the reason of using ONPD for saving money, and the emergency of use as well as being healthcare students as shown in Figure 4.6.

Figure 4.6 Associations with antibiotic's use without prescription

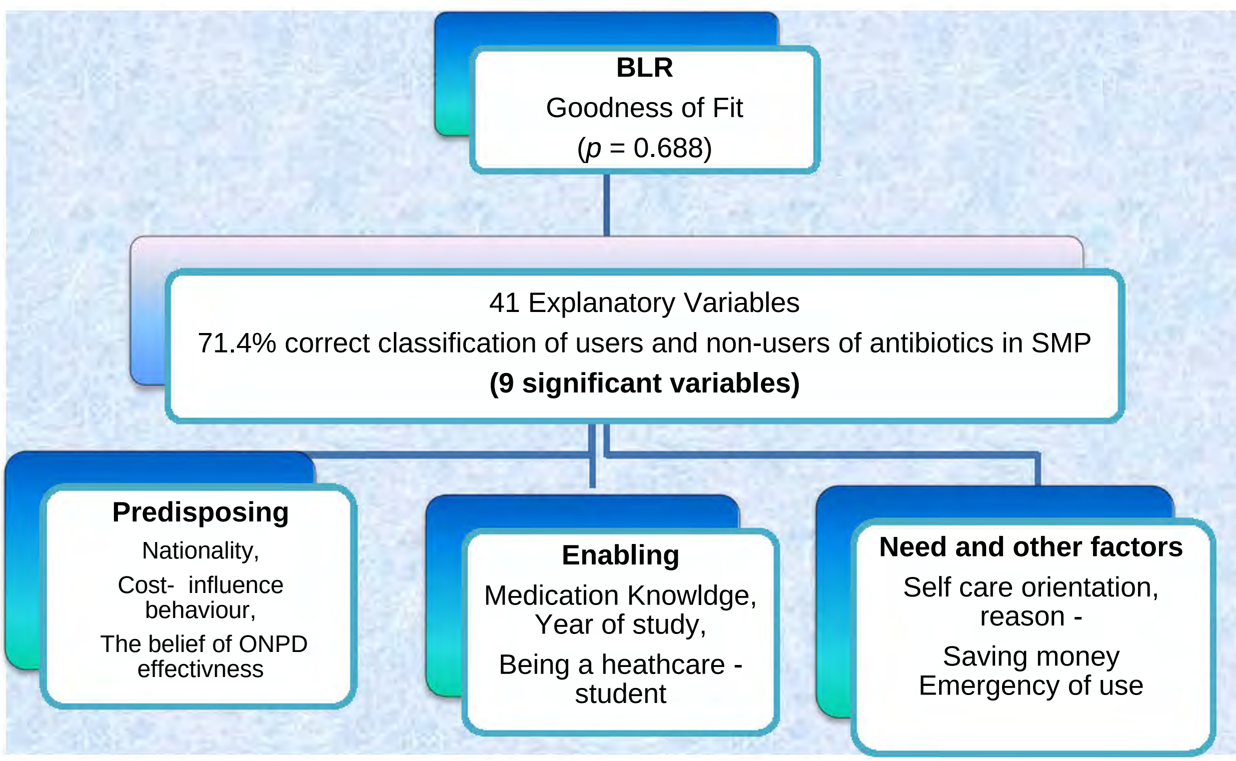


Table 4.18 depicts the distribution of variables associated with the use of antibiotics without prescription. Nationality was a significant predictor variable. Participants of UAE nationals are 47% times less than expatriates' counterparts with the true population effect between32% and 68% and this result was statistically significant

(OR= 0.471, 95% CI: 0.326-0.681, $p<0.001$). Furthermore, the cost of drugs was a risk factor for misusing antibiotics without a prescription. Participants reported that the cost of drugs affect their decision to use them had 1.7 times higher odds of using antibiotic without prescription compared to those who were not influenced by the cost of ONPD (OR = 1.716, 95% CI: 1.175-2.508, $p<0.005$). Therefore cost-influence behaviour might be a risk factor for misusing antibiotics.

Belief is another factor that has been shown in our study to be related to individual health behaviour, especially using antibiotics without a prescription. Participants believing that antibiotics are only moderately effective are 33% times less likely to use them by contrast with those who believed that antibiotics are effective (OR = 0.332, 95% CI: 0 .135-0.815, $p<0.05$). Similarly, participants believing that ONPD are ineffective are 40% times less likely to use them than those who believed that ONPDs are effective (OR =0 .400, 95% CI: 0.161-0.994, $p<0.05$). Therefore, the belief about the effectiveness of ONPD might be a protective factor against using antibiotics without prescription.

Participants with poor-moderate medication knowledge had significantly lower odds of using antibiotics without prescription compared to users with good medication knowledge (OR = 0.619, 95% CI: 0.443-0.866, $p< 0.005$). This indicates that having medication knowledge acted as a contributing factor to using antibiotics without prescription. Also, participants in their fourth year of study (OR = 0.310, 95%, CI: 0.141-0.681, p < 0.004), fifth year of study (OR = 0.243, 95%, CI: 0.088-0.666, $p< 0.01$), or sixth year of study (OR = 0.101, 95%, CI: 0.015-0.678, $p < 0.02$) had lower odds of using antibiotics without prescription compared to participants in their first year of study. This may be explained by the fact that accumulating knowledge and education in relation to antibiotic use through years of study could reduce the use of antibiotics without prescription.

Being a healthcare student was a significant variable for using antibiotics without prescription. Healthcare participants had 1.4 times higher odds of using antibiotics without prescription compared to non-healthcare participants (OR = 1.465, 95%, CI: 1.012-2.120, $p< 0.05$). Therefore, being a healthcare participant might be a risk factor for misusing antibiotics without prescription. The urgency of the situation and financial reasons were significant predictors. Participants who usually used ONPD to save money had 1.6 times higher odds of using antibiotics without prescription compared to participants who did not (OR = 1.665, 95% CI: 1.047-2.649, $p<0.04$). Furthermore, participants who did not use ONPD because of an urgent health situation had 1.6 times higher odds of using antibiotics without prescription compared to those who did (OR = 1.644, 95%, CI: 1.144-2.363, $p<0.007$). Therefore, the urgency of the situation and financial reasons may be risk factors for using antibiotics without prescription.

Participants with a high self-care orientation had significantly 1.8 times higher odds of using antibiotics without prescription compared to a low self-care orientation participants and this result was statistically significant (OR = 1.878, 95% CI: 1.304-2.706, $p<0.001$). Therefore, a high level of self-care orientation may be a risk factor for using antibiotics without prescription.

Table 4.18 Logistic Regression model for associations with antibiotic's use without prescription (n=484)

Variables	Response	OR	95% CI		*p*-value
Nationality (ref-Expatriate)	UAE national	0.471	0.326	0.681	0.001
Cost -influence behaviour (ref-No)	Yes	1.716	1.175	2.508	0.005
Effectiveness of ONPD belief (ref-effective)	Moderately	0.332	0.135	0.815	0.016
	Ineffective	0.400	0.161	0.994	0.048
Medication knowledge (ref-good)	Poor-moderate	0.619	0.443	0.866	0.005
Medical versus non-Medical (ref-non-medical) students	Healthcare	1.465	1.012	2.120	0.043
Self-care orientation (ref-low)	High	1.878	1.304	2.706	0.001
Reason- saves money (ref-yes)	No	1.665	1.047	2.649	0.031
Reason-urgency of ONPD use (ref-yes)	No	1.644	1.144	2.363	0.007
Year of study (ref-first year)	Second	0.824	0.415	1.636	0.580
	Third	0.544	0.265	1.117	0.097
	Fourth	0.310	0.141	0.681	0.004
	Fifth	0.243	0.088	0.666	0.006
	Sixth	0.101	0.015	0.678	0.018

4.7.4.4.2. Bivariate Analysis of the Risk Factors of Using Antibiotics without Prescription

There was a statistically significant association between the nationality of the participants and the behaviour of using antibiotics without prescriptions. A chi-square test for independence indicated that the proportion of students using antibiotics without prescription was significantly (p< 0.001) higher among expatriates (44.4%) than UAE nationals' students (26.6%). This may indicate that UAE nationals who benefit from medical insurance are more likely to get medical consultations and receive adequate treatment for their conditions. At the other end of the spectrum, expatriates that do not benefit from medical insurance had higher odds of using antibiotics without prescription.

This is not supported only by past research (Zaghloul et al., 2014; Panagakou et al., 2012) but also by other results obtained in this study presented below. There are not enough evidences to demonstrate an association between the following predictors and misusing antibiotics: effectiveness belief ($X^2(2) = 5.687$, $p > 0.05$); medication knowledge ($X^2(1) = 2.746$, $p > 0.05$) and; being a healthcare student ($X^2(1) = 0.263$, $p > 0.05$). On the other hand, the proportion of students using antibiotics without prescription was significantly ($p<0.001$) higher for those who were influenced by the cost of the drugs (44.4%) compared to those who did not (33%). This may imply that participants who used antibiotics without prescription did so to avoid costs of consultations. Since the use of antibiotics was reported to be higher among expatriates without medical insurance, this could explain the association with costs.

A year of study was associated with missing antibiotics. The proportion of students who exhibited the behaviour of using antibiotics without prescription was significantly higher ($p<0.001$) for senior participants ($p<0.003$) compared to junior participants. Another statistically significant association was observed between the urgency of use and using antibiotics without prescriptions ($X^2(1) = 16.234$, $p<0.05$). Furthermore, there is enough evidence to suggest an association between the reason of saving money and using antibiotics without prescription ($X^2(1) = 39.631$, $p<0.01$). The proportion of using antibiotics without prescription was significantly ($p<0.001$) higher for those who used ONPD to save money ($p<0.001$) or because of urgency of use ($p< 0.001$). As previously noted, this indicates that in lack of medical insurance, students who are expatriates will attempt to avoid costs associated with medical consultations and thus use antibiotics without prescription.

Furthermore, there was a statistically significant association between self-care orientation and using antibiotics without prescription [$X^2(1) = 20.028$, $p \le 0.001$] as shown in Table 4.19. This indicates that students who were more self-care oriented had a higher tendency to use antibiotics without prescription, in a paradoxical process, in which they sought to address immediately a health care issue with antibiotics. Yet this behaviour can have significant negative effects on health.

Table 4.19 The proportions of Antibiotic use and do not use without prescription by associated factors (n =1348)

Associated factors	Used Antibiotic without prescription		Have not used Antibiotic without prescription		*p*-value	df	χ2
	Number	*Percent*	*Number*	*Percent*			
Nationality							
UAE national	172	26.6%	474	73.4%	< 0.001	1	46.416
expatriate	312	44.4%	390	55.6%			
Cost influence behaviour							
Yes	151	44.4%	189	55.6%	< 0.001	1	14.297
No	333	33.0%	675	67.0%			
Effectiveness belief							
Ineffective	23	51.1%	22	48.9%	0.058	2	5.687
Moderately effective	271	34.3%	519	65.7%			
Effective	190	37.0%	323	63.0%			
Medication knowledge							
Good	270	34.1%	522	65.9%	0.097	1	2.746
Poor-Moderate	214	38.5%	342	61.5%			
Year of study							
First Year	44	44.0%	56	56.0%			
Second Year	126	41.9%	175	58.1%			
Third Year	148	37.9%	243	62.1%	0.003	5	18.231
Fourth Year	128	30.8%	288	69.2%			
Fifth Year	32	28.8%	79	71.2%			
Sixth Year	6	20.7%	23	79.3%			
Healthcare student							
Healthcare		36.8%	311	63.2%	0.608	1	0.263
Non-Healthcare	181	35.4%	553	64.6%			
	303						
Reason-save money							
Yes	101	57.1%	76	42.9%	< 0.001	1	39.631
No	383	32.7%	788	67.3%			
Reason-emergency					< 0.001		
Yes	149	45.2%	181	54.8%		1	16.234
No	335	32.9%	683	67.1%			
Self-care orientation							
High self-care	365	39.9%	549	60.1%	< 0.001	1	20.028
Low self-care	119	27.4%	315	72.6%			

4.7.4.5. Research Question 5- Risk factors of polypharmacy behaviours

4.7.4.5.1. Binary Logistic Regression analysis

Binary Logistic Regression (BLR) was conducted to assess the association of a number of factors with the likelihood that respondents would use more than one ONPD a day in self-medication practice. This analysis was also used to estimate the individual probability of polypharmacy as an outcome variable. All study variables were entered into the model. For each independent variable, there were 461 cases (respondents) in each category.

The Hosmer and Lemeshow goodness of fit test was non-significant (p = 0. 432), indicating a good model fit of the data. The statistically significant Cox and Snell R^2 (0. 107) and Nagelkerke R^2 (0.147) suggesting that the predictive power of the model is modest. The VIF using Cox and Snell R^2 (0. 107) was 1.11 and using Nagelkerke R^2 (0.147) was 1.17 which are both less than 10. This indicates that the inflation of the standard error caused by collinearity, if exists, is not a cause of concern and there is no collinearity problem. The Full BLR model resulted in 70.7% correct classification of polypharmacy and the monopharmacy users.

Binomial logistic regression was performed to ascertain the effects of 26 potential predictors on the likelihood that participants being polypharmacy user. The logistic regression model was statistically significant, $\chi2(8) = 8.020$, p=0.432. The model explained 14% (Nagelkerke R^2) of the variance in the least inappropriate ONPD use and correctly classified 70.3% of cases. Sensitivity was 31.7%, specificity was 90.3%, the positive predictive value was 62.9% and the negative predictive value was 71.7%. From the total of 26 predictor variables, only 7 were statistically significant. These were: frequency of use, dose seeking behaviour, effectiveness belief, informal source, self-care orientation, perceived-health, and, appropriateness of drug use as shown in Figure 4.7.

Figure 4.7 Associations with polypharmacy

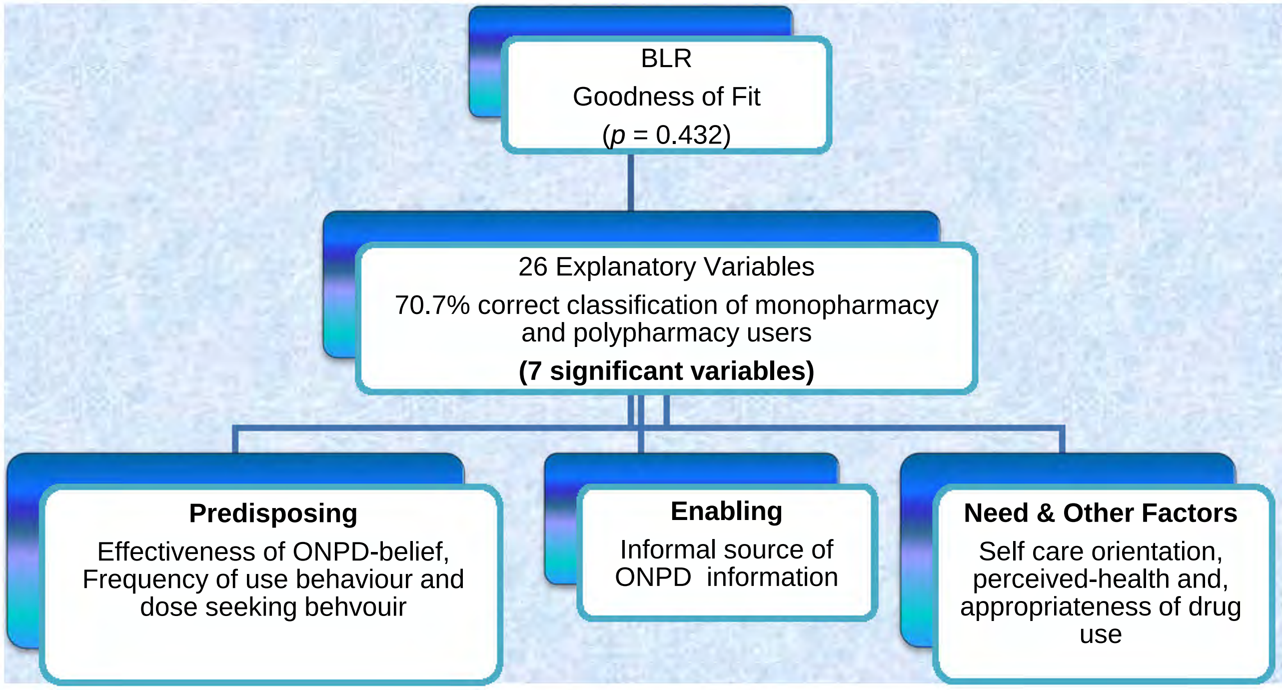


Table 4.20 shows that the odds of being polypharmacy user in the response group who were daily drug users are 3.3 times higher than yearly users and this result was statistically significant ($p<0.001$). Therefore, the daily use of ONPD may be one of the risk factors for polypharmacy use (OR= 3.443, 95% CI: 1.899-5.905, $p<0.001$).

Taking more than the recommended dose behaviour was a significant predictor. Participants who reported taking usually more than the recommended dose of ONPD had 1.9 times higher odds of polypharmacy use than those who did not (OR= 1.919, 95% CI: 1.440-2.557, $p<0.001$). Again, this result was statistically significant ($p<0.001$) which indicates that this predictor may be a risk factor for polypharmacy. The odds of being a polypharmacy user among participants who believed that ONPD are ineffective are 76% less than for those who believed that ONPD are effective. In this case, the true population effect was between 59% and 98%. This result was statistically significant (OR= 0.763, 95% CI: 0.591-0.986, p=0. 038). Therefore, the belief that ONPD is ineffective may be a protective factor against being polypharmacy user.

Using an Informal-source of ONPD information was a significant variable. In this case, the OR is greater than 1.0, which implies a positive relationship. Participants who got their information about the use of ONPD from informal sources had a 1.3 times higher odds of being polypharmacy users compared with those who did not (OR= 1.366, 95% CI: 1.058-1.764, *p*=0.017). Therefore, informal-source of ONPD information may be a risk factor for polypharmacy use. High self-care orientation may also be a risk factor for being a polypharmacy user. The odds of being a polypharmacy user among the participants in this study, was significantly associated with a high level of self-care orientation. The OR in this case indicates that participants exhibiting high self-care orientation are 1.7 times more likely to be polypharmacy users when compared with participants with a low level of self-care orientation. The true population effect in this case was between 13% and 23% (OR = 1.792, 95% CI: 1.363-2.356, $p<0.001$).

Inappropriate drug users had 1.6 times higher odds of being polypharmacy users when compared with appropriate counterparts (OR = 1.633, 95% CI: 1.062-2.509, $p<0.05$). Therefore, inappropriate drug use may be a risk factor for polypharmacy use. Furthermore, participants that perceived their current health as good had 1.5 times higher odds of being polypharmacy users compared to those who rated their health status as very good-health (OR = 1.546, 95% CI: 1.150-2.077, $p<0.01$). Similarly, a fair-self-reported health status might be a risk factor for polypharmacy behaviour (OR = 1.465, 95% CI: 1.005-2.135, $p<0.05$).

Table 4.20 Logistic Regression model for associations with polypharmacy behaviour (n=1348)

Variables	**Response**	**OR**	**95% CI**		***p*-value**
Effectiveness of NPD belief (ref-effective)	Moderately	1.062	0.539	2.095	0.862
	Ineffective	0.763	0.591	0.986	0.038
Frequency of use behaviour (ref-yearly)	Monthly	1.459	0.925	2.301	0.104
	Weekly	1.645	0.996	2.717	0.052
	Daily	3.349	1.899	5.905	0.000
Taking more than the recommended dose behaviour (ref-No)	Yes	1.919	1.440	2.557	0.000
Informal- source of ONPD information (ref-No)	Yes	1.366	1.058	1.764	0.017
Self-care orientation (ref-low)	High	1.792	1.363	2.356	0.000

Table 4.20 Continued

Variables	Response	OR	95% CI		*p*-value
Appropriateness of drug use (ref-appropriate drugs use)	Inappropriate drug use	1.633	1.062	2.509	0.025
Perceived-health (ref-very good)	Poor	0.985	0.388	2.506	0.976
	Fair	1.465	1.005	2.135	0.047
	Good	1.546	1.150	2.077	0.004

4.7.4.5.2. Bivariate analysis of the risk factors of polypharmacy

Table 4.21 shows that there is enough evidence to suggest an association between the frequency of ONPD use and polypharmacy behaviour ($p > 0.001$) with the highest proportion of polypharmacy behaviour for daily users (53.5%) and the lowest for the yearly users (20.4%).

The proportion of polypharmacy users was significantly ($p<0.001$) higher among users who reported taking more than the recommended dose of ONPD (50%) compared to those who did not or were not sure (29.9%). Moreover, no significant association was found between ONPD effectiveness belief and polypharmacy ($\chi^2(2) = 2.615$, $p = 0.271$). There was an association between the informal source of information and the polypharmacy ($X^2(1) = 16.630$, $p<0.01$). Similarly, high self-care orientation is significantly associated with polypharmacy ($X^2(1) = 20.034$, $p<0.01$). Moreover, perceived-health was significantly associated with the polypharmacy ($X^2(3) = 17.426$, $p<0.01$). Therefore, we can reject the null hypothesis and accept the alternative hypothesis.

The proportion of polypharmacy users was significantly higher among inappropriate ONPD user (44.4%) compared to appropriate users (33.3%). Therefore, there is enough evidence to suggest an association between the appropriateness of ONPD use and polypharmacy behaviour ($X^2(1) = 5.477$, $p<0.05$). The data indicates that students, who were frequent users of ONPD and/or tended to take more than the recommended dose, also had a higher chance of engaging in polypharmacy. As presented above, results of this analysis indicate that these two types of behaviours are associated with polypharmacy. Implicitly, this signifies that this group is at a significant risk of experiencing adverse events. Concomitantly, since this sample also exhibited inappropriate use, this demonstrates irrational use of medication, demonstrated by polypharmacy, inappropriate use and increased frequency of use.

Table 4.21 Explanatory variables/predictors that had significant associations with Polypharmacy behaviour of users (n =1348)

Associated factors	Polypharmacy users		Monopharmacy users		*p*-value	df	χ2
	Number	*Percent*	*Number*	*Percent*			
Frequency of use							
Daily	69	53.5%	60	46.5%	0.001	3	38.574
Weekly	114	38.9%	179	61.1%			
Monthly	248	31.8%	531	68.2%			
Yearly	30	20.4%	117	79.6%			
Dose seeking behaviour							
Yes	145	50.0%	145	50.0%	0.001	1	40.996
No/not sure	316	29.9%	742	70.1%			
Effectiveness belief							
Ineffective	18	40.4%	27	60.0%	0.271	2	2.615
Moderately effective	257	325%	533	67.5%			
Effective	186	36.3%	327	63.7%			
Informal source							
Yes	282	39.1%	439	60.9%	0.001	1	16.630
No	179	28.5%	448	71.5%			
Self-care orientation							
Low	112	28.5%	322	74.2%	0.001	1	20.034
High	349	38.2%	565	61.8%			

Table 4.21 Continued

Associated factors	Polypharmacy users		Monopharmacy users		*p*-value	df	χ2
	Number	*Percent*	*Number*	*Percent*			
Perceived-health very good Good Average Poor	 96 263 94 8	 74.4% 37.3% 38.7% 33.3%	 279 443 149 16	 74.4% 62.7% 61.3% 66.7%	0.001	3	17.426
Appropriateness of drug use appropriate drugs use Inappropriate drug use	 413 48	 33.3% 44.4%	 827 60	 66.7% 55.6%	0.019	1	5.477

4.7.5. Relationship among outcomes variables

The chi-square test of independence was carried out to test the relationship among the outcome variables: incautious ONPD use, inappropriate ONPD use, antibiotic use without prescription and polypharmacy behaviour. Incautious use was independent of inappropriate use (*p*>0.05, χ^2=0.223) and antibiotics use without prescription (*p*>0.05, χ^2=248) and significantly associated with polypharmacy behaviour (*p*≤ 0.001, χ^2=10.769). Furthermore, polypharmacy behaviour, antibiotics use and inappropriate ONPD use were dependent (i.e. associated) with each other. Therefore, these results indicate that participants who engage in polypharmacy behaviour are also more likely to use antibiotics without prescription, and are also more likely to be inappropriate ONPD users. This data is presented in Table 4.22 below.

Table 4.22 Relationship among outcomes variables (n=1348)

Outcome-variables	Incautious ONPD use	Inappropriate Use	Antibiotic use without prescription	Polypharmacy behaviour
Incautious ONPD use	✕	*p*-value=0.637, $\chi 2$=0.223	*p*-value=0.619, $\chi 2$=248	*p*-<0.001, $\chi 2$=10.769
Inappropriate use	*p*=0.637, $\chi 2$=0.223	✕	*p*<0.001, $\chi 2$=17.887	*P*=0.019, $\chi 2$=5.477
Antibiotic use	*p*-value=0.619, $\chi 2$=0.248	*p*-<0.001, $\chi 2$=17.887	✕	*p*<0.001, $\chi 2$=17.028
Polypharmacy behaviour	*p*-<0.001, $\chi 2$=10.769	*p*=0.019, $\chi 2$=5.477	*p*<0.001, $\chi 2$=17.028	✕

4.7.5.1. Research Question 6

What are the reasons for ONPD use; the sources of ONPD information; the sources of ONPD acquisition; and the therapeutic categories of commonly used ONPD?

4.7.5.1.1. Reason(s) for ONPD use

The majority of respondents (78.7%) reported that management of minor illness was the main reason for using ONPD. Saving time as a reason for using ONPD was reported by more than half (54.4%) of the respondents. Furthermore, previous experience was cited by 42.4% of the respondents and about a quarter of the respondents (24.5%) reported emergency cases as common reasons for self-medication with ONPD. Respondents could indicate more than one reason for ONPD use, so percentages sum are more than 100% as shown in Table 4.23

This indicates that the main reason for using ONPD is because participants believe that they can treat minor illness, while at the same time saving time that would otherwise be spent at the physician. Thirdly, previous experience was rated as a reason for using ONPD. This further indicates that if participants had a positive previous experience with using ONPD, then they will be more likely to engage in this behaviour in the future.

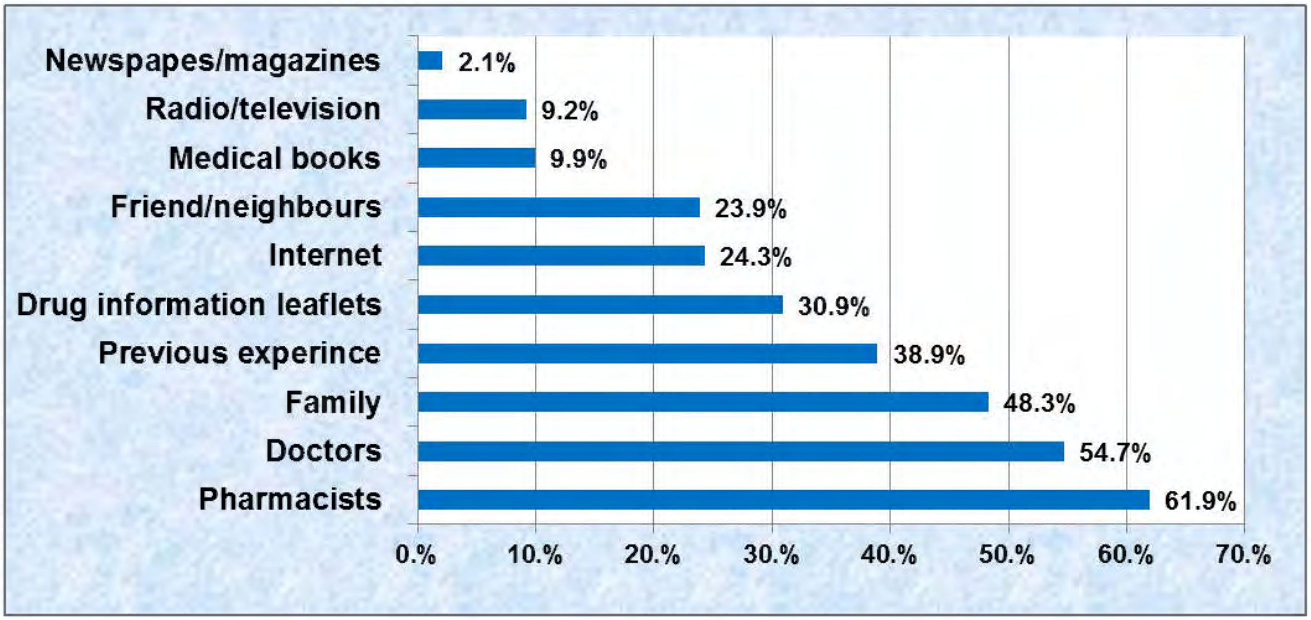
Table 4.23 Distribution of the most common reasons for self-treatment with ONPD (n=1348)

Reason(s) for ONPD use	Number	Percentage
Minor illness	1061	78.7
Saving time	734	54.5
Previous experience	572	42.4
Emergency	330	24.5
Disease prevention	182	13.5
Saving money	177	13.1
As effective as prescription drugs	62	4.6

4.7.5.1.2. Source(s) of ONPD information

Pharmacists (61.9%) were the most commonly cited source of ONPD information by the respondents, followed by physicians (54.7%), family (48.3%), and previous use (38.9%). Drug information leaflets were ranked at 30.9%. Note that respondents could indicate more than one source for ONPD use, so percentages sum to more than 100%. Figure 4.8 shows the sources of ONPD information among users.

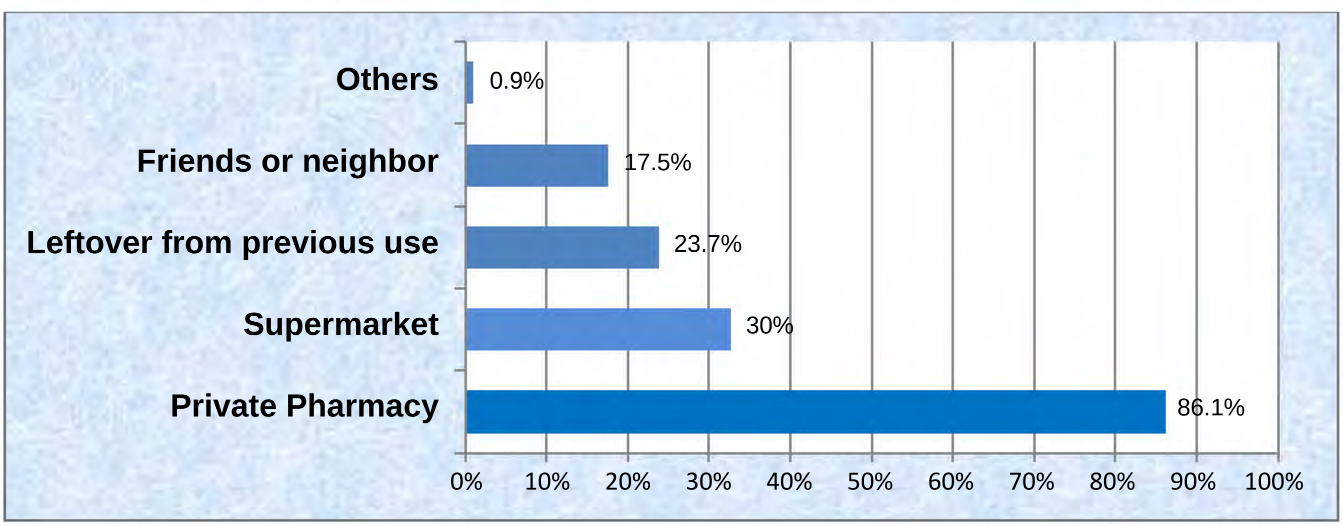
Figure 4.8 Sources of ONPD information (n=1348)



4.7.5.1.3. Source(s) of ONPD acquisition

Private pharmacies were the most common source for ONPD acquisition (86.1%) among respondents. Supermarkets were cited by 30%, followed by leftover ONPD from previous use (23.7%) and friends/neighbours (17.5%). Respondents could indicate more than one source of acquisition for ONPD, therefore percentages sum are more than 100% as shown in Figure 4.9.

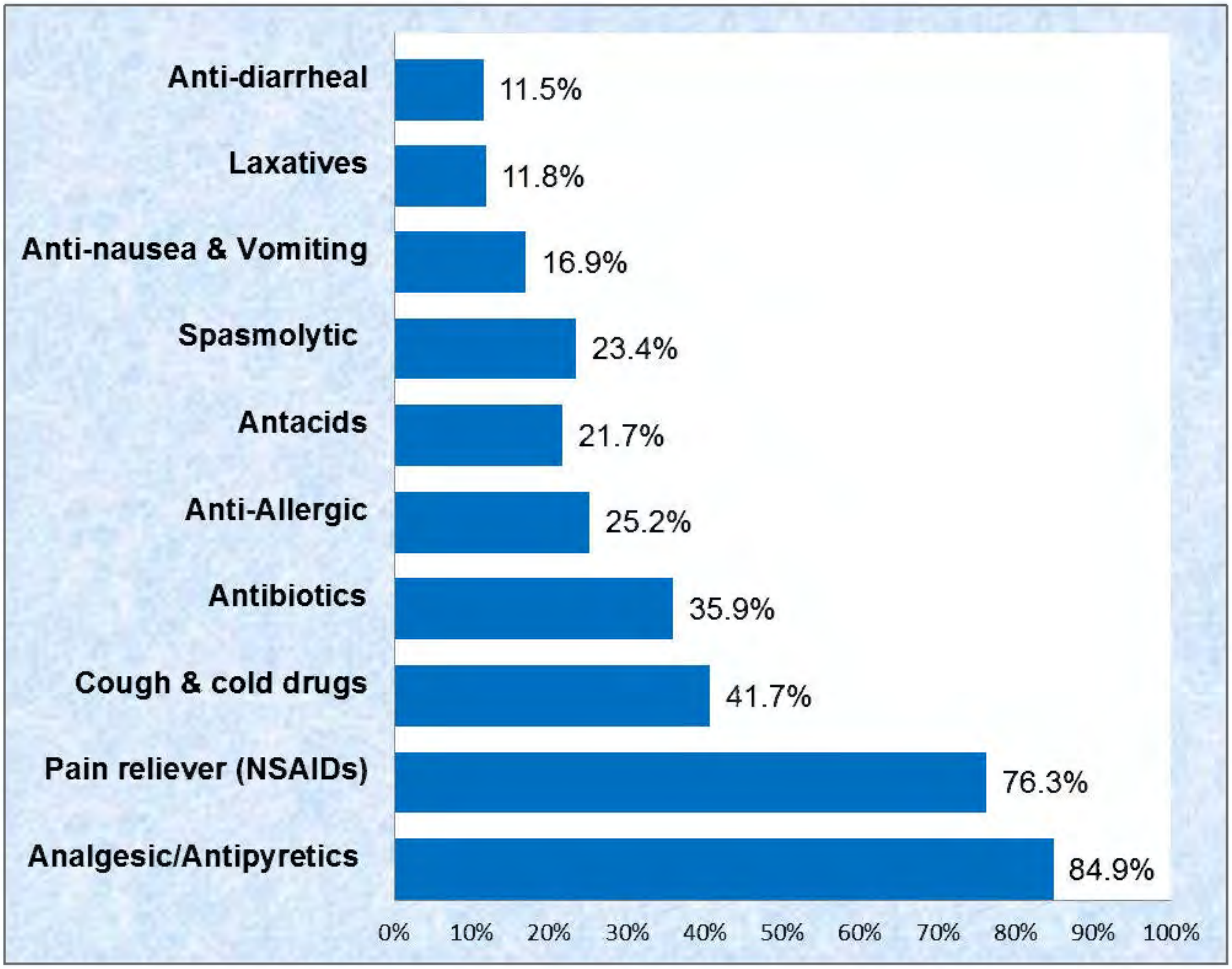
Figure 4.9 Sources of ONPD acquisition (n=1348)



4.7.5.1.4. Types of the most commonly used ONPD categories

The most commonly used ONPD in the present study were analgesic and ant antipyretic medication (paracetamol) at 84.9%, followed by the pain relief category [non-steroidal anti-inflammatory drugs (NSAIDs) such as Brufen®] at 76.3%. Drugs used for treating cough and cold symptoms such as cough syrups were reported to be used by more than two-fifths of the respondents (41.7%) as shown in Figure 4.10.

Figure 4.10 Types of the commonly used ONPD categories (n=1348)



4.8. Discussion

This survey sought to answer six main research questions. Firstly, the study investigated the current status of ONPD use among university students in the UAE. Secondly, the study sought to determine the risk factors that lead to incautious ONPD use among students in the UAE. Thirdly, this investigation aimed at determining the risk factors associated with inappropriate use of ONPD. Fourthly, the survey aimed to determine the risk factors associated with using antibiotics without prescription in the selected sample. Fifthly, the study aimed to determine the risk factors associated with polypharmacy in the selected sample. Finally, the study aimed to determine the reasons for ONPD use, namely the sources of ONPD information; the sources of ONPD acquisition; and the therapeutic categories of commonly used ONPD among university students in the UAE. Each of these questions will be answered and discussed considering the results obtained within the following sections.

4.8.1. Prevalence of ONPD use

In the studied time-frame, results indicate that 57.2% (1348 of 2355) of the sample used ONPD drugs. This rate is similar to results retrieved by Sharif (2012) and Sharif and Sharif (2013) who found that over 50% of students in the UAE self-medicate with NP. Different prevalence rates have been registered in Iran (76.6%) by Sarahroodi et al. (2012) and in Palestine with rates of 37.7% and 60% respectively (Sweileh, 2004; Sawalha 2008). These differences may be explained by several factors uncovered in the literature. One of these differences refers to the recall period used by the researches as this differed among studies. As argued by Cleland and Durning (2015) and Kjellsson et al. (2014) the recall period used can produce different results in the same sample due to participant recall bias. Another factor to consider is access to health care. As argued by Zaghloul et al. (2014) and Sharif et al. (2015) when healthcare is available, there is a lower probability that people will self-medicate with NP. Therefore, studies working with samples who have limited access to health care may achieve a higher prevalence rate. Conclusively, all these differences in methodologies may produce different prevalence rates, especially when not acknowledged by authors and controlled as confounding factors in the analysis process.

In the present study, all further testing was carried out by using 57.2% of participants, who reported to have been using ONPD in the past 90 days. In this case, participant bias becomes less relevant as if some participants did not recall using ONPD these were eliminated as reporting non-use. Furthermore, the total sample included that did use ONPD, which was 1348, meet the statistical requirements of sample size, which was 1068. Based on this data, it can therefore be stated that over half of students in the UAE use ONPD.

4.8.2. Prevalence of Cautious ONPD Use

Previous research (James 2006, James, et al. 2008) into cautious use of ONPD indicates that over 70% of students who self-medicate with NPD read the information on or in the package before taking the drug. The current survey found similar rates (77.8%) of cautious behaviour when taking medication. However, only 32.3% of the students who read the leaflet inside the package argued that this information changed the way in which they were taking the medicine. 36% stated that this had no effect on their self-medication behaviour. This difference was not found to be statistically significant, yet it was supported by additional findings, including the fact that from the 77.8% of participants who read the leaflet, 44% read only the drug use section while 72.7% did not read all the information. It can therefore be argued that although a high percentage of students did read the instructions, not all of them read the whole leaflet.

For the purpose of examining this behaviour in the selected sample, this survey considered different types of cautious use, such as reading the whole leaflet or keeping the leaflet for further use. However, it is to be noted that the correct form of behaviour is to read the whole leaflet (James 2006, James, et al. 2008), although some intermediary forms exist. For example, reading the dosages could protect users from using an inappropriate dose or/and an inappropriate frequency, yet this will not protect users from interactions with food or other medication. It was therefore considered that reading some of the leaflet is in part better than not reading it at all. Considering this aspect, it should be noted that the 77.8% of students who were cautious users, were not fully exhibiting this behaviour, but some aspects of it. This indicates that this percentage should not be considered as the total percentage of students who engage in cautious behaviour.

4.8.3. Prevalence of the Appropriate ONPD use

Results showed that the most recent symptoms identified were headache (46.4%; 626 of 1348), menstrual pain (51.1%; 203 of 1348) and finally common cold

(10.8%; 145 of 1348). To determine if the correct ONPDs were used for the right type of symptom, this study assessed participants' self-medication behaviour based on five criteria which verified the accuracy of the drug taken. A total of 92% of the participants had five correct assessment criteria, which thus indicated that they had taken the right type of drug for the correct symptom. All these symptoms are common among the general population and display characteristics that are easily identifiable. This may explain the high positive rate achieved in this assessment.

A total of 72.3% satisfied the correct self-diagnosis criterion by selection of the right drug (paracetamol 66.3% and ibuprofen 10.5%). Over ¾ of users (76.7%) selected the correct drug; correct dose and frequency of use for both the paracetamol and ibuprofen (4–6 hours, if needed, to a maximum of 4 grams every 24 hours) caused two-thirds of the users (66%; 894 of 1348) to satisfy the dose and frequency criteria; and finally. Because there are no food–drug interactions for paracetamol this was not considered as an assessment factor. However, Ibuprofen must be taken after food to avoid gastric issues (FDA and NCL, 2013, p.7; Bobroff et al., 2009, p.7). A minority of users (1.3%; 8 of 1348) violated the food-drug administration criterion related to the use of Ibuprofen.

Results reported by this study are in contrast with previous literature which shows that the prevalence of appropriate drug use is much smaller. For example, in Sudan Awad and Eltayeb (2007) reported only 20% appropriate drug use while James et al. (2006) reported a rate of 16%. The significant differences may be explained by the methodological approaches, as well as by the differences in the sample used. As previously indicated, (Kjellsson et al., 2014) recall bias can interfere with the accuracy of results, especially when a longer period has passed between the assessment period and the behaviour analysed. Some of the studies showing different results (Awad and Eltayeb, 2007; James et al., 2008; James et al., 2006; Sclafer et al., 1997) used longer recall periods which may have interfered with the results. Another difference between the current study and additional literature exploring the same topic is the sample used. 92% of the participants in this study demonstrated moderate-to-good levels of ONPD knowledge and 86% demonstrated moderate-to-good medication knowledge. Other studies (Sharif and Sharif, 2013; Sharif and Sharif, 2014; Sharif et al., 2015) found lower levels of ONPD knowledge among similar student samples. This difference may emerge from the fact that the sample included in this study contained healthcare students.

Additionally, 61.9% of our sample stated that they followed pharmacists' advice on using ONPDs. Other studies did not consider this variable and thus a clear comparison cannot be made. Nevertheless, over half of our sample (54%) disagreed with the fact that ONPDs are safe regardless of the frequency of use. This indicates that the sample used in this study may have displayed higher levels of awareness by contrast with samples used in other research. Yet it cannot be disregarded that the other half of participants did not consider ONPDs to be unsafe regardless of the dose. This indicates that risk awareness in the studied sample is limited to around half of the participants, which implies that the other half is unaware of these risks. Other research by James et al. (2008) and James et al. (2006) used data from healthcare students who were in the first university year while in our sample only 7.4% were first year students and 36.5% were studying medical related disciplines. Subsequently, it is evident that the participants in this survey had a higher level of knowledge in relation to the use of ONPD as they were not only healthcare students but also further ahead in the curriculum by contrast with the other samples used in the aforementioned studies. This may have translated in results that indicate high levels of ONPD and antibiotic knowledge. Additional variations in results obtained may relate to the class of drugs included for assessment. Some studies (James et al., 2006; James et al., 2008; Sclafer et al., 1997) included vitamins, creams and ointments, while this study focused exclusively on oral-dosage drugs. Therefore, it is probable that the relatively high prevalence of appropriate ONPD users in our study is attributable to the exclusive focus on ONPD use.

Finally, another justification for the differences in results obtained by other research and the results of the current study may relate to sample size. A significantly larger number of participants (n=1348) was used in this study by contrast with other research (James et al., 2006 (n = 134) and James et al., 2008 (n = 141)). Large samples are generally more representative of a target population by contrast with smaller samples (Howell, 2011; Tabachnick and Fidell, 2007). Therefore, our research incorporated more possible characteristics of the studied population, thus avoiding data error by limiting the sample studied to only a small number of individual characteristics.

4.8.4. Prevalence of either Incautious or Inappropriate ONPD Users

Two recent studies conducted in the UAE by Sharif and Sharif (2013) Sharif and Sharif (2014) and Sharif et al. (2015) argue that the rate of erroneous medication use among various groups of health care students is high. These studies therefore recommend interventions to minimise negative behaviour on medication consumption among this population. In the present survey, the results obtained via the self-administered questionnaire revealed that over a quarter of the participants (28.2%) used medication incautiously or inappropriately. The findings thus reflect the results elaborated by Sharif and collaborators, reinforcing the idea that an educational intervention is required to help minimise irrational medication use among health care students.

4.8.5. The Prevalence of Using Antibiotics without Prescription

From the total sample, 38.6% of responders indicated to having used antibiotics without prescription within the last three months. Our results showed that 40.4% (n = 492) of healthcare students used antibiotics without prescription while non-healthcare students exhibited lower rates at 37.6% (n = 856). For this population, knowledge seems to be an enabling factor. The results indicate that the rates of self-medication with antibiotics are similar to other values reported by literature. Sharif et al. (2012) reported a rate of 32% among pharmacy students in Sharjah University in UAE while Sharif and Sharif (2013) reported a rate of 40.2% among students in pharmacy and dental colleges at the University of Sharjah, UAE. Some contrasting evidence is presented by Sharif and Shari (2014) who reported that antibiotic use without prescription rate is only 11% among business students in a university in the UAE. However, the same study reports that only 8% of the sample participants were aware of the implications of antibiotic resistance and consequently used medication appropriately. Thus, irrational use of medication as related to the use of antibiotics without prescription, was significantly high among healthcare students, regardless of profile studied (dentistry, medicine, pharmacy).

4.8.6. Prevalence of Polypharmacy use

Around one-third of participants (34.1%; 461 of 1348) had engaged in polypharmacy behaviour within the last three months. This accounts for over one third of the participants who, according to research (Koh et al., 2005; Viktil et al., 2007; Pinheiro, 2011; Rambhade et al., 2012) exposed themselves to a variety of risks, including drug interactions, side-effects and food-drug interactions.

Additional data extracted in this survey may provide some reasons for which a significant portion of the participants engaged in this behaviour. The most evident reason as indicated by the data retrieved seems to be quick relief. Students in this study noted that the most common type of pain was headache. Consequently, the most common drugs used were paracetamol, with 84.9% of participants using it, and non-steroidal anti-inflammatory drugs, which was used by 76.3% of participants. Considering this evidence, it is therefore possible that students sought out a quick relief for pain. Several studies into similar phenomena (Mumtaz et al., 2011; Da Silva et al., 2012; Sharif et al., 2012; Pandya et al., 2013; Sharif and Sharif, 2014) attribute the use of these drugs to seeking quick relief for symptoms hence these results are supported by previous evidence.

Another reason for which participants engaged in polypharmacy behaviour relates to having previous experience with using the medication for treating the same symptom. Similar to the findings of Sawalha (2008), participants repeated the same medication regimen for the same symptom. Therefore, it can be stipulated that previous polypharmacy behaviour is likely to cause a similar behaviour in the future once the initially treated symptom reappear. Other than the aforementioned reasons (which may be connected to polypharmacy behaviour) another significant motive emerged from the data. This relates to the belief that a single ONPD is not effective or that it is only moderately effective. Over half of the sample (58.6%) held the belief that ONPD are moderately effective while 3.3% believed that this medication is ineffective. Similar results have been presented by Chana and Bradley (2011) in reporting medication use behaviour in the general population in Cameroon as they used multiple drugs because they do not have sufficient trust in the effectiveness of a single drug.

4.8.7 Risk Factors of Incautious ONPD Use

One of the focuses set for this study was to extract the factors associated with incautious use of ONPD. Subsequently, 25 potential explanatory variables were tested by using the binary logistic regression analysis to determine which of these elements can better explain this behaviour among the studied population. An aspect worth mentioning is that this analysis did not find any correlation between incautious use and inappropriate use of ONPD. Therefore, reading the drug information leaflets when first using the medication is not related to appropriate use behaviour.

As demonstrated by the results section of this research, only 11 out of the 25 proposed variables seemed to pinpoint to the risk factors associated with incautions ONPD use. In the current study, the factors associated with incautious use of ONPD were related to: younger age, gender, expiration date checking behaviour, polypharmacy behaviour, trust in health care professionals, medical advice seeking behaviour, professional source of ONPD information, informal source of ONPD information, reading medical books/ the internet source of ONPD information, self-care orientation and being a healthcare student. The extraction of these factors was conducted in line with Andersen healthcare utilisation model and was applied on a considerable sample size. A cohort study conducted by Vinker et al. (2007) used a limited number of explanatory variables (five) yet similarly to our study it concluded that female participants were less likely to engage in incautions ONPD use.

Similar findings have been reported by James et al. (2006) and Akici and Basran (2013). In contrast to some reports in the literature (Vinker et al., 2007), participants aged 21 years or older had a lower probability of being incautious ONPD users compared to those with a lower age. It can therefore be suggested that the older users are more conscious of the importance of reading the drug information leaflets to ensure the safe and effective use of drugs. Inconsistencies may therefore be attributed to differences in participants' age. (18 to 35 years with a mean age of 21 years (SD = 2.0) in our study versus 18–87years (mean ± SD= 15.6 ± 55) in Vinker et al., (2007)) In relation to cautious behaviour, this study found an unexpected result. Participants who did not verify the expiration date on the drug labels were more likely to read the information leaflet of the medication. This signifies that not checking the expiration date acted as a protective factor against being an incautious user. Although participants who purchased drugs from stores may be at risk of using expired medication, this finding has not been reported by other literature.

Students who did not have a high level of trust in the information offered by healthcare professionals were more likely to seek information about the use of ONPD from drug information leaflets, and consequently were more likely to be cautious ONPD users. Participants might intentionally avoid seeking information from healthcare professionals, reading medical books, searching the internet or reading drug information leaflets because these sources of information simply “scare” them, for example by telling them about the potential side and adverse effects of a drug (Case, 2012). Therefore, many people trust information about drug use from family, friends and neighbours (Cusack et al., 2013). However, as previously mentioned, this result is describes for the first time and therefore cannot be compared with other studies. More data should also be collected in relation to information seeking behaviour and its result for ONPD consumption. Intuitively, the results of this study also showed that participants who failed to get ONPD information from reading medical books or the internet were at high risk of not reading the drug information leaflets as well. This behaviour subjected participants to a variety of identified risks, including taking the inappropriate medication after setting an inappropriate diagnosis, or the inappropriate dosages with an inappropriate frequency.

Healthcare students had a lower probability of being incautious users compared to non-healthcare students. This result suggests that healthcare students have higher awareness about the importance of reading drug information leaflets for the first use, compared to non-healthcare students. This positive finding is encouraging since healthcare students might have a false sense of confidence because of having pharmacology courses in their academic curriculum, so they might not be eager to read drug leaflets. As previously mentioned our finding is new and cannot be compared with other studies. Students with polypharmacy behaviour (using more than one drug for treating a single illness) had a higher probability of being incautious users than monopharmacy users. This finding demonstrates that using more than one drug increased the likelihood of not reading the drug information leaflets. As noted for other findings in this study, this result was also firstly reported by this research thus a comparison with other studies cannot be made. .

4.8.8. Risk factors for the least Inappropriate ONPD Use

From the total of 25 variables considered as factors associated with inappropriate use of ONPD, only three were found to be associated with the highest likelihood of using ONPD inappropriately. These factors included polypharmacy behaviour, safety belief about the use of ONPD, and medication knowledge. Participants who engaged in polypharmacy behaviour were also more likely to be inappropriate users. Participants who usually took more than one drug concurrently for self-treating a single symptom had a higher probability of being the least inappropriate ONPD users than those who usually took only one drug daily. This expected result can be interpreted in several ways: using different drugs means using different active ingredients, which increases the possibility of drug–drug interactions. Furthermore, there is a possibility of using multiple drugs with different brand names but the same active ingredients, which increases the risk of exceeding the maximum recommended dose and also puts these participants at risk of being inappropriate ONPD users (Hughes CM 2001; Hardon et al., 2004; Ruiz 2010).

Mamun et al., (2004) investigated a different target population yet also uncovered similar results in relation to polypharmacy and risk of inappropriate ONPD use. Considering that this research is over a decade old, the current study can be regarded as an update on the topic, demonstrating that the association between polypharmacy behaviour and inappropriate use may be consistent through time. Although 54% of our sample disagreed that ONPDs are safe to use regardless of frequency of use, the other half of the sample did not see ONPDs as dangerous. Because our study also shows significant levels of incautious ONPD use, such results under this variable were to be expected previous cross-sectional investigations from

UAE (Sharif and Sharif, 2014) display similar findings as 20% of the university students (n=200) in UAE, believed that increasing drug dose cannot be dangerous (Sharif and Sharif, 2014).

Another result we expected to find was that low levels of medication knowledge would result in more inappropriate usage. However, our findings showed that a low-level of medication knowledge was not associated with the use of ONPD but instead, a moderate level of medication knowledge was found to be associated with appropriate usage. Therefore, having a moderate level of medication knowledge acted as a protective factor against the inappropriate use. This finding suggests that students with adequate medication knowledge are using their drugs appropriately. Therefore, our study demonstrates that moderate level of medication knowledge enables students to use ONPD correctly and appropriately. To the best of the author's knowledge, this is the first study to examine the relationship between medication knowledge and inappropriate drug use. However, our findings can be compared with other studies that investigated the associations between self-medication practices yet without connecting this with knowledge and appropriate use. These results are however contrasted by the study conducted by Auta et al. (2012) who found no statistically significant connection between the level of knowledge over ONPD and inappropriate use. This contrast may be explained by using only a chi-square testing and also by the limited sample and the demographic characteristics of the participants.

Incautious ONPD use was not associated with inappropriate ONPD use. This finding was quite surprising and suggests that reading the drug information leaflets before first-time use is not related to actually using ONPD appropriately in terms of five assessment criteria. This unexpected result might be related to the fact that our study was focused on examining the association between least inappropriate ONPD use and Incautious ONPD use; therefore, our finding might not reflect the full influence of reading the drug information leaflets on moderate or most inappropriate ONPD use. Future studies are required to investigate this relation in depth.

4.8.9. Risk factors for using Antibiotics without prescription

Previous research (Awad and Eltayeb, 2007) investigated the risks associated with using antibiotics without prescription; however, the current survey used a significantly higher number of variables when testing for these risks. In this regard, one of the associated factors of concern was nationality which was connected with medical insurance. UAE nationals had lower odds of using antibiotics without prescription compared to expatriates.

These data were retrieved from information provided by Zaghloul et al. (2014) arguing that non-UAE nationals have limited or no health insurance in comparison to UAE nationals who have access to premium health care. Testing for nationality therefore allowed this study to discover that non-UAE nationality students had statistically significant increased odds of using antibiotics without prescription. Additional research carried out by Panagakou et al. (2012) reported that immigrant status, being immigrants, were significantly associated with use of antibiotic without prescription among parents treating their children for Upper respiratory tract infections (URTIs) in Greece.

Our study shares several similarities with that of Panagakou et al. (2012) comprising: study design; sampling technique; adequate sample size; using bivariate and multivariate statistical analysis. However, the target populations are quite different in both studies. In addition, differences are noted in the number and the types of predictors in the analysis which may justify the differences in the results of this study and the study carried out by Panagakou et al. (2012). To the best of the researcher's knowledge, this was the first study to directly assess immigrant status and antibiotic use among students. As noted by Abasaeed et al. (2009) and Al Akshar et al. (2014) although antibiotics are prescription-only drugs in UAE, this law is not enforced, thus granting easy access to this type of medication and facilitating use.

Other associated factors which increased the likelihood of the studied population to use antibiotics without prescription were the price of the drugs and the type of health seeking behaviour. Specifically, the participant's perception of the disease severity dictated the odds of using antibiotics without prescription. Participants who were influenced by the cost of drugs had a higher probability of using antibiotics without a prescription than those who were not influenced. This finding might be attributed to the belief that more expensive drugs are more effective because higher cost signals higher quality. Participants might buy more expensive drugs rather than cheaper drugs, (wrongly) believing that the more expensive drug (antibiotics in this case) will cure their symptoms more quickly. This is particularly evident, in the case of infections, which were perceived by participants as a serious health condition.

While MacKian (2003) determined that health-seeking behaviour differs within the same individual depending on perceptions of illness severity, to the best of the researcher's knowledge this is the first study to correlate these two variables. Keeping this in mind, the study also found that belief was an important factor associated with taking antibiotics without prescription. Thus, participants who believed that ONPDs had moderate to no effect were less likely to take antibiotics without prescription. This belief might be attributed to the availability of these drugs (including antibiotics) without prescription in the UAE (Al Akshar et al., 2014). Because no other studies have engaged with these variables it is not possible to compare this finding with other researches. Consequently, it is recommended that future research should explore this gap.

Pan et al. (2012) also found similar results and argued that a false sense of confidence and easy access to antibiotics in Chinese healthcare students made them more likely to use antibiotics without prescription. Our study did not find any links between previous medication knowledge and use of antibiotic without prescription although Pan et al. (2012) did note this link. This discrepancy can be connected with variables used to explain the level of knowledge, as well as with the types of predictors used in multivariate statistics. Due to these aspects, it can be argued that further studies should investigate this topic in depth.

The university year of study was found to be connected with the risk of taking antibiotics without prescription. Students in the first year of study were more likely to take antibiotics without prescription by contrast with students in the fourth, fifth and sixth year of study. James et al., (2008) also found similar connections regarding the use of antibiotics. Although these findings may contradict the initial findings of this study according to which an increased level of medical knowledge is connected with an increased likelihood of taking antibiotics without prescription, this discrepancy may be explained by the notions of knowledge and awareness measured. Healthcare students in particular may have sufficient knowledge to pass exams in relation to antibiotic use and the functionality of the human microbiota, yet this knowledge may not be reflected in the level of practical awareness. Gurteen (2003) stipulates that to have a practical effect, a high level of knowledge and awareness is needed.

Money saving behaviour seemed to act as a risk factor for taking antibiotics without prescription. As stipulated by Zaghloul et al. (2014), participants who had to pay for consultations would renounce this practice and engaged in self-medication, including in taking antibiotics without prescription. This was also true for the population studied through this research. On a contrasting yet corroborating line, Pan et al. (2012) argued that Chinese students, who benefited from free medical care from the university campus, were less likely to take antibiotics without prescription. This study also found that participants who did not use an ONPD for an urgent health situation (i.e. having a fever at night) were also more likely to take antibiotics without prescription. In a study (Ibrahim et al., 2015) conducted in Saudi Arabia and in another Pakistan based research (Mumtaz et al.,2011) authors argued that students generally do take ONPDs in an emergency situation. Similar findings were also reported by the current study. Nevertheless, it can be stipulated that in lack of controlling symptoms of a cold, such as fever or headache, on a normal course of the illness, people would feel increasingly sicker and thus perceive their condition as more severe hence taking antibiotics without prescription in the belief that this medication is more effective. Although previous research (MacKian, 2003; Biswas et al., 2006) notes that perceiving a high severity of illness is associated with taking antibiotics without prescription, more research should investigate the correlation between not taking ONPDs on an emergency situation and risk of subsequent antibiotic use without prescription. As far as we are aware, this is the first time that urgency of drug use is investigated as an associated variable for the use of antibiotics without prescription in the literature.

Another finding of this study underlines a clear distinction between perception and reality of medication use. In this sense, participants who had a high perception of self-care were more likely to take antibiotics without prescription by contrast with participants that had a low self-care perception. This finding is similar with data presented by Sawalha (2008) who found that university students exhibiting high self-care orientation in Palestine were more confident in self-medication across a variety of drug categories including antibiotics. It can therefore be concluded that, counter-intuitively, participants with high levels of self-care were also more likely to engage in taking antibiotics without prescription.

4.8.10. Risk Factors for Polypharmacy Behaviour

To the best of the researcher's knowledge this is the first study to assess 26 variables that might be associated with polypharmacy behaviour. Succeeding the analysis of these variables, seven were found to be statistically significant: frequency of use, dose seeking-behaviour, effectiveness-belief, informal source, self-care orientation, perceived-health, and appropriateness of drug use. Furthermore, participants who were likely to use antibiotics without prescription were also likely to engage in polypharmacy behaviour. This element was not explored further hence new research should look into the specific correlations of this association. In terms of frequency of use, participants who were labelled as high frequency users had a higher probability of engaging in polypharmacy behaviour. Misra et al. (2000) and Koushede et al. (2010) connect frequency of use and over-dosages with stressful exams which may also increase the probability of dependence and abuse. In the current study, the research was conducted following the academic examination period, which may thus explain the increased rates of polypharmacy behaviour.

Additional findings in this study indicate that participants who took more than the recommended doses of ONPD were also more likely to take more than one medication. Ellen et al., (1998) indicates that over-dosage use is taken in the belief that the medication will be more effective or that it will act faster. While our research provides further evidence linking polypharmacy behaviour with exceeding the recommended dosages, more studies should investigate risk factors associated exceeding the normal dosages of ONPD. Case (2012) argued that people preferred to attain information on NPDs from informal sources such as friends and family, as formal sources would “scare” them. Nevertheless, our study found that participants who exhibited these characteristics were more likely to engage in polypharmacy behaviour. Cusack et al (2013) also argued that health risks are substantially higher for this group. Further explorations on using formal and informal sources of ONPD information and risk of polypharmacy use should be conducted. Users of ONPDs exhibiting self-care orientation were more likely to engage in polypharmacy behaviour. Sweileh and Arafat (2006) and Sawalha (2008) indicated that this type of behaviour is generally associated with taking more than one medication at a time to treat a symptom. It can therefore be stipulated that in the false sense of taking care of their own health, participants in this study engage in polypharmacy behaviour with the aim of improving health, yet nonetheless resulting in a behaviour which might be harmful.

The current study also found that inappropriate use was correlated with a higher likelihood of polypharmacy behaviour. This result may be explained by drug ineffectiveness when administered based on an inappropriate diagnosis or/and taken with inappropriate frequency of use. Side-effects of using more than the recommended dose of ONPD might lead students to use additional drugs and thus increase their chances of polypharmacy behaviours. The findings related to the risks of polypharmacy behaviours indicate that there is a substantial need for educating students in relation to ONPDs use. Counter-intuitively, participants who perceived their health status as good or fair were similarly at risk of engaging in polypharmacy behaviour. Although more research is needed to explore the dimension of these phenomena in depth, it can be stipulated that students had a false sense of confidence in their own knowledge by using several drugs at a time and not perceiving any dangers in doing so. Other concerning results showed that for the sample studied, polypharmacy was associated with antibiotic self-medication.

4.8.11 Reasons for ONPD Use

The findings in this study indicated that 78.8% of the participants invoked minor illness motive for ONPD use while 54, 5% invoked time-saving. Previous studies (Abay and Amelo, 2010; Sharif et al., 2012; Akici and Basaran, 2013; Badiger et al., 2012; Banerjee and Bhadury, 2012) assessing reasons for NPD use indicate that the presence of a minor illness is the most common motive for using this type of medication succeeded by time-saving reasons. Thus, the results of the current study reflect previous literature notes on this topic. Several other studies conducted in UAE and other European countries (James et al., 2006; Awad and Eltayeb, 2007; James et al., 2008, Badiger et al., 2012; Sharif et al., 2012; Akici and Basaran, 2013; Stephen et al., 2013, Pandya et al., 2013) indicate the same reasons for self-medication with NPDs. Considering this evidence and the results of the present study it can therefore be concluded that the main reasons for ONPD use is the presence of a less severe illness and the convenience of saving time by not visiting a physician.

The following most common reasons for use were having previous experience with using this medication (42.4%) and the urgency of need (24.5%). Both these reasons seem logical as participants who were likely to have had a positive previous medication use's experience was also likely to use the medication again. Although the current study did not connect urgency of need with time saving, it can be stipulated that it would be counterintuitive to wait for a physician's appointment when faced with a headache or with a fever during the night. Participants thus reached for this medication as an urgently available treatment for their symptoms. Previous research (Awad and Eltayeb, 2007; Fadare and Tamuno, 2011; Gutema et al., 2011, Ehigiator et al., 2013; Javed, 2013) also emphasises on previous experience making participants more likely to use the drug again, while additional research (Mumtaz et al., 2011; Da Silva et al., 2012; Sharif et al., 2012; Pandya et al., 2013; Sharif and Sharif, 2014) argues that people are more likely to use NPD for quick relief. Considering the present evidence and the results of this study it can be argued that there is little room for error in identifying the four main reasons for ONPD use.

4.8.12. Sources of ONPD Information

A significant part of the participants in this study took their ONPD information from informal sources including family advice (48.3%) and previous experience (38.9%). However, over half of these participants (62%) also took advice from pharmacists while 54.7% also took advice from physicians. Only 24.3% of the participants took information from the internet. It is to be noted that even though most participants took information from healthcare professionals, rates of inappropriate use were also high (n=270). This may imply that participants took advice from health care professionals at some point, but not always, which is reflected in their inappropriate use. This data could not further be assessed due to the quantitative nature of this study. These results indicate that participants used more than one source of information when seeking data on the use of ONPDs, but at the same time that only some information sources could protect against inappropriate use. In line with other research findings (Da Silva, 2012) the main sources for information were pharmacists.

Studies conducted in other countries, such as Ethiopia, Iran and India (e.g. Gutema et al., 2011; Sarahroodi et al. 2012; Kumar et al., 2013) noted very low rates of pharmacist advice (2%, 9% and 22%). In UAE recent campaigns to improve the roles of pharmacists in communities and raise awareness (Rayes, 2015; Sadek, 2016) may have contributed to the high rates of pharmacists seeing advice among participants. Additional reasons may be connected with the level of training and trust that the general public, including students, have in pharmacy personnel (Mohanta, 2001; Basak, 2010; Desale, 2013). A total number of 54.7% of participants responded that they seek medical advice on ONPD from physicians. Due to the fact that 39% of the sample used antibiotics without prescription, it can be argued that this behaviour was initiated as a result of a previous medical advice, followed by an antibiotic prescription, which participants followed on the next treatment skipping the medical consultation. The remaining 15.7% of 54.7% may have sought advice from a relative or friend working in health care. For healthcare students, this is highly plausible as they come in contact with physicians every day.

Approximately 48.3% of the participants sought advice from family members. Although the age of these advisors was not explored, Cusack et al. (2013) argue that people are likely to seek advice from older family members as they are perceived as having more experience. Finally, the 24.3% of participants seeking advice and information from online sources can be explained by statistics presented by Sinclair (2013) arguing that 85% of the UAE population has access to internet while Hardon et al (2004) and Talevi (2010) argue that the internet is regarded as an important source of drug information.

4.8.13 Sources of ONPD Acquisition

A total number of 17.5% of participants acquired NOPDs from friends, family or neighbours however 86.1% acquired medication from private pharmacies. Supermarket acquisition accounted for 30% of purchases while 23.7% of participants indicated that they use leftover medication. While these results are in line with findings of previous studies (Sharif, 2012; Sharif and Sharif, 2013; Sharif, et al. 2015) it can be noted that a significant number of students procured their medication from unauthorised locations. As argued by Bartlett et al. (2013) and Spellberg et al. (2013) this behaviour may result in significant negative health outcomes. Purchases from authorised pharmacies are not without risk, as in UAE there is no enforcement of the law prohibiting the sale of antibiotics without prescription (Abasaeed et al., 2009; Al Akshar et al., 2014). It is to be considered that supermarkets are not subjected to the same scrutiny as pharmacies; hence these locations may sale medication that has expired. Furthermore, by using leftover drugs there is an increased probability of using medication that was inadequately stored, expired or even harmful. Considering these aspects, awareness campaigns should be developed to reduce this behaviour.

4.8.14. Most Commonly Used Types of ONPD

The most common class of ONPD used by participants in this study were analgesics and antipyretics (paracetamol; 84.9%). The high percentages may be explained by the wide spectrum of conditions treatable with this drug (e.g. headache, pain, flu, common cold and fever). Additionally, these ONPD also benefit from a wide advertisement variety that makes them highly recognisable and thus usable by people (Stasio et al., 2008). Pain-relief drugs under the form of NSAIDs accounted for 76.3% of

ONPDs used, while ONPDs for treating coughs and colds accounted for 41.7% of used medication. A significant number of studies (James et al., 2006; Sawalha 2008; Badiger, et al. 2012; da Silva, et al. 2012; Sarahroodi, et al. 2012; Kumar, et al. 2013; Pandya, et al. 2013; Sharif and Sharif 2013) assessing NPD use trends use among university students also present similar classifications based on drug popularity. Findings in this study indicate that the prevalence of ONPD use high among UAE university students. Although contrasting at some points, this finding is in agreement with previous studies. A contrasting point with previous literature is that the current study showed a higher prevalence of appropriate ONPD use. However, the present study also found that more than one third of the participants used antibiotics without prescription. This was considered to be the most dangerous type of behaviour associated with ONPD use. As a result, this issue was thus considered a priority in line with WHO (2004) recommendations described in Chapter one, Section 1.6.2.2.1.

4.9. Strengths of the Survey Study

4.9.1. Novelty

The present survey study is unique in that it represents the first research specifically designed to investigate rational ONPD use among university level students. Therefore, the researcher measured the prevalence of drug use among students and then identified risk factors for incautious ONPD use, inappropriate ONPD use, antibiotics use without a prescription and polypharmacy among university students in the UAE in a single research.

The topic is timely and important because when ONPD are used irrationally, the students in the UAE will be potentially vulnerable to serious negative health consequences. These consequences include incorrect self-diagnosis, incorrect choice of therapy, drug–drug interactions, food–drug interactions, insufficient or excessive dosage and using expired drugs. Similarly, at the community level, irrational NPD use may result in a high prevalence of drug-induced diseases and increase public healthcare expenditure.

To the best of the researcher's knowledge, the present investigation is the first to adopt the Anderson behavioural model of healthcare utilisation to investigate incautious ONPD use, inappropriate ONPD use, using antibiotics without a prescription and polypharmacy, which is a unique contribution of the study.

4.9.2. Identifying Risk Factors for Incautious/Inappropriate ONPD Use, Using Antibiotics without a Prescription and Polypharmacy

The present study is the first to identify the risk factors for incautious drug use, inappropriate drug use, antibiotic use without a prescription and polypharmacy behaviour among students in the UAE in a single study. Measuring multiple outcomes allowed the results of the present study to be compared across outcome variables towards identification of similarities and differences in the risk factors for incautious drug use, inappropriate use, antibiotics use without prescriptions and polypharmacy behaviour among students in the UAE, which is useful towards constructing evidence-based programs to foster rational drug use among university students in the UAE.

The present research provided four different BLR models for the four different outcomes variables, which can be used in the future by other researchers and interested healthcare institutions as prediction models to estimate the individual probability of each outcome. Furthermore, the present research provided odds ratios for the identified risk factors to prioritise health problems and analyse these problems for identifying solutions.

4.9.3. Rigorous Development of a New Tool for the Assessment of Appropriate ONPD Use

For the present survey study, the researcher established and employed a novel assessment tool for appropriate ONPD use. Future scholars seeking to investigate appropriate ONPD use can now use this rigorous, valid and reliable assessment tool.

4.9.4. The Number and Range of Explanatory Variables (Predictors)

This study included more than 40 predictors as potential risk factors for incautious NPD use, inappropriate non-prescription drug use, antibiotic use without a prescription and polypharmacy behaviour among students in the UAE. This volume of explanatory variables was far greater than previous studies that investigated drug use in self-medication practice. Furthermore, the explanatory variables studied in the present study were diverse, including a full range of predisposing factors, enabling factors and need factors of the Andersen behavioural model of healthcare utilisation.

4.9.5. Sampling

The study utilised an adequate and representative sample of the target population using a multistage random sampling method. Furthermore, the pilot study was conducted in multiple stages prior to collecting data. The sample that was used for this study was educated and cooperative, engaged in the topic at hand and appeared to have a sufficient understanding to answer the questions accurately. Therefore, the response rate was good and higher than anticipated, and can serve as evidence of the success of using a self-administered survey during classes. The study was capable of capturing the students' responses for both UAE nationals and expatriates, including Arab, Asians and Iranians, which are the three main ethnic groups in the UAE.

4.10. Limitations of the study

Although the current study used a validated investigation tool, some limitations can arise from the methods used. Self-reported questionnaires may be subjected to both recall bias as well as to social desirability bias. Moreover, it was not possible to validate the self-reported answers (Sawalha, 2008; Martín-Pérez et al., 2015). Nevertheless, Andersen et al. (2007) demonstrated that self-reported answers from drugs users are valid and can be used in epidemiologic research. However, because this study assessed numerous variables, the questionnaire was extensive, which may have exhausted responders and thus interfered with their responses. Another limitation of this study refers to the cross-sectional design used which is inadequate for making predictions. A longitudinal study would have been more appropriate. However, as indicated by Kjellsson et al. (2014) recall bias may interfere with results if participant reports encompass a longer period. Even so, the fact that this study used a 90-day recall period does not automatically eliminate recall bias altogether.

Other limitations of this study are reflected by the quantitative design, which limited the current findings to quantifiable results. As a result, the study did not investigate qualitative notions, such as psychological characteristics. Additionally, while the methodological process was described in detail, hence aiding in any future replications of this study, the results are generalizable only to the UAE student population. Other limitations derive from the variables measured. The cut-off point used to identify high and low self-care orientation in the present study was adopted from previous research among the public in Sweden. Nevertheless, this behaviour may be different from the self-care orientation situation among students in the UAE. At the same time, the assessment of self-care orientation was based on the first action taken to cope with the symptoms. Different results may have been achieved if looking at the most recent two symptoms.

Another limitation derives from the characteristics of the sample selected. The majority of the participants (over 80%) were female. Previous studies have shown that females are more cautious users of ONPD (Al Rasheed et al., 2016), while this aspect was also observed through the results extracted from this study, according to which being female is a protective factor against incautious use of ONPD. As a result, the data extracted from this survey may be generalisable only to female students. This discrepancy was also present in other research (Sharif et al 2012; Rizah et al 2016). Another potential limitation of this study refers to the exploration of the relationship between marital status and self-medication behaviour. This was illustrated by Aljaouni et al. (2015) Ibrahim et al. (2015) in Saudi Arabia. Nevertheless, our sample was comprised of young participants who were not yet married. Since married percentages in the sample were substantially low, an analysis of this kind could not be conducted. Finally, the final limitation of this study refers to the fact that measurement of participants' medication knowledge might not be adequate to assess multiple aspects of drugs' use.

Limitations may derive from the cross-sectional design of the study. In this case, the behaviour analysed may be relevant only for a specific period. To exemplify, healthcare students may revise their ONPD and antibiotic use behaviour as they progress through college. This aspect was attempted to be addressed by including participants from various years of study. Yet this does not guarantee that the behaviour observed in ONPD use will not change. At the same time, it must be considered that some of the factors derived from Andersen's model are also subjected to change. For example, as indicated by the model, and as demonstrated in the study, students who were expatriates were more likely to use ONPD and antibiotics without prescription. In this sense, it cannot be determined if they exhibit the same behaviour in their country of origin. This further indicates that the behaviour analysed may be influenced by social and financial constraints and may therefore change once these constrains are removed. If considering HUM, this may indicate that once medical insurance is present, this may act as an enabling factor for seeking medical advice, while in the absence of medical insurance, being knowledgeable of ONPD enables use. As it can be observed, several interpretations are possible, yet this study focused only on ONPD use at the time of the investigation among the selected sample. Consequently, several issues were not captured by the survey, including different applications of the healthcare utilisation model used as well as the potential behavioural changes through time. Furthermore, since data from students who did not use ONPD was eliminated, behavioural comparisons with this group were not carried out.

4.11. Conclusion

This study examined the behaviour of using ONPD in a sample of UAE students. It was determined that at least half of the students available for the study (3346) used ONPD. The prevalence of use was therefore determined to be high. Subsequently, it was determined that while some cautions and appropriate use is observable, the majority of students did not meet all the criteria for being cautious or appropriate users. Similarly, a significant portion of students were noted to use antibiotics without prescription. At the same time, polypharmacy behaviour was noted in the sample, most significantly among those who were inappropriate and incautious users.

Various studies (Da Silva et al., 2012; Sarahroodi et al., 2012; Kumar et al., 2013; Sharif and Sharif, 2014; Zafar et al., 2014; Aljaouni et al., 2015) looking into the medication behaviour of students concluded that the rate of self-medication is high in this population. The results of the current survey demonstrated that in the surveyed population, 57.2% of the participant used ONPD in the last three months. Hence it can be concluded that the results of the survey reflect the findings of previous literature. Furthermore, subsequent investigations carried out in line with the research questions of this study found that one third of the students used antibiotics irrationally and the same fraction engaged in polypharmacy behaviour. Lack of caution was also reported, with one in five participants not reading the information leaflet of a non-prescribed medication. A quarter of the total number of participants provided answers which framed them as inappropriate or incautions users. Nevertheless, the research offers the first empirical evidence that the prevailing minority of the participants proved to be inappropriate users, grounded mostly on a valid and reliable novel assessment tool.

The investigation tool developed for assessing inappropriate ONPD use focused only on the last symptom experienced by participants and treatment used to address it. However, the practical implications of this self-medication behavioural time snapshot are significant. Firstly, it is to be considered that healthcare students will become UAE's future medical practitioners. As a result, a part of their role would include promoting cautious and appropriate use of medication. Secondly, as argued by Sarahroodi et al. (2012) a source of drug information comes from friends and family. Therefore, all students in this sample may become advisers on medication for others, including for their future families, who may copy incautious drug use, use of antibiotics without prescription and polypharmacy behaviour. Thirdly, because one third of the studied population practices polypharmacy behaviour, they are subjecting themselves to risks of adverse effects which can lead to serve health complication. This is particularly relevant for participants who engage in polypharmacy (Rambhade et al. (2012) and have a low level of health literacy Boardman et al. (2005).

The research also confirms that the reading of drug information leaflets for the first time of use (cautious use of a drug) is not necessarily associated with appropriate use of that drug; this in turn makes it certain that both behaviours are interdependent upon one another. The given results give the chance to ascertain that reading the drug information does not guarantee the appropriate drug use What is more, the survey offers sound proof that the category of the program attended by the student (i.e.

healthcare versus non- healthcare) makes an impact on two types of irrational drug use. These are the reading of drug information leaflets and the use of antibiotics without prescription. The results show that incautious use of drugs, as well as f use of antibiotics without prescription is significantly associated with healthcare students.

Regarding conducting a survey for exploring polypharmacy and its probable impact on incautious drug use, inappropriate drug use and using antibiotics without a prescription, one must know that the above-mentioned dimensions proved crucial. It was surprising to learn of a relationship between the behaviour of reading the drug leaflet (i.e. cautious use) and the use of multiple drugs for a single ailment (i.e. polypharmacy). It was even more surprising to learn of the relationship between the irrational use of antibiotics without prescription and the tendency to use more than one drug by a student (i.e. polypharmacy). Furthermore, it is also striking to know that the likelihood of using a drug inappropriately is associated with polypharmacy behaviour. These results directly indicated the value of developing and carrying out an intervention with the intent of reducing students' tendency to use more than one drug. These findings add to a growing body of literature on our understanding of polypharmacy.

The length of a drug leaflet (i.e., extremely long) proved to be the major reason why the majority of students gave up on reading it. Notably, almost two-fifths of participants are predisposed to take counsel from their families or close friends rather than reading leaflets. As a result, it's important for any intervention to place an increased focus on relatives and/or close friends. In conclusion, the survey study was crucial to gathering specific information recommended by WHO for investigating medication use. This study succeeded to measure the prevalence and determines the reasons behind four types of irrational drug use among university students. The findings of the survey showed that using antibiotics without prescription is alarming and required an intervention based on the prioritization matrix in chapter one, section 1.4.1. The most striking finding was that healthcare students is at higher risk of misusing antibiotics compared to other university students. The information provided from the survey study will guide the creation and the development of an educational intervention to improve the rational use of antibiotics among healthcare students. Moreover, a further in-depth interview study is essential to determine if there are other reasons for misusing antibiotics (see Chapter Five).

4.12. Summary

This chapter presented the survey study for identifying the prevalence of ONPD use and associated behaviours among university students in the UAE. Andersen's Healthcare Utilisation Model was used as a theoretical and conceptual framework for developing the instrument of data collection. The questionnaire developed was piloted by using three different samples to ensure validity. These samples comprised of physicians, pharmacists and students. Subsequent improvements have been brought to the instrument for validation based on this process. The developed questionnaire was delivered after piloting to a substantial sample of UAE students. After application of the inclusion criteria, only 1348 students where further assessed for ONPD use behaviour. These represented 57.2% of the total initial sample, who met the criteria of having used ONPD. Finally, data retrieved from these participants indicate that a substantial number of students are both incautious and inappropriate users of ONPD. Furthermore, the use of antibiotic without prescription has also been identified in the present sample. The data obtained in this study resonates with previous investigations conducted on similar populations, hence contributing to the reliability of this study. Noting these aspects, the intervention will rely on the use of antibiotics without prescription as this was identified to be a global threat. The following chapter will therefore extract more data in this respect.

Chapter Five: Student Interviews

5.1. Introduction

This chapter addresses the second study of this thesis presented in Chapter One, section1.6.3. involving qualitative interviews of 15 healthcare students in the UAE. This study was conducted within the first week of October 2016. The semi-structured interviews were developed based on data extracted from the main survey study. Once the interviews were carried out, thematic analysis was applied to the data following data familiarisation procedures. Finally, the extracted results were triangulated via a constant comparison between the participants in the study. This procedure also enabled theoretical sample saturation.

Five main themes were identified from the semi-structured interview carried with first-year healthcare students. These themes focused on the knowledge, attitudes, experiences, and beliefs of students in relation to antibiotics use, the role of professionals and institutions as well as potential solutions to reduce the irrational use of antibiotics. Data extracted from this study, particularly results discussed under theme five, will be further used in study three to develop the intervention for reducing antibiotic use without a prescription.

5.2. Research question and Objectives

5.2.1. Research Question

What are the factors that contribute to use antibiotics without prescriptions among first-year healthcare students in UAE and how can these factors be addressed?

5.2.2 Objectives

(1) To explore participants’ knowledge, awareness, attitude, belief, experience and behaviour regarding using antibiotics without prescription.

(2) To explore participants’ opinions about the role of healthcare professionals in tackling the problem of use of antibiotic without prescription and the potential role that the university might play in raising students’ awareness about the risks attributed to use of antibiotics without prescriptions.

(3) To enhance the creation and development of the educational intervention in study three by providing rich descriptions about the topics that should be covered in the intervention as well as the best approaches to deliver the educational intervention among the target population from participants' own perspectives and views.

5.3. Methods

The methods described in this section complement the procedure presented in Chapter Two (Programme of Work) where the justification of the methodology used for conducting the qualitative study and key decisions employed in this study were provided.

5.3.1. Study Design

This study employed a qualitative research design to address the objectives of the study.

5.3.2. Methodological Justification

In this phase of work, phenomenology was the philosophical paradigm for conducting the qualitative method that focused on students' subjective experiences (Rubin and Babbie, 2009). The German philosopher, Edmund Husserl (1859 – 1938), as the founder of phenomenology, defined phenomenology as “the science of essence of consciousness” (Husserl, 2012; Wojnar and Swanson, 2007).

Phenomenological research is concerned about understanding people‘s social world and uncovering meanings of their personal experiences from the first-person point of view (Wojnar and Swanson, 2007). Phenomenological research is claimed to be a subjective, inductive, and dynamic method of inquiry (Reiners, 2012). Phenomenological research is a popular methodological approach in healthcare research enquires (Daymon and Holloway, 2010).

The phenomenological approach helps the researcher to acquire data from the participants' perspective, thus facilitating an understanding of the participants' experience with the phenomena under investigation (Daymon and Holloway, 2010). Strength of Phenomenology goes further than any other qualitative research approaches by providing a mean for the researcher to set aside his/her own preconceived ideas about the phenomena to understand it according to participants' own terms and views (Daymon and Holloway, 2010). Therefore, researchers can see the phenomena through the eyes of participants. Furthermore, it provides a mean to understand the sense-making framework of each participant that has been developed over time to shape their subjective experiences regarding a particular phenomenon under study (Daymon and Holloway, 2010). It helps the researcher to go beyond the surface to see the 'real', 'intended' meaning, of the phenomenon (Daymon and Holloway, 2010).

5.3.3. Study setting

The study is set at the Ajman University- College of Dentistry, in the UAE.

5.3.3.1 Study Participants

Based on the findings identified from the main survey in study one, the following inclusion criteria were set:

- First-year heathcare (dental) students. This specific sample was selected based on literature data and the results obtained in the study, confirming that healthcare students are a high-risk population for self-medication. The most approachable heathcare sample for the researcher was represented by healthcare students in the college of dentistry.
- Using antibiotics without a doctor's prescriptions in self-medication practice in the year prior for conducting the study.

5.3.3.2 Sampling and recruitment

The aim of qualitative research is to provide illustrative findings of particular experiences and points of view from the perspective of a small number of participants that cannot be generalised to the whole population from which the sample was drawn from. Unlike quantitative research, the sample size in qualitative research is not representative of the target population under study, and therefore there are no guidelines or rigid rules calculating the number of participants (Daymon and Holloway, 2010). The criterion for generalisability in qualitative research is assessed by transferability. To ensure transferability of data, the results in this study will be compared with similar research on self-medication and antibiotic use carried out in the UAE or/and using university student samples. This will ensure that the study is in line with previous literature, which will indicate that the data extracted is transferable to other UAE populations.

Snowball, convenience and purposive sampling are the main methods of recruitment in qualitative research (Daymon and Holloway, 2010; Newell and Burnard, 2010). All these methods were considered before initiating participant recruitment. After the assessment of potential strategies for recruiting participants for the interview study, it was concluded that the best possible approach is purposive sampling.

The snowball sampling strategy was not employed in this study because the study subjects were easily accessible and agreed to sign to the inform consent before the interview. The convenience method of recruitment was not considered in this study because this strategy is employed when only a few subjects are available and recruiting people is difficult (Daymon and Holloway, 2010). Purposive or 'criterion-based' sampling was employed to recruit study subjects because this approach depends on certain criteria determined by the purpose of the study to decide the type of participants that need to be investigated (inclusion or exclusion criteria) and where and when to conduct the interview (Daymon and Holloway, 2010).

In qualitative research, sample size can vary as data collection proceeds and is completed when theoretical data saturation is reached (Richards and Munsters, 2010). Theoretical data saturation refers to the point at which new information does not add anything new to the observations or themes and can be considered as just redundant information (Daymon and Holloway, 2010; Richards and Munsters, 2010; Rubin and Babbie, 2012; Profetto-McGrath et al., 2010). However, this approach is a complex, continuous and time-consuming process based on the on-going analysis of the data to identify new ideas and questions that remained unanswered to extend the emerging theories (Daymon and Holloway, 2010; Profetto-McGrath et al. , 2010). Therefore, the point at which data saturation will be reached cannot be predicted (Daymon and Holloway, 2010).

The maximal variation sampling strategy is often considered as the most practical choice to identify the most important patterns across a heterogeneous study sample and to provide a holistic view about the scope of the phenomena under study (Daymon and Holloway, 2010; Profetto-McGrath et al. , 2010). This approach is a non-probability purposive sampling method (Rubin and Babbie, 2012). This means that the participants are purposefully selected to capture their diverse and heterogeneous characteristics and to generate more useful insights about the phenomena under investigation (Rubin and Babbie, 2012). However, the maximal variation sampling strategy was not employed for the student interviews because the researcher's aim was to identify if there is a new experience and perception until we reach to the point of data saturation (Daymon and Holloway, 2010; Profetto-McGrath et al. , 2010).

Purposive or 'criterion-based' sampling was employed in this work to recruit study subjects. 15 participants were recruited from Ajman University-College of Dentistry using a brief screening questionnaire to ensure eligibility. The screening questionnaire focused on assessing the participants' antibiotic use status and self-medication status. Given the nature of this research, study participants needed to have used at least once antibiotics without prescription and to have engaged at least once in self-medication with NPD. Theoretical sample saturation was not carried out in light of the fact that this process was laborious and would have taken a significant amount of time, which would have disturbed the course of the research (end of academic year). Additionally, since this investigation relies on a high-risk population for taking antibiotics without prescription, the students selected need to be enrolled in a healthcare University. The limitations of purposive sampling (Daymon and Holloway, 2010) have been attempted to be addressed by employing several strategies. Firstly, to avoid researcher bias, the pre-screen questionnaire was used based on the criteria of having previously used antibiotics without prescription.

At the same time, the target population was extracted based on the literature review conducted for this study, from which data indicates that healthcare students represent a high-risk population for using antibiotics without prescription. Secondly, to limit the bias of purposive sampling referring to the limited cases included for analysis, the data obtained from the interviews has been triangulated not only within the sample but also with the wider literature and by employing the assessment of another researcher for the emerging codes.

Considering this aspect, the results in this study should be transferable to the UAE heathcare student population who engages in self-medication practices, especially antibiotics use and ONPD. It is to be noted that the data may be transferable only to first-year heathcare University students. Since the focus is set on first-year students, results may not be transferable to students from other academic years or Universities.

Students who agreed to participate in the intervention study (study three) were asked to volunteer to participate in the qualitative interviews (study two). This strategy allowed the researcher to triangulate the data achieved from the interview study and the baseline assessment of the intervention study to enhance the trustworthiness of the findings achieved from the qualitative interview study (i.e. credibility and dependability of the results) as shown in Chapter Six, section f. p. 294.

Each respondent was approached via an invitation letter (Appendix 17) delivered by hand by the researcher during first-year dental college histology lab sessions. Also included with the invitation letter was an informed consent form (Appendix 18).

5.3.4 Data Collection

The choice of methods used for qualitative data collection depends mainly on the research questions, the aim/purpose of the study and the philosophical assumptions of the research (Holloway, 2005). In qualitative research, there are four methods for collecting data in health intervention studies: direct observation, in-depth interviews, focus group discussions and participatory methods (Smith et al., 2015).

During the interview process, indirect observation of the study's participants, allow the researcher to act as an observer, hence providing him/her with additional data on the subjects' behaviour during the interview. However, in observational studies, the researcher becomes a part of the population under investigation to gain a full understanding of participants' experience. The researcher may focus on a pre-prepared set of particular observations that he or she is looking for, or alternatively, record whatever he/she observes for gathering data to be used in the future analysis process. Observation is a cornerstone of ethnography (Smith et al., 2015). However, in this study; direct observation was considered inappropriate because the participants were asked to explain their experience of using antibiotics without prescription through conversations, rather than being observed on how they normally act in their natural setting.

Interviews were considered an appropriate approach to the qualitative study because interviews capture participants' experiences from the 'insider perspective' and in the words of participants (Holloway, 2005). In-depth interviews, provide "much more detailed information" compared to other methods of data collection and also offer a more relaxed atmosphere where participants may feel more comfortable through the conversation (Maharaj, 2012, p.93). Interviews have a specific advantage in that the respondent can ask the interviewer to explain questions that they have not understood while the researcher can ask for further elaboration of responses. Additionally, the interviewer can be assured that the questions are asked and thus answered in the appropriate way (Phellas et al., 2011, p.182). The environment, in which the interview is conducted in, can be controlled by the interviewer to make sure that the interview takes place in a suitable setting, which may contribute to the collection of accurate responses (Phellas et al., 2011).

Several types of interviews can be distinguished based on the instrument used. These are structured (closed-ended set of questions), unstructured (open-ended list of questions) or semi-structured (a combination of the two types).The data collection method used in this study was semi-structured interviewing. The semi-structured interviews schedule has clearly defined goals and guidelines to make data collection systematic, and at the same time, offers flexibility to change the sequences of the questions and respond to certain circumstances during the interview (Cramb and Purcell, 2001). Qualitative interviews could be carried out via the telephone or the internet (Holloway, 2005); a face-to-face approach was employed in this study to build a relaxing and personal relationship with the participants. Furthermore, face-to-face interviews assisted in overcoming some logistical challenges, such as obtaining the written informed consent from the participants prior to the interview and recording the interview.

Individual interviews were chosen as a method of data collection rather than focus group. This is because the focus group approach has limitations that can have a negative influence for achieving the objectives of the present study. One of these limitations includes the potential for false consensus and its influence on the whole group. False consensus occurs when a dominant group member does all the talking while the rest of the group remains silent. This limitation leads to other problems, such as the leading question bias and manipulation. Manipulation is problematic, especially if the interviewer influences the interviewee in such a way that the interviewee says what the interviewer wants to hear. Another limitation includes the difficulty of distinguishing between the individual's point of view and the group view because of the 'weight' of group influence. This is also a problem because some of the group participants may feel unable to express their disagreement or talk about the issue in the group context. The final limitation of concern is the problem with making generalizations as a consequence of sample size and the difficulty of acquiring a truly representative sample (Litoselliti, 2003).

All interviews were audio-recorded using a digital audio recorder and audio files were stored digitally on a secure computer that was accessed only by the researcher. A pre-interview questionnaire was completed by participants to collect the demographic data (Appendix 19). The interviews were conducted face-to-face with participants in the meeting room in the main library building. Interviews lasted from 15 to 20 minutes and were done in English.

5.3.4.1. The Interview Topic Guide

The interview topic guide (Appendix 19) was developed from the literature and was based on the risk factors identified from the survey study (study one). The topics covered included reasons for use of antibiotics without prescription, knowledge about antibiotics, awareness about bacterial resistance, attitudes and belief towards antibiotics, participant's perceptions towards pharmacist, the role of healthcare professionals in reducing the use of antibiotic without prescription, the potential role that universities might play in raising students' awareness about the risk of using antibiotics without a prescription and the best approach to deliver the educational materials of the intervention.

Leading questions and questions that reflect the researcher's own views and preconceptions were excluded during the development of the interview guide, with the aid of a qualitative supervisor to make sure that the views and perceptions obtained would primarily belong to the study participants. Moreover, to further reduce researcher bias, all additional questions used for clarification were strictly related to the response that needed clarification (e.g. "Can you explain that?"; "What do you mean by that?" etc.).

5.3.4.2. Interview Process

Students were given options to be interviewed alone or in the presence of their family members. The purpose of the study and the process of the interview were explained to all students. Students' permission to audio-record the interview was obtained. They were also reminded that they were able to withdraw their participation with no resulting consequences at any point in the process and that they only need to answer questions that they felt comfortable answering. This process was aimed to provide a non-threatening environment that would encourage respondents to tell their own experience. Demographic data, including gender, age, ethnicity, and living status, were also collected from each student.

All participants chose to communicate in English. The use of an interview guide helped to focus on the research topics and obtain consistent, relevant data from all participants (Ritchie & Lewis 2003).

5.3.5. Analysis

The data collected was analysed using thematic analysis (Braun & Clarke, 2006). Thematic analysis is a method of analysis that aims to identify analyse and report repeated patterns of meaning (or "themes") within a data set (Braun & Clarke, 2006). Thematic analysis was chosen as the method of analysis for this study as it is a flexible technique that enabled the researcher to determine themes in several ways.

Thematic analysis applies inductive techniques for data analysis. In inductive data analysis, codes are derived from the data itself without trying to fit it into an already existing coding frame, theory or structure, and the emerging themes are closely linked to the data (Braun & Clarke 2006). Therefore, inductive thematic analysis is data driven (Braun & Clarke 2006). Despite being considered a time-consuming process, inductive analysis is common to qualitative research (Burnard et al., 2008).

Constant comparative analysis was applied by comparing one piece of data with all other data to reveal the possible relationships between them (Thorne, 2000). For example, a comparison was done to look for links between data collected from female interviews and data from male participants, and further within the same group.

In order to sort and organise the qualitative data, and to make it easier to deal with, several computer-assisted qualitative data analysis packages are available. One of the common computer assisted qualitative data analysis software (CAQDAS) for data analysis is NVivo. It is important to note that these programs are facilitators for making the process of analysis easier and more flexible. Nonetheless, the researcher's task is to 'analyse' the data (Burnard et al., 2008). In the present study, the researcher preferred coding the analysis manually rather than using NVivo as it is basically only a data management package and does not confirm the scientific value of qualitative research (Burnard et al., 2008; Stewart et al., 2008; and Zamawe, 2015).

5.3.5.1. Process of Conducting Thematic Analysis

In this study, field notes were made during and after the interviews using a diary to record the researcher's thoughts and ideas about participants' non-verbal communication, and to reflect on the process. The audio-recorded interviews were transcribed verbatim. The guidelines outlined by Braun and Clarke (2006) were the basis for performing the thematic analyses in this study and are illustrated by the steps below:

5.3.5.2. Familiarisation with the Data and Transcription of the Verbal Interviews

The first step was to become more familiar with the data. While the researcher had previous knowledge of the data collected, it was vital to become more familiar with the data and understand its depth. This was achieved by listening to the audio recording of each interview multiple times, transcribing each interview verbatim, and reading the interviews multiple times to identify existing patterns.

5.3.5.3. Generating Initial Codes

The data set was coded manually and highlighted using a coloured pen to specify sections of the text representing the different initial codes from the text. Interview transcripts breakdown into smaller pieces using a preliminary coding of nine broad segments of the interview guide (previous experience of using antibiotics without prescriptions; reasons of using antibiotics without prescriptions; access to antibiotics; knowledge of using antibiotics; awareness of antibiotic resistance; attitude of using leftover antibiotics , completing the full course of antibiotics and recommending antibiotics to family and friends; perceptions about physicians and pharmacists; suggestions for tackling the problem of using antibiotics without prescription and the best approach to deliver the educational materials). The generation of the initial codes was organised under these eight broad segments which made the process of searching for themes and subthemes simpler and easier. A theory-driven approach was used to generate the initial codes of specific texts of interviews' transcripts which answer particular questions in relation to the objectives of the study (e.g. why do you self-medicate with antibiotics?)

5.3.5.4. Searching for themes and subthemes

After the extraction of all the codes, the researcher started to analyse those codes so that new codes could be created by combining two different codes and some of the initial codes could be dropped whilst retaining the most important ones from the researcher's perspective, then creating categories or themes. Similar codes were gathered in order to create the primary categories, the so-called sub-themes. As for this procedure, it rested upon carefully re-reading all the phrases, sentences along with paragraphs aiming to accurately reveal 'what it was about' so as to distinguish concrete meaning and ascertain the extent to which these data could correlate (Ritchie & Lewis 2003). Each identified sub-theme was recorded manually and highlighted by a highlighter pen and the researcher then tried to connect between those codes and sub-themes to determine if some initial codes may be discarded while transforming others to form sub-themes (Braun and Clarke, 2006). Similar subthemes were grouped under main or key themes. As a result, each theme was given a particular colour so that the distinctions between them could be absolutely clear. Other sub-themes which seemed not directly relevant to the research questions were grouped under a ‘miscellaneous sub-themes’ and reviewed later on. At this step, an initial thematic map can be seen (Braun and Clarke, 2006).

5.3.5.5. Reviewed and Refined Themes

Once all candidate themes had been created, the researcher started to determine which one of the ‘miscellaneous themes’ was not a relevant theme because there is not enough data to support them. Moreover, other themes might be broken into distinct themes, whereas others could be condensing to form a new theme. A developed thematic map can be presented at the end of this step (Braun and Clarke, 2006).

5.3.5.6. Defining and naming themes

This step begins once a satisfactory thematic map of the data made. The researcher then defines and further refines the themes to identify the “essence‟ of each theme, determine data that captured by each theme and ensure that there is not much overlap between themes (Braun and Clarke, 2006). This process involves seeking relationships across emerging themes, similar themes will be grouped together to provide clustering themes in which each cluster have its own descriptive label (Pietkiewicz, and Smith, 2012). This step aids the researcher in making a summary structure for a particularly complex and large theme, and describing the hierarchy of meaning for the data. At the end of this step, the researcher had a fairly good impression of the existent different themes are and how they can be combined in order to produce an overall story about the data (Braun & Clarke 2006).

5.3.5.7. Producing the report

A report that tells the full story of the data was produced. This report provides the results of the analysis of the data obtained. Easily identifiable extracts with appropriate quotes were provided. These were considered to be sufficient evidence for supporting the prevalence of each theme (Braun & Clarke 2006).

5.3.6. Reflexivity and Rigour of the Methodology

In qualitative research, the main tool of data collection is the researcher and he/she is a part of the phenomenon to be studied, and hence needs to be self-aware of how, whether intentionally or unintentionally, he/she influences the research process and findings (Daymon and Holloway, 2010; Jootun et al., 2009). There is a relationship between the qualitative researcher and the research environment; the researcher influences and is influenced by the research environment by engaging in the process (Leavy, 2014). Therefore, the researcher's self-critique and self-appraisal of their personal involvement is an essential on-going process during all the stages of the research to make the research process transparent (Koch, 2006; Jootun et al., 2009). Hence, reflexivity is important to promote the honesty and transparency of the research process with the aim of improving the quality of research in order to improve rigour (Barry et al, 1999).

Jootun and other researchers suggested several practical actions to achieve reflexivity in qualitative research, such as using a diary to record what is influencing the researcher's relationship with the phenomena under study and the participants or the method of data analysis and interpretation (Jootun et al., 2009). Reflexivity and rigour were integrated in all stages of this research by the use of a reflective diary and an on-going process of self-awareness and self-reflection. The main scope of this process was to identify and address the researcher's subjectivity and to determine how the relationship between the researcher and the research environment altered the development of the study. Furthermore, the researcher undertook training in qualitative data collection and data analysis and consulted local advisor after each interview and during the analysis of the data.

5.3.7. Reliability and Validity of the Data and Methods of the Qualitative Study (Trustworthiness)

When conducting qualitative research, one must consider issues of reliability and validity or what is called trustworthiness of data (Pitney and Parker, 2009). The challenges associated with conducting qualitative research include the potential for bias and the inability to generalise results; the latter is usually a consequence of smaller sample sizes, particularly those that are identified via non-random methods. Regardless of these issues, qualitative research can produce reliable, valid, unbiased, credible, meaningful and accurate data if the study is conducted appropriately (Anderson, 2010).

5.3.7.1. Reliability

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5.3.7.2. Validity (Credibility)

Validity is the extent to which the study’s findings accurately represent the phenomenon under investigation (Anderson, 2010; Smith, 2002). In qualitative research, internal validity refers to the ability of the researcher to capture what is actually occurring (Pitney and Parker, 2009). Credibility is a term used in qualitative researcher which is analogues to internal validity and relates to whether the results of the study are believable (Pitney and Parker, 2009, p.62). External validity refers to the generalisability of the results to be applied to other settings or participants. However, qualitative researchers are keener in understanding the phenomena under investigation and used the term of “transferability” of the results (Pitney and Parker, 2009). Transferability is the ability to apply the finding of a study to a similar environment (Pitney and Parker, 2009, p.63).

There are a number of strategies that can be used to ascertain validity. These include constant comparison, the application of contradictory evidence, respondent validation and data triangulation (Anderson, 2010). As elaborated below, all these methods were applied to enhance validity. The application of contradictory evidence was carried by planning to include in the study data that did not follow a constant direction. For example, since all participants self-medicated, responses from participants that rationally self-medicated were planned to be included. Such details would be used in enhancing the results' analysis.

The use of respondent validation involves the study's participants in the process of validation. The participants read the data and analyses and then offer the researcher feedback regarding the researcher's interpretations or applications of their responses. This method also allows researchers to check for inconsistencies, challenging the researcher's assumptions and providing the researcher with the chance to reconsider the data (Anderson, 2010). This study employed this method by presenting the findings in an oral presentation to the participants after the completion of the study. Respondents were able to check the consistency of the findings and interpretations and then offer clarification or feedback on issues they identified. One pertinent inconsistency emerged and was later addressed with discussions carried out with first-year healthcare students. This referred to the fact that some healthcare students felt that they were knowledgeable enough in using antibiotics without prescription. The researcher then pointed out to their responses (i.e. human body developing resistance to antibiotics) and indicated that this is not how antibiotic resistance works. The three main mechanisms (resistome, persistence, tolerance) were explained to participants. None of the participants were aware of these facts and an agreement on the interpretation of results was reached.

This approach to increasing credibility in qualitative research has been criticised by Smith and McGannon (2017), arguing that participant validation cannot provide an objective verification of data. Considering the discrepant case identified (participant not agreeing with conclusions according to which he used antibiotics incorrectly), it becomes evident how Smith and McGannon (2017) produce a valid argument. However, in this particular case, the researcher had sufficient objective knowledge supported by scientific literature, which was presented to students. A comparative assessment initiated during the discussion with the students, in regards to what they responded versus what the scientific literature demonstrates, settled this dispute.

5.3.8. Data Triangulation

Triangulation involves utilising two or more methods to examine a single finding or phenomenon. This allows the researcher to obtain and compare different viewpoints on the same finding or phenomenon in order to facilitate a more thorough understanding of the subject under investigation. If both methods produce the same (or at least similar) findings, the results can be considered valid (Smith, 2005). In the present study, some of the issues were validated using triangulation, namely a different strategy of inquiry (that is, the baseline assessment of intervention study), as a means of authenticating the findings. This study used two types of triangulation, which are data triangulation and investigator triangulation.

5.3.8.1. Investigator Triangulation

The objective of investigator triangulation consists of ensuring that the analysis of data extends beyond a single standpoint. Yardley (2000) advances an argument that triangulation in qualitative research centres around comparing the coding of data by different researchers. There are two ways to succeed in accomplishing the aforementioned task:

- The researcher will code a section of the data and then meet with another researcher who has read the transcripts to discuss the emerging codes. This process can help in identifying any potential themes the researcher had not yet captured and highlight any clarifications that may be needed to increase the coherence or consistency of the analysis.
- The coding of the same transcript is carried out by more than one researcher. This enables data comparison between researchers for the purpose of inter-rater agreement.

The option listed as number one is a better fit with this study. The researcher coded a section of text and had a meeting with a local supervisor in order to address the validity of the codes and to give constructive critique.

Qualitative research is very dependent on those that conduct it; therefore, it is important to recognise what those individuals bring to the research, and particularly how that may influence their interpretations, understanding, and analysis of the data

(Charmaz, 2006). If the respondents do not feel comfortable expressing themselves or they feel restricted, the validity of the study can be undermined (Smith, 2002). This researcher took the necessary steps to make sure that the participants felt comfortable discussing their experiences. However, the validity of the data could have been affected by certain unavoidable factors.

5.3.9. Ethical Issues

Ethical considerations are critical in terms of determining whether research has been performed with integrity and in a trustworthy manner (Bryman, 2008). As such, ethical considerations will be discussed in terms of this thesis and with regard to the manner in which the study was conducted, beginning with informed consent or approval.

Official approval from Ajman University was obtained prior to conducting the study (Appendix 20). Permission to conduct the study and access study participants was also granted from the Dean of the College of Dentistry. Additionally, approval for the study to take place was also obtained from the Dean of the College of Pharmacy. For this purpose, the College of Pharmacy assigned one local advisor from the college to review the interview guidelines.

All participants in the study were provided with a clear explanation of its purpose and procedure. Protocols were established to protect all participants from being exposed to any harm during the course of their participation. All participants were given information sheets, which were reviewed and discussed in order for everyone to clearly understand the study's parameters and procedures. Each participant was also required to sign a consent form and to provide verbal confirmation. They were also advised that their participation was voluntary and that they could terminate their agreement to be in the study at any point in time without any repercussions. Each participant also provided verbal consent to be tape-recorded during their interview.

Before the interviews, each participant was clearly informed about their right to withdraw from the interview and/or study at any time for any reason. There was a contingency put into place in the event of such occurrence, whereby any data collected would be immediately discarded from the future analysis. Considering data must remain confidential and anonymous, the privacy, dignity, and sensitivity of each participant should be ensured throughout the research continuum and in any related interview (Bryman, 2008; Lincoln & Guba, 1985).

In this study, the data were maintained in a confidential manner, and pseudonyms were used for all participants. Transcripts also remained anonymous, and a strict chain of custody was maintained, with recordings stored in a secure location and access to data limited to the primary researchers and his supervisors. Participants in the study had the ability to ask questions at any time during the process and to review the results once the project was complete and submitted by the researcher. Participants involved in the research were aware of the researcher's identity and academic and professional background. All participants were also made aware of this information when consenting to the research and interview process.

Because this research included interviews with participants who had elected to use antibiotics without a physician's prescription, there was the distinct possibility that some interview subjects would become anxious about talking to the researcher or have internal conflicts concerning such disclosure. Such emotion-driven factors could clearly impact the ability of a participant to get through an interview in the normal way (Goodman and Evans, 2010). A plan was made by the researcher if such situations arose; the participants were asked if they wanted to continue and reminded of their ability to terminate the interview or study participation at any time.

5.4. Results

This section presents the results of the thematic analysis obtained based on the data collected from a purposeful sample of 15 healthcare students in their first-year of study in the UAE. Interviews were audio recorded and transcribed for analysis. From the data, themes were revealed, shedding light on the experiences and perceptions of the participants with regard to trends in self-medication and observable roles in education concerning antibiotic resistance.

Initial observations from the analysis procedure – steps 1 and two, familiarisation and generation of initial codes, suggested that the experience, knowledge, belief, attitude, and perceptions of participants were relatively similar, nevertheless there were minor differences in a number of subthemes. Individual descriptions of each of the participants' demography included in the sample are provided. The results are presented by assessing the participants' perceptions and opinions, based on the thematic categories and specific common themes revealed from the analysis.

5.4.1. Demography of the participants

The participants in this study represented different age groups, genders and ethnicities, but were all healthcare students. In all, the age range of participants was 17-22, with a mean age of 17.9 years. Five participants were Iraqi or Emirati, four were Egyptian, two were Jordanian, one was Palestinian, one was Iranian, one was Sudanese, and one was British. Most of the respondents (87%) were expatriates, table 5.1 outlines the demographic data obtained on each participant.

Table 5.1 Respondents characteristics

Participant	Age	Gender	Ethnicity
1	17	Female	Egyptian
2	17	Female	Jordanian
3	17	Female	Jordanian
4	22	Female	Egyptian
5	18	Male	Emirati/Iraqi
6	19	Male	Iranian
7	18	Male	Iraqi
8	18	Male	Egyptian
9	17	Female	Iraqi
10	18	Male	Sudan
11	16	Female	British
12	18	Female	Egyptian
13	18	Female	Emirati
14	18	Female	Palestinian
15	18	Female	Iraqi

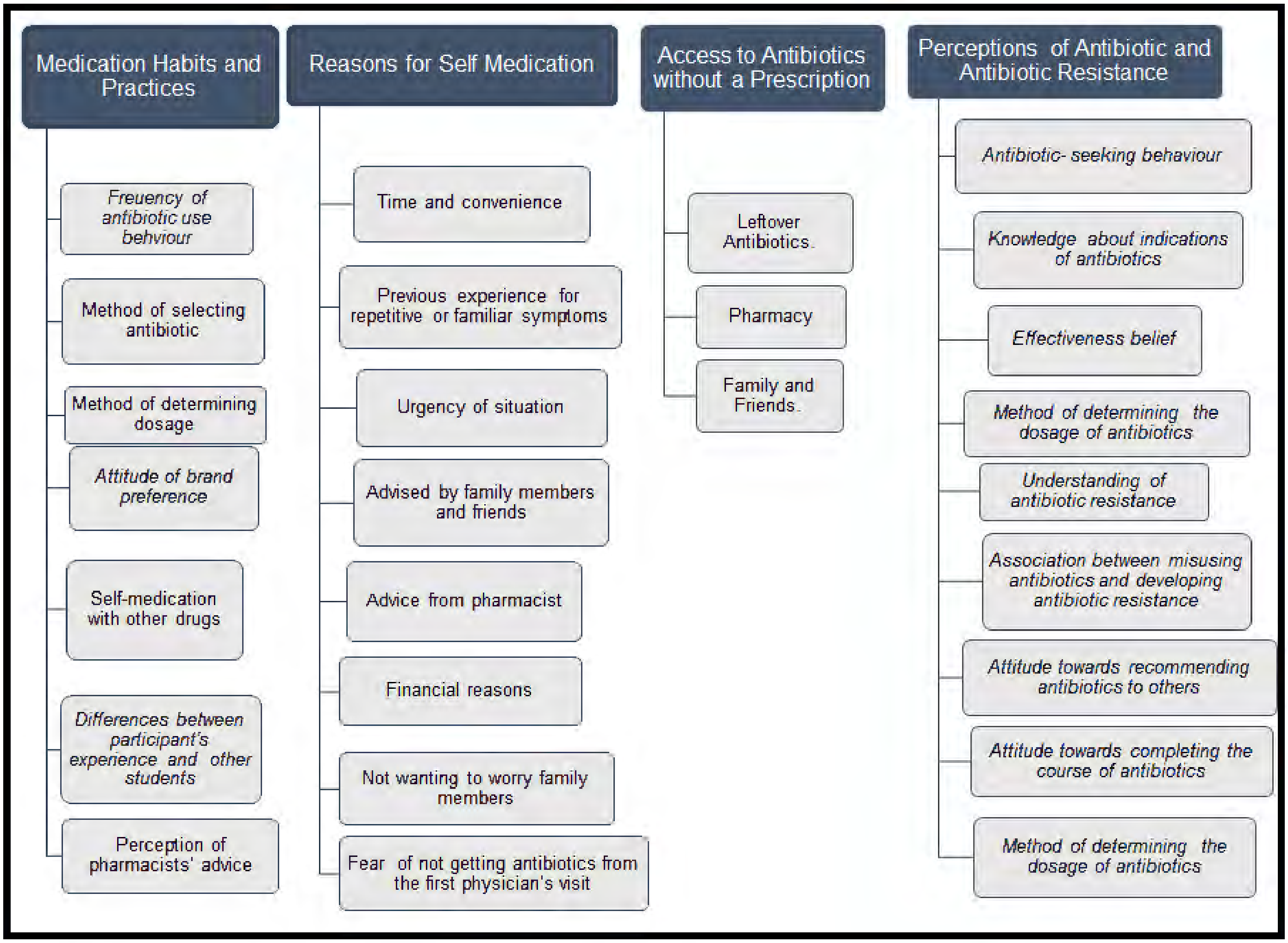
Analysis of the data reveals five main themes relating to participants' experiences, knowledge, attitude, belief and perceptions about antibiotic use which reflects the existing student understanding of the relationship between self-medication with antibiotics and the development of antibiotic resistance, as well as methods for potentially elevating student and public awareness on rational use of antibiotics as shown in Figure 5.1. These are:

- **Theme one**: Medication habits and practices.
- **Theme two**: Reasons for Self-Medication
- **Theme three**: Access to antibiotics without a prescription
- **Theme four**: Perceptions of antibiotic and antibiotic resistance
- **Theme five**: Possible solutions for reducing use of antibiotic without prescription and resistance

Themes one to four explored the habits and practices of healthcare students in relation to antibiotic use and self-medication, their reasons for engaging in these practices, the way in which they access these medications and their perception of antibiotic resistance. The exploration of these themes provided an ample picture of how and why students use antibiotics without prescription and most of all, what do they actually know about these medications. Four of these themes are listed in Figure 5.1.

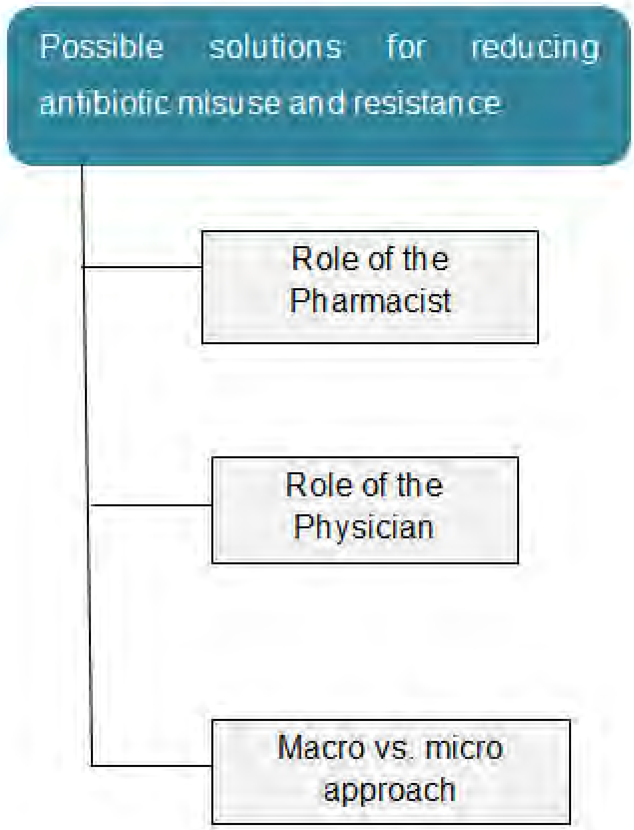
Theme five was used to extract data for the intervention study. This theme is listed in Figure 5.2.

Figure 5.1 Main four themes and Subthemes identified from the thematic analysis



As illustrated in Figure 5.1, each of the main themes identified has various subthemes which will be discussed based on interview extracts.

Figure 5.2 Theme Five



As illustrated in the figure above, three main subthemes have been identified under theme five. These subthemes concerned the role of pharmacists and the role of physicians in reducing antibiotic use without prescription. Additionally, one subtheme focused on potential approaches at the macro and micro level for addressing this issue.

5.4.2. Main themes

The interviews focused on the core of the risk factors identified from the quantitative survey study in Chapter Four to explore what is behind those factors, without ignoring other reasons and findings which may emerge only through the qualitative data. Therefore, during the interviews, participants were probed about many factors which might contribute to the use of antibiotics without prescription.

The analysis of the data identified five main themes and various subthemes. These are described below.

5.4.2.1. Theme one: Medication Habits and Practices

The first theme revealed in the analysis of the interview data included responses reflecting the participants' descriptions of their personal experiences with self-medication. This theme compromised six subthemes: frequency of antibiotic use, method of selecting antibiotics, attitude of brand preference, self-medicated with other drugs, differences between participant's experience and other students, and perception of pharmacists' advice.

5.4.2.1.1. Frequency of Antibiotic Use Behaviour

Frequency of antibiotic use behaviour was investigated in this interview as the survey study identified this as a risk factor for other types of irrational drug use among university students. Therefore, during the interviews, participants were asked to describe how frequently they used antibiotics without prescription. Nearly all participants reported that they self-medicated with antibiotics at least once in their life. Seven participants described self-medicating only when the situation was serious or only rarely. For other participants, self-medication was a more common occurrence when compared to the use of antibiotic without prescription. There were participants who reported that self-medication was something they frequently engaged in (i.e. Participant 9). Another participant (Participant 10) reported that while he had frequently engaged in self-medication in the past, he no longer did so. This participant reported that education changed his behaviour regarding the use of antibiotics, as he had learned about the dangers of using antibiotics without prescription.

5.4.2.1.2. Method of Selecting Antibiotics

Participants offered descriptions of the ways that they selected types of antibiotics without the guidance of a physician when self-medicating. Common responses for selecting the type of antibiotic included (a) relying on previous recommendations from physicians; (b) consulting pharmacists; and (c) using what was available in the house from family members or past illnesses. The most commonly noted response was relying on a previous prescription from a physician. Five of the participants (1, 2, 4, 12 and 15) indicated this as the preferred method of antibiotic selection. Participant 1 reported:

“Usually when I self-medicate I took the one that I took from the last infection. If it has the same symptoms … with the same antibiotic I took. If it is the first time I have these symptoms I usually go to a doctor and find what is wrong with me exactly because it is the first time that I have a sequence of symptoms and all that”

(Participant 1)

The approach described in this case may be problematic because common symptoms, such as fever, myalgia or throat pain may be caused by several classes of bacteria which can be non-responsive to commonly used cephalosporin antibiotics. At the same time, frequent consumption of wide-spectrum antibiotics is bound to produce resistance (Vogwill et al., 2016). In many cases, within the selected samples, students used antibiotics for common colds. Since people tend to get sick from variations of the common-cold virus several times a year, repeated exposure to antibiotics is more likely to result in resistance (Wistrand-Yuen et al., 2018; Brauner et al., 2016).

Pharmacist recommendations were also mentioned as a common way of selecting antibiotics. Five participants (7, 5, 8, 9, and 13) cited this method of selection. Participant 7 stated, *“I actually use the advice or prescription of a pharmacist;” and Participant 7 indicated a preference to “ask the pharmacist which type.”*

According to the ECDC (2017) pharmacists have the duty to educate consumers. Although the UAE has a policy for prohibiting the purchase of antibiotics without prescription, when referring to pharmacist advice, none of the participants mentioned that they could not purchase antibiotics. In fact, they received brand consultation form the pharmacists. This indicates that policies in place are not enforced in practice, which allowed these students to purchase antibiotics without prescription.

A small number of participants (i.e. three) believed that antibiotics were interchangeable and that they took whatever antibiotic they had available to them. Participant 6 indicated he takes whatever antibiotics are available in the household, no matter what type it is. Therefore, the results extracted in this subtheme indicate that the methods used by healthcare students to select their antibiotics was widely depended on system failures to enforce existing policy related to the prohibition of selling antibiotics without prescription.

Another reason for which healthcare students seem to be able to get antibiotics is the lack of education, which should have been addressed by pharmacists. This includes the discarding of leftover antibiotics once the course of medication has been completed. These situations gave rise to two possible scenarios based on which healthcare students can obtain antibiotics without a prescription. Firstly, because consumers are not educated in relation to disposing of leftover antibiotics, students had access to these types of drugs. Secondly, because policies on antibiotic restrictions are not enforced, healthcare students could purchase antibiotics without prescription, and at the same time, could seek advice on which type of antibiotic to use.

Finally, parents' preference was another way of selecting antibiotics as reported two participants (11, 14). When the researcher asked participant 11, how does she know which antibiotic to use, she clearly identified her father. This person was an ophthalmologist and brought her antibiotics from the hospital after she described her symptoms to him.

Data provided by this participant indicates another problematic aspect of using antibiotics without prescription, specifically, the self-medication practice with antibiotics present among people with medical knowledge or/and from the medical profession. Different types of bacteria are known to infect different parts of the body. Because of this, other than wide-spectrum antibiotics, some antibiotics are specifically designed to target a particular type of bacteria. Without further testing, the father of Participant 11 could not have known which bacteria caused the symptoms of his child. Furthermore, since a virus infection can mimic symptoms of a bacterial infection (fever, muscle ache, inflammation), it is possible that he may have given his child antibiotics when there was no need for this type of intervention.

5.4.2.1.3. Attitude of Brand Preference

Participants were probed to indicate their attitude towards generic or branded drugs aiming to further probe the participants to determine if the cost of antibiotics influenced their misuse (i.e. cost-influence behaviour risk factor as identified from the survey study one). When given the choice between name brand and generic antibiotics, although five participants did not consider the type of antibiotics to be an issue, nine preferred to have a brand name antibiotic. Reasons that were given for this choice included the perceived reliability of a brand name company over a generic option and past experience. The experience cited by participants referred to either taking the medication based on their own decision or the medication being prescribed to them by a physician. However, none of the participants referred to the cost of antibiotics as an influence of their brand preference's attitude.

Interviews with other participants revealed more reasons for brand preference (e.g. the effectiveness, pharmacists' recommendation). Participant 8 indicated that he asks about the producing company when buying antibiotics, as he uses the brand name to determine the effectiveness of the drug based on previous experience with drugs produced by the same company as illustrated by the following quotes:

"I: Normally, you care about the generic or a brand name antibiotic or not?

P: Actually, I ask for the company itself.

I: Why?

P: Cos, the company itself may have some … some medicines that it works with me before. And, also, these medicines, I confirmed it with my parents if it work, with my parents. So, it's like a famous company, it's product is much, good quality and it works good.

I: So, is it the quality of the product?

P: Yeah, it's cos of the products it's too important. High quality yeah, as well I know if quality is good for sure it will be good." (Participant 8)

Other participants took the brand their physician prescribed because they felt like the physician was more knowledgeable. Others felt like they didn't have a choice, and had to take the brand their physician preferred. Participant 1 indicated that she trusts her doctor's judgement and takes the brand previously prescribed to her, as she does not know if other brands are as effective. In contrast, a participant was not concerned about a specific brand name and he followed pharmacist preference only (Participant 6). Moreover, effectiveness rather than brand preference was the main concern of Participant 12 as well:

"It doesn't matter really. What matter is that it becomes really strong and it is effective" (participant 12)

As it can be observed from the above data, participants selected brands of antibiotics not based on cost, but based on past experience. Participants who took once antibiotics with prescription sought to buy the same brand of antibiotic that was initially prescribed to them by their physician. Other participants relied on their past experience with other medication for the brand while the remaining participants noted that they selected their antibiotics based on the advice of the pharmacists. Similar reasons to the ones discussed in subtheme 5.8.2.1.3. of Theme One can be quoted here for why these practices result in irrational use of medication. Firstly, for the group of participants who preferred to purchase antibiotics based on previous prescriptions, there is a high possibility that their symptoms could have been attributed to other conditions.

In this case, without a physician consultation, although they bought the same antibiotic as previously prescribed, the medication could have been taken based on inaccurate self-diagnosis. Secondly, for participants who focused on purchasing a brand of antibiotics from which they had previously bought other types of medication, can find themselves in a similar situation. Inaccurate self-diagnosis could have therefore led these healthcare students to use antibiotics without prescription, which may have been the wrong type of antibiotic or the wrong type of medication for their symptoms. None of the participants mentioned that their pharmacists required a prescription or that they pharmacists required them to consult a physician before using antibiotics.

5.4.2.1.4. Self-medication with other drugs

Participants were further interviewed about their behaviour of self-medication with other drugs (polypharmacy) and symptoms that they often self-treated (self-care orientation risk factor) as identified from the survey study one. Many participants described using painkillers, the most common of these being Panadol®. However, the use of *Panadol* was only on need (e.g. if they have headache or pain) and often for a short period of time. Therefore, the responses did not show any association between self-medication with antibiotics and other drugs. Furthermore, the most common symptoms quoted by the majority of the participants referred to headaches or pain (i.e. low self-care orientation). Participant 4 said she uses Panadol when she has a sore throat or a fever and resorts to antibiotics if the symptoms do not improve the next day, taking it "*for a day or two maximum*".

"I: Do you usually self-medicate with other drugs?

P: Yes, usually I start off with Panadol and see. So, like I said, if I have a sore throat or a fever sometimes I do start with Panadol and then I see if I feel better the next day. If I don't then I go straight to the antibiotic.

I: How long do you usually take it?

P: Sore throat, fever, runny nose, those are always my three main symptoms and I take it for a day or two maximum.

(Participant 4).

This participant seems to display a case on inappropriate dose and inappropriate frequency of use. Because common colds that are characterised by fever and sore throat, usually improve in a few days, waiting just one day to feel an improvement is an insufficient period of time to observe any kind of positive effects. Antipyretic and analgesics used during cold-like symptoms will only minimise this symptomatology and allow for the body to naturally produce antibodies to fight off the virus. Infection with bacteria generally occurs after a week or even more time of cold-like symptoms. These symptoms are generally accompanied by other more severe clinical signs such as severe cough and increased sputum (Kon and Rai, 2016). The bacterial infection if produced with bacteria that normally populate the respiratory tract (i.e. pneumococci), yet due to the viral tissue damage, it multiplies significantly, leading to infection (Choffnes et al., 2010). All this pathology takes 1-2 weeks to occur. Therefore, using antibiotics just one day after taking symptom relief medication is a case of inappropriate dose and inappropriate frequency of use. Moreover, if this process is repeated, the bacteria normally populating the respiratory tract becomes resistant to the antibiotic used, generally a cephalosporin. This may result in severe complications for the patient, as any future infections with these types of bacteria will become irresponsive to antibiotic prophylaxis.

5.4.2.1.5. Differences between Participant's Experience and Other Students

Participants also listed ways in which their experiences with self-medication differed from what they believed to be the common experiences of other students. Several claimed that they did not perceive any differences between their own medication habits and the habits of others. Because of this, they assumed that other students also use antibiotics without prescription. For these participants, self-medicating with antibiotics, rather than seeking a physician's prescription, was something that was done depending on which courses of antibiotics they previously took (i.e. how experienced they felt). Without having a clear understanding of the potential dangers involved with using antibiotics without prescription they also lacked a fear that an antibiotic resistant infection could happen to them. Therefore, the intervention in study three will focus on the negative consequences of developing antibiotics resistance at an individual level (e.g. prolonged recovery and higher cost of treatment).

Some participants reported that many of their classmates held the belief that taking antibiotics was the best action when feeling ill. These participants held the belief that taking antibiotics available in the household, or that can be bought from a pharmacist, was as effective as getting a physician's prescription.

Three respondents believed that they were in a better position to self-medicate because of medical courses they had taken. Participant 4 reported she had "*the privilege*" to learn about antibiotics in school, so she tries to help other students self-medicate with antibiotics. This belief was also shared by Participant 1 who explained that because she studied about antibiotic use in a special course in school, she feels she has more knowledge about antibiotic use by contrast with her colleagues and friends. Such statements clearly underline why healthcare students represent a high-risk population for using antibiotics without prescription. For these participants, knowledge on antibiotics acted as a negative factor which enticed them to use these medications without prescription. Furthermore, they used this medical knowledge to advise others not on seeking physician consultations, but on using antibiotic without prescription.

In contrast to all other participants, one participant (Participant 10) felt dissatisfied with his experience of using antibiotics. Furthermore, he thinks that his experience was the worse as he started talking in a different tone and his facial expression changed once he was asked. The reason why he considered his experience worse is because he did not complete all the antibiotic treatment.

From the statements of this participant, it can be concluded that he attributed his negative experience not to having used antibiotics without prescription, but to not having completed the full course of antibiotics. This being said, it can be deduced that without the misplaced blame, this participant would have still used antibiotics without prescription.

After conducting this interview, the researcher felt that knowledge and awareness alone are not enough to change the behaviour of using antibiotics without prescription for any participant similar to Participant 10. Therefore, tactics that focused specifically on behaviour change should be created or developed to achieve a successful intervention in study three.

5.4.2.1.6. Perception of pharmacists' advice

Medical advice-seeking behaviour was also investigated during interviews as it was already identified in study one as a risk factor for other types of irrational drugs use. Most participants reported that pharmacists usually provide them with medical advice about using antibiotics at the time of the purchase. Furthermore, many participants indicated that pharmacist's advice was useful. Data extracts included:

"He [pharmacist] advises me to complete the course, to take it before the breakfast or after the breakfast, twice or once a day. Only one week, such things" (participant 12).

However, two participants described that the pharmacist' advice was limited to specific issue only as she stated that:

"Yeah they [pharmacists] make sure to finish the course. They tell me to make sure to finish the full course of the antibiotic." (Participant 15).

Another participant reported that they relied on the pharmacist's advice to the same degree that they would rely on the physician's advice. This participant reported that pharmacists and physicians often encouraged him to take the same medication, and that this agreement gave him confidence in the advice. As discussed by this participant:

"Actually, the pharmacist advisement is the same as the doctor advisement. Cos, I had an experience with … I had an experience that it takes like … I had an experience when I went to a doctor, not a pharmacist doctor. He gave me advisement about a special medicine and when I went to the pharmacy to buy this medicine, he also gave me the same advisement that the doctor told me." (Participant 8)

Based on the comments of these participants, it can be argued that in some cases pharmacists do provide advice that can prevent antibiotic resistance. This includes: frequency of use and correct dosages. Based on the genetic mechanisms for antibiotic resistance (Vogwill et al., 2016; Brauner et al., 2017; Wistrand-Yuen et al., 2018) these advices can help prevent the emergence of antibiotic resistance. However, in the absence of a physician's consultations, the pharmacists may have given antibiotics to consumers without these types of drugs being the right type for treating their symptoms.

In contrast to most participants, pharmacist's advice was not useful for other participants who believed that the pharmacist is only interested in selling highly expensive medicines rather than paying attention to their customers. Participant 6 looked very disappointed once he started talking about his perception as he explained that pharmacists showed him a variety of brands and then recommended the more expensive one. This made him believe that pharmacists only want to sell their more expensive drugs.

Interestingly, Participant 5 revealed different medical advice seeking behaviour compared to other participants claiming he usually gets different advices from different pharmacists for the same symptoms. He also said that on some occasions the antibiotic worked immediately, while in other occasions the antibiotic had to be taken for a longer time before amelioration was felt.

On the whole, it was clear that the majority of participants trusted pharmacists as their advice was considered to be useful. These perceptions and views are encouraging and can have implications in any training programme for pharmacists in UAE to prevent dispensing antibiotics without prescriptions. However, for this strategy to function, it is essential for the government to enforce regulations related to the sale of antibiotics without prescriptions.

5.4.2.2. Theme Two: Reasons for Self-medication

Two different risk factors related to the use of antibiotics without prescription as identified from the survey study. These are saving money and urgency of use. Therefore, participants were probed to further explain the reasons behind the use of antibiotics without prescription. When asked about the reasons for their self-medication with antibiotics, the most common responses highlighted time limits or scheduling difficulties, reliance on prior prescriptions given for similar symptoms, the urgency of their situations, and advice from parents or friends for taking the antibiotics. In addition, participants also cited financial reasons and fear of not getting antibiotics from the first visit to the physician.

5.4.2.2.1. Time and Convenience

The most commonly noted response among all participants was that the time commitment of seeing a physician or the scheduling limitations of student life compelled students to self-medicate with antibiotics. One articulated:

"Usually it is because of time. Us being students, like on the campus and all of that. You don't really have time and if it happens during the week and you still have lectures tomorrow or during the day, and we have a strict attendance so you know you can't miss the lecture. So you need something to help you get through the day without it being a fact that makes you delays work or anything". (Participant 1)

These responses indicate that healthcare students are not aware of the fact that symptoms can be managed with non-antibiotic medication. In fact, antibiotics have no effect at all in treating cold-virus infections. This is an indication of the fact that students in the selected sample may not only be unaware of the actual use of antibiotics but also unaware of the use of other ONPD for managing flu-like symptoms. As a result, the time variable quoted by this participant is problematic only because the participant did not know how to correctly self-diagnose (inappropriate self-diagnosis) and take the correct drug (inappropriate self-selection) for his condition.

5.4.2.2.2. Previous Experience

Other common reasons for taking antibiotics without a prescription were experiencing familiar symptoms and relying on prescriptions that had been recommended for those symptoms in the past. Participant 9 believes the infections "*are very repetitive*", so "*everyone knows what are the symptoms of the flu, what to use for them and if you have a fever what you should do*". As a consequence, she does not believe seeing a physician in such cases is necessary.

As Participant 9 correctly pointed out, flu-like symptoms are easy to manage. However, the way in which these symptoms are managed, via appropriate diagnosis and appropriate self-selection of ONPD is an important aspect of rational use of medication. Fever can be managed via antipyretic medication; inflammation can be managed with anti-inflammatory drugs. One example of drug that can provide this as a double action is Ibuprofen. This ONPD is not an antibiotic and it is generally administered in flu-like symptoms. However, Participant 9 seems to be unaware that virus infections produce similar symptoms with bacterial infections (i.e. fever).

5.4.2.2.3. Urgency of Situations

Few participants also discussed the role that the urgency of situations played in making the decision to self-medicate. Participant 2 recounted that he would self-medicate "if *I have a sudden very high fever, if it was an urgent situation".*

Based on the fact that the urgency of the situation was not invoked by participants as one of the reasons for which they would engage in self-medication, it may be argued that students in the selected sample engaged in self-medication when the situation was not urgent. From this, it may be deduced that more severe symptoms may have led these students to consult a physician.

5.4.2.2.4. Advice from Friends and Family

Some participants referenced advice from friends and family as a contributing factor in deciding on self-medication. Three participants were urged by loved ones, both with and without medical backgrounds, to take antibiotics for their respective illnesses. Participant 9 recalled: *"as soon as I started getting worse my dad advised me to take some antibiotics."*

Two participants perceived themselves having sufficient knowledge from their parent for self-prescribing antibiotics as they undoubtedly confirmed in the following quotes this belief:

"Cos, my parents they taught me that if you have like, throat inflammation you can take antibiotics without going to the doctor. If it did not work, then you will have, to go to the doctor." (Participant 8).

When seeking advice from friends and family, participants seemed to be faced with inappropriate self-diagnosis, as well as with inappropriate self-diagnosis set by others for their condition. From the description of their conditions, participants seemed to be suffering from flu-like symptoms, which do not require the use of antibiotics. However, they have been advised by their friends or family to take these types of drugs. Moreover, when symptoms seemed to worsen, instead of seeking medical advice and physician consultations, participants engaged in using antibiotics without prescription.

5.4.2.2.5. Advice from pharmacist

Few participants self-medicated with antibiotics because of the pharmacists' advice. The quote below illustrates this experience:

"One of my friends is a pharmacist. I just call him and ask him which is the best thing for this disease or this particular, thing, and he would prefer … like suggest that particular medicine for, you know an antibiotic for me and I would go and buy it".

(Participant 7)

This subtheme contrasted the responses attained in Subtheme 5.8.2.2.2. under, Theme One, based on which five Participants (7, 5, 8, 9, and 13) sought advice from the pharmacist in relation to what type of antibiotic they should purchase. Considering this contrast it can be argued that while pharmacists do not specifically advise people to buy antibiotics for their symptoms, when people specifically seek antibiotics, pharmacists provide these to them.

5.4.2.2.6. Financial reasons

A few participants reported that self-medication was less expensive or less of a financial burden than seeing a doctor. For these participants, buying medication was supposedly less costly than first seeing a doctor. One participant reported that it was expensive to see the doctor, and unless he believed his condition was severe, it didn't seem necessary to spend the money to do so:

"Financial cos you know nowadays it's really, expensive to go and see doctors and find … and I don't think it's a major problem to have a headache or some, you know some minor diseases. So, that's why I usually self-medicate myself" (participant 7).

Interestingly, Participant 10 showed some relationship between the fees paid for a physician and his belief about the consultation. He argued that for him it is obvious that the physician would prescribe antibiotics anyway, so he thinks there is no need to pay for a consultation as long as the drug is available without a prescription. He found that buying antibiotics was more cost effective than first seeing a physician. From these statements, it can be deduced that first-year healthcare students do not possess knowledge in relation to when antibiotics are to be used. Secondly, as pointed out by Participant 7, minor conditions that can be treated with ONPD do not require a physician consultation. However, Participant 10 assumes that the physician will prescribe antibiotics "anyway". Responsible prescription by physicians is the first line of defence against antibiotic resistance (WHO, 2001). Because of this, it may be assumed that physicians would prescribe these medications only in cases that require antibiotic intervention.

5.4.2.2.7. Not Wanting to Worry family Members

Some participants indicated that their motivation for self-medicating was to avoid worrying or inconveniencing their family members. For these participants, the concern was that going to the physician or admitting an illness would cause their family worry, and the easier solution was to self-medicate in an attempt to deal with the illness themselves. One participant reported that she self-medicated when visiting the physician was not feasible, and when telling her parents about her condition would worry them. She indicated that,

"But if it is fever and if it is during the night and I can't go to doctor or my parents are asleep, I'm usually scared to just tell them because they worry and all that. So yeah, I just end up taking an antibiotic." (Participant 1).

Participant 6 reported that while she used to ask her parents for advice regarding medication, she no longer did so due to her concern about inconveniencing them. She reported that rather than bothering her parents, she self-medicated using the knowledge she had about antibiotics.

Such statements lead back to the need of educating the public in relation to self-care and the involvement of self-medication in this process. Having a fever or having a cold is a very common symptom across all age categories. The reaction to take antibiotic medication when such minor symptoms arise link back to excessive self-care which may result in overreaction and cause more harm than good.

5.4.2.2.8. Fear of not getting antibiotics from the first physician's visit

Although one participant initially appeared to have the same reason as other participants, however, she revealed that she had a concern of not getting antibiotics from the first visit to the physician as well. The quote below describes this concern:

"Actually the time because when you go to the hospital you spend time sitting waiting for the doctor and you know the prescription in the end or something that would cure you fast. Because not all of the time the doctor will write for you an antibiotic. Mostly they will write a painkiller and such things to reduce the pain, they don't write directly antibiotics. So that is why I go and buy it alone"

(Participant 13)

Some contrasting ideas can be observed in this case. While Participant 10 assumed that the physician will prescribe antibiotics anyway, Participant 13 did not get a medical consultation before using antibiotics because she feared that the physician will not prescribe an antibiotic.

5.4.2.3. Theme three: Access to antibiotics without a prescription

This section examines how participants get access to antibiotics without visiting physicians. According to the participants, there are several ways students gain access to antibiotics without a prescription. Thus, this theme consists of three subthemes: using antibiotics left over from another prescription, buying them from the pharmacy without the prescription, or getting the medication from a family member or friends. Despite the fact that most participants were aware that using leftover antibiotics was not rational, they still used them as long as those antibiotics were not expired.

Participants' responses under this theme provide a message for the researcher that behavioural change is unlikely unless participants in the intervention study three have a clear sense of the importance of change.

5.4.2.3.1. Leftover Antibiotics

Participants were asked whether they took leftover antibiotics from previous treatments, and the majority admitted to doing this, as long as the medication was not expired. This allows participants to gain access to prescription medication to treat an illness without seeing a physician.

Although a participant was aware that using leftover antibiotics is not rational he still used them. As he explained, he knows using leftovers is a problem, but somehow it is justified if "*we also look if it is too old to use then we don't use it*" (Participant 10).

5.4.2.3.2. Pharmacy

Interviews revealed that community pharmacies were the major source of antibiotics' acquisition among ten participants. Participant 5 describes that the first time he used antibiotics without a prescription he went to the pharmacy and the pharmacist told him antibiotics are suitable for his symptoms.

Only one participant indicated that the pharmacist recommended antibiotics for his symptoms. For other five participants (7, 5, 8, 9, and 13), the pharmacists only advised on the brand to be used. Based on these statements, it may be argued that pharmacists contribute to the use of antibiotics without prescription via two pathways: firstly, they sell the medication even though customers do not have a medical prescription; secondly when people specifically come to buy antibiotics, they recommend certain brands but do not advise people to first seek medical investigations. Furthermore, accounting for the statement of Participant 5, it may be argued that a third pathway may exist, specifically that pharmacists may recommend antibiotics.

5.4.2.3.3. Family

Another means of acquiring such medication without a prescription was through friends and family. This included friends and family members who were healthcare professional.

"I: I see, so your dad normally is the one who will give you the antibiotics?

P: Yeah.

I: But from where do you get the antibiotics?

P: I'm not sure. I think my dad gets it from the hospital where he works from. But I don't go to the doctor and have a check-up in order to get it.

I: Which speciality is he?

P: He is an ophthalmologist.

I: And normally he gives you antibiotics for what reason?

P: A sore throat and ear infection." (Participant 11).

In this particular case, even though the father of Participant 11 was a medical doctor, he was an ophthalmologist. Participant 11 accused symptoms of ear infection or sore throat, which would be referred to otolaryngology, not ophthalmology, as the otolaryngologist deals with infections of the ear and upper respiratory tract. Therefore, it may be argued that the father of Participant 11 was not qualified to prescribe antibiotics for a sore throat or ear infections.

Using the prescription medication given to family members was another source of getting non-prescribed antibiotics. In the words of one participant:

"I would just normally use it in the house [leftover antibiotics], just with my mother's prescription and not a doctor's prescription." (Participant 10).

This is another case on inappropriate use as illustrated by inappropriate dosages and inappropriate frequency of use. If the prescription was given to the mother of Participant 10, she would have been different in terms of weight and of symptom severity. To ensure efficiency, dosages in antibiotic prophylaxis are generally calibrated based on the person's weight and severity of the infection. This indicates that by taking antibiotics that were prescribed for his mother, Participant 10 engaged in irrational use.

5.4.2.4. Theme four: Perceptions of antibiotic and antibiotic resistance

Participants were probed to describe their current level of knowledge about antibiotics and antibiotic resistance, as well as methods of determining the dosage of antibiotics. During the discussion, participants were also probed further about their attitude towards using leftover antibiotics and whether they recommend antibiotics to others. Seven key subthemes emerged from the analysis. These are:

5.4.2.4.1. Antibiotic- seeking behaviour

The interviews showed that if participants had a serious symptom, their goal was to manage it by taking antibiotics. Based on most participants' responses, often the decision is to take antibiotics as they believe it cures illness fast and when relief is not forthcoming, they seek care from a physician.

“I: Can you tell me please about your experience of self-medication of antibiotic without doctor’s prescription when that was the first time ever you did this?

P: I started when I was in the school. Once I went to a doctor and he gave me an antibiotic, my mother realised that I got cured fast with the antibiotic so every time I get sick my mother goes and buys me an antibiotic.

I: And you feel better after that?

P: Actually yes.

I: So now you are in the university have you ever been to a pharmacy and bought an antibiotic without seeing a doctor?

P: Yes it happens a lot because I need to get cured fast because I can’t miss studying lessons and lectures and such things. So I find the antibiotic is something that will cure me fast so I go and buy it without a prescription.

I: Normally what kind of illness do you use antibiotics for?

P: The fever, flu”. (Participant 13)

Considering these statements, it can be argued that Participant 13 is exposing himself to serious antibiotic use risks, which derive from an increased frequency of use since childhood. Repeated exposure is a main mechanism of creating antibiotic resistance (Vogwill et al., 2016; Brauner et al., 2017). Since Participant 13 has been taking antibiotics since childhood without a medical prescription, and still continuing the practice, this raises serious concerns about his future health. Other potential serious events include permanent damage to the gut flora which can manifest itself in chronic inflammatory disease (Yoon et al., 2018).

Additionally, some participants are influenced by their parent or previous experience of a similar symptom. In this case, directly use antibiotics as illustrated by a quote below.

“Cos, my parents they taught me that if you have like, throat inflammation you can take antibiotics without going to the doctor. If it did not work, then you will have, to go to the doctor.” (Participant 8)

It appeared that none of the participants tried traditional therapy for self-management of their upper respiratory symptom, fever, headache and pain (e.g. gargling with salt water for sore throat). Thus, this issue will be addressed in the intervention study three, so the participants will have the opportunity to learn alternative home remedies for managing minor symptoms. This strategy might have an influence on changing students' behaviour.

Furthermore, participants favoured taking left-over antibiotics instead of using antipyretic or anti-inflammatory medication for flu-like symptoms. This indicates that their previous experience with antibiotics, similar to the experience of Participant 13, led them to believe that antibiotics can quickly solve their symptoms. Some participants quoted the need to be active to attend demanding classes as the main reason for using antibiotics. As noted by these participants, their symptoms improved immediately after taking antibiotics. One randomised control trial (Barrett et al., 2011) noted that participants experienced an immediate improvement in their flu symptoms when given placebo pills, versus the group that did not receive such pills. Therefore, the comments of participants in this study may indicate that when taking antibiotics, they experience a placebo effect and attain an improvement in their symptoms. For this reason, it is possible that through educating healthcare students in relation to how antibiotics actually work, this effect will be diminished, or even disappear. This may result in them no longer using antibiotics and turning to more conventional treatment pathways.

5.4.2.4.2. Knowledge about indications of antibiotics

The vast majority of the participants demonstrated misconception about the purposes (i.e. indications) for which antibiotics are usually used. Most of them confused antibiotics with other medicines used for pain or allergy. Most participants described using antibiotic to treat symptoms that were often caused by a virus rather than bacteria (e.g. flu or cough). The quotes below clearly show the common pattern of responses extracted from most participants.

"Well when I feel unwell and ill. Like even if I have a headache or something I usually take antibiotics" (Participant 7)

" I generally do use antibiotics frequently when I get sick when I feel that I have flu or am starting a cough or am developing any symptoms or fever and such diseases" (Participant 9)

"Sore throat, fever, runny nose, those are always my three main symptoms" (Participant4)

"It is mainly for just pain relief" (Participant 10).

5.4.2.4.3. Effectiveness belief

All participants share a common belief that antibiotics are powerful and effective and this might be the reason behind using them during self-medication of symptoms. Some of them correlate the effectiveness to the rational use of antibiotics as stated by participant 1:

"It is powerful but it depends on … if you are using it for the right bacterial infection some people use wrong antibiotics for the wrong bacteria so that won't be effective at all. So it depends on what you are treating in your body. Then the antibiotic will be effective and if you continue the course fully".

However, one participant demonstrated clear misconceptions about the type of micro-organism for which antibiotics are effective biocides. These misconceptions were also present among all participants, as shown in the subtheme above.

"It has a strong power. I believe that when we take antibiotics it will kill the virus, reduce the symptoms that we get from the virus. So it works well" (participant 15).

These statements indicate that while participants are aware of the potency of antibiotics, they still use them without prescription. Other than lack of knowledge and awareness over the risks of antibiotic use, there was also a lack of knowledge on the type of illness usually treated by using antibiotics. Furthermore, when participants did note that some antibiotics are to be used for a particular type of bacteria, they still used these medications without prescription. This indicates that having knowledge in regards to the use of antibiotics does not result in using antibiotics with prescriptions. Even more than this, as demonstrated in the previous themes, students are more inclined to use antibiotics if they have knowledge related to their purpose.

Considering these aspects, it is important to recognise that knowledge alone will not change the behaviour of using antibiotics without prescription.

5.4.2.4.4. Method of Determining the Dosage of Antibiotics

Common responses on the subtheme of determining dosage highlighted (a) referring to medication labels and instructions; (b) following the pharmacist's recommendations; (c) parents and; a previous prescription from a physician.

The most frequently reported response referred to medication labels. Four participants (3, 4, 5 and 10) cited medication labels as the primary source used to determine dosages of antibiotics.

"I do look at that [information leaflet] sometimes because as I have grown older I became more alert about this and I started to care more about myself in terms of medication. I don't want to take anything that might harm me in terms of dose or anything." (Participant 10)

Recommendations from pharmacists were another source of drug information about antibiotics as indicated by seven participants (1, 6, 8, 7, 9, 12 and 13). Participant 6 reported that:

"The pharmacist can answer you and his … yeah, and he is more …he knows and he is sure about what he is saying. So, if he's sure, that's his responsibility then" (Participant 6).

Having had a previous prescription from a physician was also reported by one participant. This approach was reported by participant 2 who described:

"Again, it would just be assuming that the previous time when the doctor prescribed at a different time. If he [physician] prescribed, for example, twice a day or once a day, I would just follow the same thing."

Parents or a parent were the source of information about the dosage of antibiotics for three of the participants, as the quotes below illustrates:

"I asked my parents before. So, I use the same doses for all the illnesses." (Participant 6).

It is important mention that participants in this study did seek out information as related to the dosages. Although the information may not have come from a reliable source (i.e. family) the participants seemed to be aware of the fact that dosages are important in relation to antibiotic use. Interestingly, no participant mentioned other sources of drug information (e.g. the internet or medical books).

5.4.2.4.5. Understanding of antibiotic resistance

Participants were asked whether they were familiar with the concept of antibiotic resistance as a whole, and were then further probed about their perceptions regarding use of antibiotic without prescription among students and whether they believed that the use of antibiotic without prescription contributed to antibiotic resistance overall. Discussion showed that participants overwhelmingly were at least somewhat familiar with the term antibiotic resistance, with thirteen having some understanding

Although he admitted misusing antibiotics without prescription very often, a participant demonstrated sufficient knowledge about the concept of antibiotic resistance:

"In some cases the bacteria may develop a mutation against the bacteria where they are no longer sensitive against the antibiotic and they are able to multiply and this will come into negative effect with the human" (participant 10).

This participant did know that bacteria can become resistant via mutations. However, he may not have been aware of the precise mechanisms (persistence and tolerance) through which this happens as this is the only information he provided. Therefore, it can be implied that since he may have been unaware of the importance of repeated exposure in creating antibiotic resistance, he continued to use antibiotics without prescription, albeit finishing the whole course.

When participants were probed further whether they believed that students used antibiotics without prescription, most respondents answered positively. Nine believed that students tend to use antibiotics without prescription.

Participant 3 stated *"Yeah. Sometimes they do by taking an over dosage thinking it might be better for them or it might make it work faster. But yeah, I do believe sometimes they do misuse it".*

First-year healthcare students do not study any subject related to antibiotics in their academic curriculum (e.g. pharmacology). However, few of the participants (three) believed that healthcare students are well-equipped and knowledgeable enough not to use of antibiotic without prescription.

Participant 7 argued:

"I think medical students, as they are studying these things, and they are in the medical field, they do have an idea about antibiotic resistance and they shouldn't … I think they don't"

Although it is noticeable that participants do not have sufficient knowledge in relation to the rational use of antibiotics, these statements demonstrate that they are overconfident in their medical knowledge, which leads them to use of antibiotic without prescription. As noted by one participant, because they are in the medical field, they feel more skilled than the general population in taking antibiotics when needed. However, since they are first-year students, and their curriculum does not include education on antibiotic use, it is less likely that they are fully aware of the risks associated with antibiotic use or of the need for a physical or even laboratory exam before prescription. Therefore, the educational intervention should devote time to discussing this phenomenon.

5.4.2.4.6. Association between misusing antibiotics and developing antibiotic resistance

Almost all of the participants, except one, believed there is a correlation between antibiotic resistance and the irrational use of antibiotics without prescription. The quote below shows the perception of a participant:

"As long, as I know, from my parents and the news that I read, when a person misuses antibiotics or doesn't use it like in the correct way and doses, the bacteria in the body will become resistant to that antibiotic and it will not affect them anymore. So, even if you use them for a whole month in the correct way it will not affect them because you use them" (Participant 4).

The quotes below show the general pattern of response from most participants about the mechanism of bacterial resistance.

"Yes because you don't know what drug you are using so you might develop these patterns where you use this and then you stop it and then you use it again without knowing." (Participant10)

"Yes. Because if you are misusing it you are allowing your body a chance to build up resistance and you are not needing it so you are just building up useless

resistance and it overall your body will stop reacting with the antibiotics." (Participant2).

It is apparent that the majority of the participants have some knowledge that other healthcare students used antibiotics without prescription. Additionally, the majority of participants were aware of the negative consequences of using antibiotics without prescription and the relation of this behaviour to antibiotic resistance. However, many of them confessed to using antibiotics without a prescription frequently. These statements clearly point to the fact that participants have insufficient knowledge of antibiotic use and of the mechanisms responsible for antibiotic resistance. However, because of the fact that some levels of knowledge have been observed, healthcare students feel that they are more knowledgeable than the general public in relation to antibiotic use. This creates a context in which healthcare students use antibiotics without prescription but do not recognise this as a form of irrational use. Therefore, it is clear that the educational intervention in study three should not only focus on knowledge, but also on behavioural change.

5.4.2.4.7. Attitude towards recommending antibiotics to others

After discussing knowledge about antibiotics and antibiotic resistance, participants were asked about their attitudes regarding recommending antibiotics to their people. Interviews showed that most participants do not recommend antibiotics to be used without prescription by their family members or friends and colleagues. This attitude was shared by most participants (1, 2, 3, 4, 5, 6, 8, 11, 13 and 15). Quotes extracted below illustrate this attitude.

"I don't recommend them because I'm not a doctor and usually, I don't usually do the things which are not in my own criteria. So, I don't usually recommend anyone to do it." (Participant 6).

"No I don't. Because you don't know what type of bacteria you are targeting so if you start taking an antibiotic that isn't going to affect your bacteria that you are intending on targeting then it is not going to be useful. The fact that it can do the opposite and kill the good bacteria in the body and that is going in the completely wrong direction". "(Participant 4).

This indicates that Participant 4 has at least some knowledge of the human microbiota and of the way in which antibiotics kill off good bacteria and thereby creating health concerns. At the same time, based on statements from Participant 4 and Participant 6, it is evident that some students may recognise the limitation of their knowledge in relation to antibiotic use. As future health care professionals, they do acknowledge these limitations and refrain from recommending antibiotics to others. At the other end of the spectrum, as demonstrated by statements discussed under previous themes, healthcare students do not hesitate to take antibiotics for themselves to treat flu-like symptoms or conditions in which they suspect an infection.

However, the attitude of recommending antibiotics was conditional by a minority of the participants (only three).

“If they know about it then why not but if they are public people who are not doctors or have no idea about those chemicals they are taking in then no I don’t.” (Participant 9).

Participant 12 was more specific to link this attitude with physician and pharmacist’s advice as he stated that:

“Yes but with the advice of a doctor or a pharmacy, not with themselves. “(Participant 12).

In contrast, Participant 10 agreed on recommending over-the-counter antibiotics. Previous responses from this particular participant indicate he used antibiotics without prescription frequently. The participant seemed overconfident about his knowledge as a healthcare student, despite the fact that he was only in his first-year and did not take pharmacology classes.

5.4.2.4.8. Attitude towards completing the course of antibiotics

Participants were probed further about whether they usually complete the course of antibiotics. Most participants (2, 3, 4, 7, 10, 11, 13, 14 and 15) reported finishing the entire course of antibiotics as explained by participant 15:

“When I came to know that finishing the course is really important, it is part of the treatment so I have to finish the course.” (Participant 15)

Interviewing more participants showed that participants' attitude was developed and changed positively based on knowledge. Two participants (1, 8) failed to finish the course prior to having been educated as to its importance*:*

"I didn't finish it once. Now since I learned about what can happen if I don't finish it, now I finish it" (Participant 1).

This information was encouraging for the researcher and valuable for the development of the educational intervention in study three. This is because the information is a significant indicator that students' attitude can be changed by improving the knowledge.

Only a few participants indicated that they generally do not finish the course; participant 1 stated that:

"Unfortunately I don't. I know I am supposed to finish it to not develop antibiotic resistance. But unfortunately it is just sometimes laziness by me" (Participant 10).

In total, misconception about the duration of treatment; failing to remember and not having the energy to complete the full course of antibiotics are three important factors that contributed to an unhealthy attitude among a minority of participants. These three reasons will be incorporated into the development of the educational intervention in study three.

5.4.2.5. Theme five: Possible solutions for reducing irrational antibiotic and resistance

When discussing the problem of using antibiotics without prescription and the approaches for its reduction, the participants listed a number of strategies that could be used to help stop the spread of the use of antibiotics without prescription and resistance, which were used to develop a unique thematic theme. The participant's detailed actions that could be taken in reducing the use of antibiotics without prescription in three different subthemes: the role that pharmacists could play, the role that physicians could play, and general strategies that could be employed to spread awareness. Overall, this theme provided useful information for addressing the problem of bacterial resistance at different levels.

5.4.2.5.1. Role of pharmacists in reducing resistance

Participants were asked about their perceptions over the role of pharmacists in preventing the use of antibiotics without prescription and subsequent antibiotic-resistance. Common responses highlighted (a) pharmacists should refuse to give out antibiotics without prescriptions; (b) the pharmacists should be offering more advice to patients about the medications; (c) emphasizing more home remedies and alternative medications for patients prescribed antibiotics; and (d) having information on antibiotic resistance posted at pharmacies for patients to review.

Pharmacists requiring prescriptions before selling antibiotics was the most popular response to the question of the pharmacist's role in managing the use of antibiotics without prescription. Participant 2 stated "*I feel pharmacists should stop handing over antibiotics without prescriptions from a certified doctor or a hospital*". This perception was also shared by Participant 6 and 13 who recommended:

"I think the pharmacy and pharmacists needs to ask for a prescription. It should, I believe it should be a drug that it's not allowed to give it without prescription. Like same … same like many other drugs in the society these days"

(Participant 6)

"They [pharmacists] shouldn't give it to us without a prescription from a doctor." (Participant 13)

Only a few participants also frequently indicated that pharmacists should make efforts to advice patients, specifically regarding the side effects of antibiotics and their ideal function.

I: And what about pharmacists?

P: The pharmacists, as I said before, them not saying anything about the antibiotics, especially I'm saying to say the side effects about every drug they give out, if they tell you a brief introduction about the antibiotic resistance while just giving you the antibiotic, then they can change lots of people's minds…..They don't tell you that, they just tell you oh take this for three days, take this for one week, they don't end up including any other useful or any side effect that might happen to you if you didn't continue that " (Participant1)

Other participants also agreed that medical advice is the main responsibility for pharmacists in the context of reducing the use of antibiotics without prescription. She stated, *"I think giving advice and making sure the patient is following this advice is the most important role" (*Participant *14).*

Another approach was for increased the emphasis on natural and home remedies in situations in which there was no serious need for antibiotics.

"They [pharmacists] should give alternative treatments. For example, natural treatments. If the case did not need antibiotics it can hold on medication other than antibiotics, they should recommend other medications. But if the case was severe and the only way to solve it is antibiotics then okay. (Participant 15)"

"Pharmacists and doctors instead of prescribing antibiotics from the first appointment, they could go to much more home remedies, stuff away from those chemicals" (Participant 9)

The recommendation raised by the above participants regarding the use of alternative medicine for self-management of common symptom was attractive for the researcher as this was consistent with WHO recommendations and therefore it will be integrated in the development of the educational intervention.

Interestingly, very few participants were more creative to suggest that information should be available in poster or flyer form in the pharmacies. By using this approach, pharmacists will not need to devote more time of educating consumers and it will be the responsibility of consumer to read and educate themselves. The quote below illustrates more about this tactic.

"On the door of each pharmacy, if you would have like a poster of the questions that you should ask and the things you should know, it would actually, help a lot. And especially since antibiotics are used very, very commonly and are mostly … and are usually prescribed, this knowledge should be known. So, if you'd have it at the door of each pharmacy it would help". (Participant 3)

5.4.2.5.2. Role of physicians in reducing resistance

In determining culpability for the spread of antibiotic resistance, all participants agreed that physicians tend to overprescribe antibiotics. Quotes extracted below show the common perception among most participants.

"Some doctors the first option they have is an antibiotic. If you have fever and all that, just take an antibiotic. You will never get better if you don't take an antibiotic. That is how they think, and the worst thing is that the patients actually believe them because they go oh he is a doctor so he knows better than us" (Participant 1)

"Yes, I do believe they [physicians] do over prescribe antibiotics. Because I've went on multiple occasions to doctors for completely different things and they would always prescribe me with antibiotics."

(Participant 5)

"I do think some doctors do [over prescribing] because this is the first step for healing the patients. So, they give it [antibiotics] and because they don't have time, they want to see other patients; they just give antibiotics for a while to see what will be the process, if the patients better. They over use, they give more than enough, so to make sure that the patient is gonna heal."

(Participant 6)

Participants were interviewed further to determine if they thought that physicians were over-prescribing antibiotics and what will be the consequences of this practice. Interviews showed that financial benefits were one of the influences.

"I: Do you think doctors over prescribe antibiotic these days?

P: I think, yes, they do.

I: Why?

P: In order, to sell more medicine for patients, to increase the salary, like the income of the hospital or the institute.

I: What do you think will be the outcome of this over prescribing?

P: If, I think prescribing could cause major health issues who … addiction could happen to the patients, people would ask more for antibiotics, people could not finish the course and build the immune system deficiency or something. That could. Yeah." (Participant 7)

Some participants noted that patient's satisfaction was another reason that may influence physicians to over-prescribe antibiotics.. This observation points to a potential miscommunication between patients and physicians. Nonetheless, this issue has practical implication that should be incorporated within any training program aiming at reducing over-prescription behaviour in physicians.

"Because it is for the patient satisfaction, they feel like they are not going to feel any better and they insist on having it but they don't know any better because they don't really understand when they need it and when they don't. Most of the time I feel like … for example, my parents they didn't really understand that antibiotics can be bad for you if you don't need them. Whereas I learnt in school so I feel like when you have become educated on that subject you pass on that information, so that is the main reason really." (Participant 4).

Similar to statements made by Participant 13 under theme 2, Participant 4 correctly intuits that some people who do get a medical consultation will be dissatisfied if the physician does not prescribe antibiotics. This may be linked back to the fact that most participants in this study took antibiotics because they felt that their symptoms improved. Although these results may be limited in transferability to the whole population of healthcare students, the results do provide some indications according to which consumers may pressure physicians to prescribe antibiotics.

Then, one of the participants probed further to elaborated on her comment because the researcher was interested in discussing cost-effectiveness belief that was identified from the survey study one as a risk factor for using antibiotics without prescription. Her quote on this topic is illustrated below.

I: Do you think doctors over-prescribe antibiotics?

P: Yes.

I: Why do they do that do you think?

P: It gives the patient more secure psychological state. It feels like antibiotics is such a big thing, such a big word, so normal people feel like okay that is what is going to help me. I guess business wise antibiotics are pretty expensive so if it satisfies the patients then the doctors might do it.

I: You say that it is expensive and it will satisfy the patient, do you mean that the cost signals high quality?

P: No, no. I mean if you buy it from the hospital pharmacy that gives profit for the hospital and considering the patients want it so the doctors will give it to them.

I: What do you think will be the outcome of this over-prescribing?

*P:	Well humans are going to be more immune to antibiotics, so there will be more disease overall since antibiotics won't be that effective. Or we are going to start needing to prescribe heavier antibiotics in which you will be damaging more in ourselves." (Participant 2).*

Using antibiotics as an effective strategy to cure symptoms quickly was also a reason identified from the interviews for making physicians over prescribe antibiotics. This aspect was underlined by a few participants.

*I:	Do you think doctors over-prescribe antibiotics these days?*

*P:	Actually yes I think they do.*

*I:	Why?*

*P:	Because they think that it is the easiest way. Probably not the cheapest but the easiest way. It could be effective in a short time.*

*I:	What do you mean by the easiest way?*

*P:	Easiest way to get cured. It is effective in the short term but then it could develop other consequences over a long period of time.*

*I:	Like what?*

*P:	For example, some people –could develop antibiotic resistance, which is a great problem. (Participant 9).*

Time constraints and the potential incompetency of physicians, were other reasons indicated by very few participants for over-prescribing.

*I:	Do you think doctors over prescribe antibiotic?*

*P:	I do think some doctors do because this is the first step for healing the patients. So, they give it and because they don't have time, they want to see other patients; they just give antibiotics for a while to see what will be the process, if the patients better. They over use, they give more than enough, so to make sure that the patient is gonna heal.*

*I:	Why do you think they do this?*

*P:	As long, as I know, maybe some of them are not professional. They don't have any other drugs or better medications in their mind and they don't know about it. So, they give antibiotics as their first option.*

(Participant 6).

When participants probed further and specifically about the role of doctors in tackling the problem of misusing antibiotics, many participants indicated that they should stop over-prescribing antibiotics.

"I: What role can doctors play in reducing antibiotic resistance, if any?

P: I think they should stop giving it out for no reason or when it is not necessary. And they should advice people that when it is needed to take the full course, that is the most important two points."

(Participant 11).

"Doctors should take more care once prescribing the medicines. Making sure that is the last resort; you have tried resting and all of that, and giving it time. Then antibiotics was the last resort" (Participant 2).

In discussing actions that could be taken by physicians aside from more conservative prescription approaches, a common response was maintaining a strong level of patient communication.

"I think it is all about focusing on the patient himself. There has to be strict controls. There has to be a patient doctor communication and the doctor must be strict with him and tell him to continue with it all the time, non-stop, until the course is finished. It is about control." (Participant 10).

"I feel like doctors shouldn't feel pressured to prescribe antibiotics to patients and that instead of feeling pressured or forced to give them antibiotics they should educate them. I think that plays the more important role because a doctor is in a more superior position, he is more knowledgeable. So they should be more assertive and educating the patient and saying no, this antibiotic isn't going to help you for this purpose. And actually that is one way of educating that patient, and then that patient can tell other patients and their family and their friends, and that is how it gradually gets spread out" (Participant 4)

"I think giving advice and making sure the patient is following this advice is the most important role" (Participant 14).

Not only did the participants show a general pattern of focusing on enhancing physician-patient communication, but some specifically mentioned that physicians should be strict with patients in assuring that they complete the full course of the antibiotics. The quote below demonstrates an example of this perception provided by a participant.

"I think it is all about focusing on the patient himself. There has to be strict controls. There has to be a patient doctor communication and the doctor must be strict with him and tell him to continue with it all the time, non-stop, until the course is finished. It is about control" (Participant 10).

Aside from finishing the course of the antibiotic, several participants also suggested that physicians should educate patients about the function of antibiotics and antibiotic resistance specifically.

"Doctors should say more information about antibiotics because actually when I went to the doctor I didn't know what is the antibiotic resistance so I didn't get a note that if I stay taking antibiotics my body will be resistant for it" (Participant 13).

Fear of side-effect and bacterial resistant were other approaches suggested by a participant for enhancing the physician's role in the prevention of antibiotic resistance.

"The doctor can tell them more about the side effects and how it can be harmful and they can tell them more about the resistance from the bacteria…….. If they include the side effects while they are describing the antibiotic it will definitely make people re-think the fact about taking antibiotics, self-medicating with the antibiotics."

(Participant 1)

Lastly, few participants recommended that physicians should emphasize more alternatives to antibiotics, such as home remedies, when antibiotics were not absolutely necessary.

"They [physicians] can replace it with another medicine, another … not always they prescribe antibiotic." (Participant 12)

"Actually they do play a big role. For example, pharmacists and doctors instead of prescribing antibiotics from the first appointment, they could go to much more home remedies, stuff away from those chemicals."

(Participant 9)

5.4.2.5.3. Macro vs. Micro Levels of Influence

Participants were asked to indicate whether spreading awareness of and encouraging the elimination of antibiotic resistance would be more effectively pursued on a macro level. This approach encompassed the government and the public sector. The other option was to pursue this issue on a micro level, by engaging physicians and pharmacists on an individual basis. On this topic, five participants believed that this initiative would be best pursued on a macro level.

"I think Ministry of Health has, like the biggest role in this. Because pharmacists could. Like they are working in a pharmacy, so, they just care about their salaries. They don't care … they don't really, care about people's health. So, the Ministry of Health is responsible … is more responsible for this issue". (Participant 7).

"It should be considered on high level so that the Ministry of Health has a control over the antibiotic doses and the amounts people are taking yearly. And they are using it for the right infections or they are just misusing it for anything they feel and pharmacists should also be monitored by the ministries. And doctors should also be advised and told to prescribe less."

(Participant 9).

"Firstly we will target the higher level and then the pharmacy. They (ministry of health) should put laws and all that" (Participant 1)

"I think yeah, high level of policy level. Policy maker" (Participant 8)

"I think it should be on a higher level because it is very important that people do not overuse antibiotics" (Participant 3)

Three other participants indicated that, while influence on a macro level was a necessary starting point, micro level actions were also necessary.

“The Minister of Health. They have, to, for example, make it mandatory for the pharmacies to ask for a prescription for antibiotics. This should be the first step. And the second step, is the pharmacy itself. They have, to mention for them and they have, to insist on not giving antibiotics like easily. They have, to at least advise the patients when they go to the pharmacy in, order to avoid this antibiotic misuse. But in low levels it’s so hard to control it, so I think the first step should start from the high levels” (Participant 6)

“It needs to be both I feel because you need the higher level laws because that is the only way people will actually follow those laws. Essentially those high levels are going to control the lower level people, so the pharmacists they have to comply with those laws as well. And then that is going to make patients comply to that as well. But when doctors have an option to give antibiotics because the patient wants it, that is not really an effective solution”

(Participant 4).

Overall, many participants also indicated that a combination of both levels are important because government and macro influence would be largely ineffective in preventing antibiotic resistance, and that the effort was better pursued on a micro level. Ultimately, however, the consensus was that both levels of influence were necessary for a comprehensive campaign against the use of antibiotics without prescription and resistance. In all, eight participants mentioned that both levels were crucial in having an impact on the levels of antibiotic resistance and the use of antibiotics without prescription.

“Of course it has to be a combination because the Ministry of Health has to communicate with the pharmacists because they are the ones dealing with the patients themselves, they contact the majority of society and the Ministries are just giving the guidelines. But pharmacists have to receive it and apply it with the patients. Not everyone follows what the Ministry says unfortunately. But with the pharmacists there is a direct contact with society.” (Participant 10)

“I: Overall do you feel that the emphasis on tackling the problem of antibiotic misuse should be upon high level policy change like the Ministry of Health or low level within pharmacies or a combination of both?

P: A combination of both I believe.

I: How, would you explain?

P: For example, health wise … I mentioned before in the previous question, the doctors shouldn't over prescribe antibiotics depending on the case.

I: But for the Ministry of Health, what should they do?

P: For example, they should hold some lectures for the students, not only the students but in general for the people, do some awareness campaigns.

I: And what about pharmacists, what can they do?

P: Give some advice as to the patients that come. For example, I'm one of the people if I don't have time to go to the doctor I will go to the pharmacist, give him my symptoms and I would ask him to give me antibiotics. And he will give me a type of antibiotics, he will tell me to take two pills every five hours, for example. They should stop that I believe." (Participant 15)

"It is a combination of both [macro and micro levels] because both should give the person the idea of what they are taking because actually the patient just takes it to get cured, they don't care about what is the medicine or what they are taking, they just want to be cured. So we should be led by the pharmacists and the medical ministry to know what is antibiotics or what the medicine we are taking is."

(Participant 13)

"I think it should be a combination of both because if it comes only from the pharmacist people might not take it very seriously. But if both of them cooperate in raising awareness to antibiotics it is going to be taken very seriously by people."

(Participant 14)

In contrast to the above, one participant only stated that emphasis on tackling the problem of the use of antibiotics without prescription should be at pharmacists' level rather than at ministry level. However, when probed further, she appeared to be confusing physicians with pharmacists as she thought that pharmacists, like physicians and some nurses, can prescribe antibiotics.

"I: Overall do you feel that the emphasis on tackling the problem of antibiotic misuse should be on high level such as policy change by the Ministry of

Health or local level within pharmacies or a combination of both approaches and using other approaches?

P: I don't think it will … not at that level.

I: Which level, Ministry of Health or pharmacies?

P: Qualified pharmacists.

I: Do we need a qualified pharmacist to tackle the problem?

P: Yes.

I: Why a qualified pharmacist, what will they do?

P: They will prescribe another medicine instead of antibiotics." (Participant 12) [Nodding her head]

Some participants considered that school action could be carried out at a micro-level in order to reduce antibiotic use. They mentioned the use of video and print materials that could be employed to raise awareness over the use of antibiotics without prescription and its risks. Although the implications of educational institutions have been discussed by students, they did not specifically indicate that their university could use specially designed programmes to reduce antibiotic use among students. One participant argues that posers could be used within the University and on the University website mostly to incite fear of using antibiotics. However, as demonstrated throughout the analysis of the identified themes, students that were already aware of the potential dangers that antibiotics hold for humans, still used them.

None of the participants indicated that their University could intervene for implementing long-standing educational programmes or raising awareness on use of antibiotics without prescription. Furthermore, none of the students indicated that their curriculum could be improved with antibiotic education. It may be presumed that such suggestions have not been made because students were already feeling confident in their skills to use antibiotics correctly, albeit as demonstrated through their statements, this was not the case. Furthermore, although inciting fear of antibiotic use was one of the proposed solutions, because students felt that they are knowledgeable, they also did not believe that they could be misusing antibiotics.

The results are presented, based on the thematic categories and specific subthemes revealed from the analysis, and supported with textual examples taken directly from the interview data. Themes are on occasion illustrated with extracts from the interviews. For quotations, a unique identification number was given to each participant (e.g. Participant1). Based on the themes that emerged from the interviews, the main sub-themes that will be targeted in study three are:

- Previous experience for repetitive or familiar symptoms from theme one;

- Urgency of situation and financial reasons derived from reasons for Self-Medication theme;

- Leftover antibiotics-subtheme from access to antibiotics without a prescription theme three;

- Knowledge about indications of antibiotics and antibiotic resistance as well as Attitude towards completing the course of antibiotics subthemes of theme four;

Responses from the participants made the researcher aware of topics that should be considered when creating and developing the intervention in study three. Interestingly, the main message provided by participants' responses was that improvement in knowledge and awareness alone is not sufficient to change the participants' behaviour towards using antibiotics with prescription. Also, behavioural change requires multiple approaches that the researcher should use and achieve a successful intervention in study three.

5.5. Discussion

This qualitative study was set to answer: "What are the factors that contribute to use antibiotics without prescriptions among first-year healthcare students in the UAE and how can these factors be addressed?". Three main objectives have been established in order to reach an answer. The completion of these objectives will be addressed in the subheadings below.

5.5.1. Participants' Knowledge, Attitudes, Experiences and Behaviour in Antibiotic Use

Firstly, this study attempted to explore participants' knowledge, awareness, attitude, belief, experience and behaviour regarding using antibiotics without prescription.

The responders indicated they frequently use antibiotics without a prescription when ill. It was concluded that the responders often resort to self-medication, antibiotics being a common choice. According to Bennadi (2014) self-medication refers to taking a broad spectrum of remedies (including drugs, home remedies or herbs) without consulting a physician, in order to treat sickness. While making informed decisions regarding one's own health is recommended, Bennadi (2014) explains that some medications, antibiotics included, should not be taken without a physician's recommendation. This statement is also supported by Hersh, Jackson and Hicks (2013) and Karim (2017) who explain there is a diagnosis process that should determine whether an infection is viral (no antibiotics are necessary) or bacterial (the correct treatment involves antibiotics).

The responders were also probed for their habits in selecting antibiotics as a preferred drug in self-medication. The findings suggested students often rely on previous recommendations from doctors for similar symptoms, or the pharmacist's advice, some of them claiming they take whatever is available in the house from family members or past illnesses. Moreover, three of the participants believed the courses they have taken make them more prepared to make a decision regarding self-medication with antibiotics. A similar analysis of self-medication patterns in healthcare students was conducted by Pandya et al (2013), who carried out a cross-sectional study using a sample comprised of students at the NHL Municipal Medical College, Ahmedabad, India. Their results indicated that out of the 685 responders, 82.3% reported self-medication for symptoms such as fever, headaches, or respiratory tract infections. Moreover, Pandya et al (2013) found that self-medication is prevalent among the urban and educated population and that confidence and habits change with time and with the advancement of knowledge. The perception of superiority in knowledge observed in this study is consistent with the findings of Pandya et al (2013), suggesting that the more knowledge students gain, the more prepared to correctly self-medicate they feel. However, there is a significant gap between the perception of knowledge and actual knowledge concerning the correct use of antibiotics.

Similarly, Sharif et al (2012) found that despite inadequate knowledge, the prevalence of self-medication is high among students in the UAE. Students who engaged in self-medication also took classes on drugs and diseases and considered they are sufficiently prepared in order to make appropriate medical decisions. These results were obtained using an anonymous questionnaire survey (Sharif et al, 2012), and they indicate that the self-medication habits of students in the UAE are strongly connected to their perceived knowledge. Moreover, Sharif et al (2012) found that one third of the students who use antibiotics without a prescription do so even though they are aware of the risks of antibiotic resistance, suggesting that the improvement in knowledge and education may be insufficient to diminish antibiotic abuse. Sharif et al (2012) argue an intervention to change students' behaviour is also necessary.

Sontakke et al (2011) conducted a comparative cross-sectional study evaluating self-medication practices among first and third-year students and produced similar findings. The increase in knowledge observed among senior healthcare students was correlated with an increased occurrence of self-medication, motivated by the confidence the students had in their ability to make proper medical decisions. Moreover, Sontakke et al (2011) observed that junior healthcare students, who did not have any education about disease and medication, also took antibiotics and other medication without prescription, based on their previous experience, or information they obtained online.

A cross-sectional study (Patil et al, 2014) conducted in India also indicates that 88.18% of undergraduate students practiced self-medication, most commonly (63.91%) using antibiotics for colds and coughs. Out of the students using antibiotics, only 37.1% completed the full course. This indicates that antibiotics are mostly used incorrectly amongst university students. Similar evidence regarding the self-medication habits of healthcare students was extracted from this study, as many responders claimed they only took the antibiotic for a day or two, until the symptoms disappeared. The results of these studies can be considered reliable as the authors'' reached these conclusions through appropriate, quantitative data collection and analysis methods.

In the present study, participants often quoted that they felt better the next day after taking antibiotics. This type of experience resulted in them using antibiotics whenever they had the flu just to avoid the symptoms in order to be able to attend classes. Research (Barrett et al., 2011) indicates that this may be a placebo effect driven by the fact that users know that antibiotics are potent and therefore must make them feel better. Education related to the actual effect of antibiotics and to potential remedies that do not involve taking antibiotics, could possibly reduce this effect.

Conclusively, although the present study used a limited sample size and selected this sample via purposive strategies, the results seem to be transferable to other student populations, especially healthcare students. As noted by the aforementioned literature, and as observed in the present study, when students become overconfident in their knowledge and skill, they are also more likely to engage in irrational use of medication including in using antibiotics without prescriptions.

While participants did not realise their actual level of knowledge and skill, the responders argued that their main reasons for self-medication using antibiotics are either the effectiveness antibiotics previously had in treating similar symptoms, the fact that they are saving time by not seeing a physician, urgency of use, financial reasons, or the encouragement they received from friends and family regarding antibiotic treatment.

These findings are in line with the literature regarding antibiotics as a preferred self-medication solution (Khalil et al, 2013). In Saudi Arabia, the non-prescription sale of antibiotics has become a routine practice, as argued by Khalil et al (2013) who found that 80% of the patients taking medication for their dental problems have taken antibiotics without a prescription, 72.9% of them claiming they decided to take this medicine as a consequence of a friend's advice. A similar finding was made by Al Rasheed (2016) who also indicated advice from friends as the most common predictor of self-prescribing of antibiotics in Saudi Arabia. Similarly, Sharif and Sharif (2013) also found that most people taking non-prescription antibiotics for common symptoms (such as a cold or dental problems) in the UAE have done so at the advice of a friend or a relative. The study of Khalil et al (2013) is relevant due to the large sample (987 patients) out of which 793 (80%) took medicine for their dental issues. The percentage of people taking antibiotics at the advice of friends and family or based on previous experiences with similar symptoms can be considered a matter of concern, because the use of antibiotics without prescription is the main cause of antibiotic resistance (WHO, 2015).

The literature offers more evidence on the prevalence of antibiotic use without prescription in Middle Eastern countries. For example, a systematic review study analysing self-medication trends among adolescents over multiple countries (Shehnaz, Agarwal and Khan, 2014) suggests that the prevalence of self-medication is higher in the UAE (89.2%) in comparison with the USA (36%) or Canada (5.9%), the numbers varying slightly depending on age, gender and education. This, together with the arguments made by the responders to the interviews concerning their use of antibiotics without prescription, indicates self-medication with antibiotics is prevalent in the UAE and the Middle East. This is also supported by other literature (Khalil et al, 2013; Sharif and Sharif, 2013; Al Rasheed, 2016). Moreover, Shehnaz et al (2013) also observed similar antibiotic use habits among high school students in the UAE, which adds further evidence supporting the existence of the use of antibiotics without prescription in the UAE. In addition, these studies (Khalil et al, 2013; Sharif and Sharif, 2013; Al Rasheed, 2016; Shehnaz et al, 2013) reported similar reasons for self-medication, such as the lack of time to see a physician, higher convenience of using medicine already available in the household or saving money on doctor visits.

Another reason for resorting to self-medication, as highlighted by the responders, was lack of time. Due to the fact they were unable to find time to visit a specialist during normal business hours, due to class and study schedules, students claimed they preferred to take antibiotics without a prescription. Although some observational studies (Nawafleh et al., 2016; Pan et al., 2012) did not report lack of time as a prevalent factor for self-medication, others (Zafar et al., 2008; Muhammad Paras Javed, 2013) found that students often consider previous experience with similar symptoms and the lack of time to visit a physician as being their main reasons for self-medication, antibiotics being the most common choice. While all four aforementioned studies used quantitative designs to produce reliable results, Nawafleh et al. (2016) and Pan et al. (2012) did not consider lack of time as a variable in their studies, which explains the differences in findings between the four studies. Moreover, Muhammad Paras Javed (2013) found that the lack of time occurs also in relation to the urgency of use. The current study found a similar result, as one of the responders argued she often self-medicated with antibiotics because she cannot visit a doctor (physician) at night when she gets a fever.

A small number of responders argued they had a financial reason for self-medication, as it was less expensive than visiting a physician and buying prescription medication. Ocan et al., (2015) observed that antimicrobial self-medication was common in low and middle-income countries. The reason for this prevalence, as explained by Ocan et al (2015), is the limitation of financial resources that occurs in these countries. Ocan et al.'s (2015) systematic review looked at the results of 34 studies with 31,340 participants in total, the overall prevalence of antibiotic self-medication being 38.8%. The results can be considered reliable, as the data were analysed using a random effects meta-analysis. This is a statistical model that synthesises quantitative data from related studies obtaining a summary estimate of a certain variable. Through this method, the sample size is ampler.

Nevertheless, a report from the UAE National Bureau of Statistics (2010) placed the UAE among high-income countries, showing how the country has experienced considerable economic and social improvement since the unification of the Emirates in 1972. Despite the economic growth shown by UAE statistics, however, Tong and Al Awad (2014) demonstrated there are significant wage inequalities in the labour market in the UAE, which cause major financial inequalities among the population. Tong and Al Awad (2014) reached this conclusion by performing a statistical analysis of the information obtained from the Wage Protection System and Administrative Database of the UAE. The conclusion reached by Tong and Al Awad (2014) is more reliable than the statistical report from the UAE National Bureau of Statistics (2010), as the report only focuses on GDP growth, without observing the large income gaps in the labour market.

The thematic analysis also revealed that students in the UAE can access over the counter antibiotics easily, without a specialist's prescription. The most common sources for obtaining antibiotics, according to the responders, were leftovers from previous treatments, friends or family, or pharmacies. These findings are consistent with the literature, as a systematic review (Alhomoud et al., 2017) indicates the same sources in multiple cases of self-medication in the Middle Eastern region. Among the most commonly used antibiotics was penicillin, and it was used for upper respiratory tract infections (Alhomoud et al., 2017). Inappropriate behaviour, such as using antibiotics for conditions that did not require antimicrobial treatment, using the antibiotic for more or fewer days than the recommended treatment period, sharing antibiotics with friends or family, or storing them improperly was observed by Alhomoud et al. (2017). Other studies report similar findings. These are discussed below.

A cross-sectional survey (Konozy et al., 2015) revealed that out of the total of 363 responders taking antibiotics for common symptoms (respiratory problems, dental problems) without a prescription, 43% were non-healthcare students and 57% were healthcare students. Out of the healthcare students, approximately 14% did not complete a course on antibiotics. Thus, the cross-sectional study conducted by Konozy et al (2015) indicates that the decision of using antibiotics for particular symptoms is not medically justifiable. Another cross-sectional study (Shah et al., 2014) also indicated that 47.6% of the participants showed they used over the counter antibiotics which they obtained from various sources (e.g. leftovers from previous treatments, friends, family, or pharmacies), 63.1% of them having no knowledge of the risks of antibiotic resistance. The sample size for this study (Shah et al., 2014) was sufficiently large, justifying an extrapolation to the general UAE population.

Another cross-sectional comparative study was conducted in 4 national hospitals in the UAE, comparing their prescription procedures to WHO prescribing indicators (Mahmood et al., 2016). The results indicated that in general, the number of drugs per prescription is higher than the prescribing indicators provided by the WHO, which explains why one of the main sources for antibiotics without prescription are leftovers from previous treatments. Thus, while antibiotics were prescribed at a certain moment, their subsequent use for similar symptoms by the recipient of the prescription, member of their family or friends is an indication of the use of antibiotics without prescription.

A national household survey conducted in Oman (ECDC/EMEA, 2009, p.31) indicated that people often keep leftover drugs from previous treatments and use them if similar symptoms occur again, or give them to friends or family who have those symptoms. The findings of this survey are consistent with the findings of the interview analysis conducted in this study, indicating the fact that antibiotic overuse without medical justification is an issue prevalent in Middle Eastern countries, a fact supported by other studies concerning this region (Emeka, Al-Omar and Khan, 2014). Furthermore, studies also pointed to community pharmacies as a common source for over the counter antibiotics (Abu-Helalah et al., 2015).

Emeka, Al Omar and Khan (2014) conducted a cross-sectional survey in Saudi Arabia, revealing that 72.8% of the responders use antibiotics for mild illnesses, such as fever, colds and coughs. Moreover, 4.5% of the responders also indicated they were periodically using antibiotics to prevent illness. This is a major indicator of irrational use in Saudi Arabia. While the current study did not reveal information that would indicate the use of antibiotics to prevent illness, the results found by Emeka, Al-Omar and Khan (2014) are comparable to the findings of the current study, as they express the irrational use of antibiotics in the Middle Eastern region.

As the study found that the main sources for accessing antibiotics without a prescription are pharmacies, family member or own sources (leftover antibiotics), and one of the responders indicated his father brings antibiotics from the hospital where he works as an ophthalmologist, there may be an indication of poor drug management in hospitals in the UAE. While the legislation in the UAE restricts and controls the use and prescription of certain types of drugs, such as psychotropic drugs (GAHS, 2007), the literature does not provide sufficient evidence to indicate the existence of any policies concerning the management of drugs within hospitals, aimed at preventing drug misuse as described by the participant.

Considering that the results obtained in this study are in line with the findings of the aforementioned literature, it can be argued that the data obtained by this research is generalizable not only to student populations but also to Middle-eastern populations. This further indicates that this region has an overall faulty system for antibiotic use, which allows members of the general public purchase and use antibiotics without a prescription.

Another manner in which the participants access antibiotics without prescription is through friends and family. Nevertheless, Sharif et al (2015) found that parents do not always make informed decisions concerning the use of antibiotics. Using a questionnaire study, Sharif et al (2015) demonstrated that despite the fact that the majority of the responders were well-educated (92.7%), the family's monthly income ranged from moderate to high and 23.7% were either working in the medical field or had medical education, antibiotics were given to children in viral conditions and the parents demonstrated a poor knowledge regarding antibiotic resistance. It was also found that the decision to use antibiotics depended on previous experience with similar symptoms, the most commonly used drug being amoxicillin for conditions such as sore throat, flu and nasal congestion. In addition, Sharif et al (2015) found that parents procured antibiotics from the pharmacy and their choice of medicine was influenced by the pharmacist's advice.

As previously stated, pharmacies in the UAE often sell antibiotics without asking for a prescription. The responders indicated that on multiple occasions they procured their antibiotics from local pharmacies. As far as their choice of antibiotic was concerned, some of the responders indicated they took what the pharmacist recommended. This indicates a certain level of trust in relation to the pharmacist. A similar observation was made by Hasan et al (2016), who argued that this trust is an opportunity to contribute to the reduction of the use of antibiotics without prescription. Hasan et al (2016) found, similarly to this study, that people prefer visiting a pharmacy and getting antibiotics because it is more convenient and less time consuming than visiting a doctor. The approach taken by Hasan et al (2016) to the study is similar to this research, as they used in-depth semi-structured interviews to evaluate the attitudes people have towards self-medication. For the purpose of determining attitudes and experiences relating to a certain topic, a qualitative design is more valuable than a quantitative method, as it allows for a greater insight into the matter. During a qualitative interview, similar to the one designed by Hasan et al (2016) and similar to the one used in the current study, the interviewer can create a connection between themselves and the participant, determining the participant to reveal more information.

The responders also demonstrated the existence of significant gaps in their knowledge regarding antibiotic necessity and antibiotic resistance. As previously mentioned, the literature (Shah et al., 2014) shows that a high number of students who rely on self-medication using antibiotics are unaware of the significance and risks of bacterial resistance to antibiotics. The cross-sectional study conducted by Shah et al (2014) involved six universities in Karachi, Pakistan. Results obtained by the study carried out by Shah et al (2014) are similar to results obtained in this study due to the the depth of the analysis and the location of the study. Moreover, the responders also demonstrated a poor knowledge regarding which symptoms require antibiotic treatment and the difference between bacterial and viral infections, believing that antibiotics were for common colds, fever and joint pains. The findings are in line with the literature. Several studies (McNulty et al., 2013; Cals et al., 2007; Elagib et al., 2016) have shown that patients often expect a treatment using antibiotics for upper respiratory tract infections. However, a study conducted by Hersh, Jackson and Hicks (2013) demonstrates that the majority of upper respiratory tract infections are caused by viruses and a treatment using antibiotics is ineffective in these situations. Bacterial upper respiratory tract infections are limited to streptococcal pharyngitis, acute otitis media or acute bacterial sinusitis, and can be identified through symptoms such as purulent nasal discharge, daytime cough, high fever (a temperature higher than 39°C) that continue for more than 3 days and are unresponsive to antiviral treatments, according to Hersh, Jackson and Hicks (2013), which demonstrates that the perceived utility of antibiotics in any upper respiratory tract infections is incorrect.

Moreover, only one participant to the study was able to correctly indicate what antibiotic resistance was, the majority mentioning they have heard about it but were unsure of the implications. Their responses indicated they perceived antibiotic resistance as a change in the human body, not in the bacteria, as the body becomes resistant to the effect of the antibiotic. The literature demonstrates a similar confusion among patients in relation to antibiotic resistance (Gaarslev, et al., 2016; Brookes-Howell et al., 2012; McNulty et al., 2013), as participants often believe resistance can be defined as a decreased responsiveness of the body to the antibiotic treatment. McNulty et al. (2013) argue that some patients believe they can resolve the resistance by changing the antibiotic used.

In contrast, other studies (Sharif et al., 2012; Sharif, and Sharif, 2013) found that students are aware of antibiotic resistance; however, they did not provide the details of this awareness. While this study shows that students are aware of the existence of antibiotic resistance, it also demonstrates the information they possess is either incorrect or incomplete. The aforementioned studies (Sharif et al., 2012; Sharif, and Sharif, 2013) only provide an indication of awareness, without further detail regarding the level of knowledge. A more in-depth analysis of the knowledge and awareness of antibiotic resistance across multiple countries was conducted by the WHO (2015) revealing that although over 70% of the responders have heard of antibiotic resistance, 66% were aware of antibiotic-resistant bacteria and only 21% of the responders knew about anti-microbial resistance. In addition, the majority of responders who were aware of antibiotic resistance were from Mexico (89%) with only 22% from Egypt, which supports previous evidence that Middle Eastern countries are faced with a significant gap in knowledge on this topic.

Moreover, the same survey (WHO, 2015) revealed that an average of 8 in 10 responders in Vietnam, Sudan and South Africa believed antibiotic resistance occurs due to changes in the human body, similarly to the responders from the University of Ajman in the UAE, indicating a problematic gap in knowledge at a global level. Carlet, Pulcini and Piddock (2014) also consider this gap in knowledge as a significant geopolitical issue, stressing the importance of implementing initiatives that aim at raising awareness. Considering the results of this study and the supporting evidence from the literature, the main focus of the educational intervention (study three) is to educate students on the risks of misusing antibiotics.

The interviews revealed that the behaviour of doctors and pharmacists also plays a role in the lack of knowledge. The observations made by the participants are concerning, as they indicated the first option doctors offer are antibiotics, without performing a deeper analysis of the patient’s symptoms with the purpose of determining whether the infection is bacterial or viral. This suggests a lack of knowledge, interest or sufficient skill among physicians, a fact which can also be observed in the literature. A retrospective analysis of 30 consultations in medical facilities in the UAE conducted by various specialists (Karim, 2017) showed that a correct prescription of antibiotics was made in only 21% of the observed cases, which led to the conclusion that there is a common lack of knowledge of appropriate antibiotic prescription among primary care physicians in Dubai. Karim (2017) indicated that doctors often prescribe antibiotics for sore throats despite the fact that the condition can be caused by a number of viruses. While 35% of the sore throats can be caused by the beta-hemolytic streptococcus, which is a common bacteria, others can be caused by the Ebstein-Barr virus (Karim, 2017). Sore throats caused by bacteria can be assessed using the Centor score, allocating one point for tonsillar exudates, the absence of cough, a history of fever and tender anterior cervical lymph nodes (Karim, 2017). A score of 4 indicates a bacterial infection, while score of one or zero suggests the cause is not bacterial and an antibiotic treatment is unnecessary. Karim (2017) observed that the majority of the doctors observed did not use the Centor score for their diagnosis. While there are certain limitations to Karim's study (2017), the results remain a reason for concern and indicate the necessity of further evaluating the reasons UAE doctors have for incorrectly prescribing antibiotics.

Another concerning observation resulting from the interview analysis is that this lack of knowledge is transmitted to the new generations of physicians, who rely on similar principles regarding antibiotic use. These are reflected in their self-medication habits. A similar observation was made by Shehnaz et al (2015) who found a high prevalence of the use of antibiotics without prescription among healthcare students at the Gulf Medical University in the UAE, self-medication being practiced by 65% of the students. These results indicate a need for educating students into practicing responsible self-medication, Shehnaz et al (2015) suggesting that the curriculum in UAE medical universities should emphasis rational drug use. Similarly to this study, Shehnaz et al (2015) also found that often students believe that because of the courses they took, they are sufficiently prepared to make a medically accurate decision about using antibiotics.

5.5.2. The Role of Healthcare practitioners in tackling antibiotic use

The second objective of this study focused on exploring participants' opinions about the role of healthcare professionals in tackling the problem of the use of antibiotics without prescription and the potential role that the university might play in raising students' awareness about the risks attributed to use of antibiotics without prescriptions.

From the interviews, it could be determined that the pharmacists also contribute to the lack of knowledge through their behaviour. Currently, as indicated by the participants to this study, pharmacists release antibiotics without asking for a prescription (Participant 6 emphasises the pharmacists' error in this situation, arguing the pharmacist should ask for a prescription) and offer little information about possible side effects and appropriateness of use. Moreover, participant 9 argues that pharmacists in the UAE do not offer treatment alternatives, prescribing antibiotics from the first appointment and overlooking home remedies. Yeboah and Yeboah (2014) have made a similar observation, as their study shows that pharmacists in the UAE often release over the counter prescription medication, antibiotics in particular. While authorities believe the issue occurs due to poor law enforcement, the study (Yeboah and Yeboah, 2014) indicates that there is an additional ethical component to selling over the counter prescription medication. Also, Yeboah and Yeboah (2014) indicate the problem is endemic to the UAE, such lack of professional ethics not being encountered in other countries. Nevertheless, Cooper (2011) and Van Hout and Norman (2015) contradict Yeboah and Yeboah (2014), bringing evidence that similar issues are encountered in other countries as well. Furthermore, other studies conducted in the past three years indicate a similar problem with the incorrect use of antibiotics in countries such as China (Lv et al, 2014), Portugal (Ramalhinho et al, 2014), Uganda (Ocan et al, 2014), or Lithuania (Pavyde et al, 2015). All these studies relied on quantitative methodologies (cross-sectional surveys) with large numbers of participants. This evidence is significant to this study, as it indicates other countries also have a problem with the use of antibiotics without prescription, but some have managed to reduce the over the counter sale of prescription medication over time. Taking this fact into account, policies in the UAE could be amended following similar management techniques.

Based on the results obtained in this study, as well as on the aforementioned literature, it can be argued that the data extracted from participants is valid. In this case, it can be concluded that pharmacists do contribute to the propagation of use of antibiotics without a prescription.

Physicians were considered from various perspectives. Firstly, some participants believed that if they were to get a medical examination for their condition, the physician would not prescribe antibiotics and therefore they would have just wasted time. Secondly, some participants considered that physicians would prescribe antibiotics anyway and therefore getting a medical exam for a prescription would be just a waste of time. Finally, other participants considered that physicians prescribed antibiotics either due to lack of time to provide patients with adequate examinations or due to lack of professionalism. A cross-sectional survey investigating the prescription behaviour of physicians in the UAE (Abduelkarem and Abu-Gharbieh, 2015) noted that physicians do indeed prescribe antibiotics for minor infections that can be treated via different pathways. Reasons for this seemed to be related to the effectiveness of the antibiotic treatment and costs. Although the study is limited in generalisability due to its cross-sectional design, similar notes were made by participants in this study. In another retrospective study carried out in Dubai (Karim, 2017) it was observed that NICE guidelines as related to antibiotic prescription for upper respiratory tract infections were applied in only 30% of the 30 retrospective cases analysed. After implementing a change programme, Karim (2017) found that only a little over 70% of antibiotics were correctly prescribed. This indicates that knowledge and education may not be the only factors that contribute to irrational prescribing. Therefore, it is possible that other factors may contribute to this, including (as extracted from the interviews) pressure from the patient to have antibiotics prescribed, lack of time to provide full consultations and medical assessments and lack of professionalism in relation to upholding the best interest of the patient. This data further points to the fact that results extracted from this study as related to the implications of physicians in prescribing antibiotics are valid. Data, as related to patients' fears of not being prescribed antibiotics, and therefore avoiding visiting the doctor, were not located in the literature.

In relation to the potential implications of the University for minimising the use of antibiotics without prescription, none of the participants in this study considered this as a solution. They did believe that the school could increase awareness over the use of antibiotics without prescription, but did not consider that they should be educated in how to use antibiotics properly. This may be due to the fact that they felt overconfident in their knowledge as related to antibiotic use, and therefore did not see themselves as a risk population for experiencing negative effects of antibiotic use.

5.5.3. Intervention enhancements

The third and final objective of this study sought to gather data that could enhance the creation and development of the educational intervention in study three by providing rich descriptions about the topics that should be covered in the intervention as well as the best approaches to deliver the educational intervention among the target population from participants' own perspectives and views.

The semi-structured interviews had shown substantial misconceptions about the indications for antibiotics as most of the participants used it for an illness that is usually caused by viruses rather than by bacteria. Furthermore, some participants confused antibiotics with painkillers as they usually used antibiotics for curing pain. This study demonstrates that participants had several reasons for using without prescriptions and multiple accesses to antibiotics without prescriptions. Most participants were at least somewhat familiar with the term antibiotic resistance and had some understanding of the phenomenon. Furthermore, the majority of the participants know that using antibiotics without prescription contribute to antibiotic resistance. Attitudes towards completing the course of antibiotics were encouraging among participants.

Based on the themes that emerged from the interviews, the main sub-themes that will be targeted in study three are:

- Previous experience with the use of antibiotics for repetitive or familiar symptoms
- Urgency of situation and financial reasons (derived from reasons for self-medication theme)
- Leftover antibiotics-subtheme from access to antibiotics without a prescription (theme three)
- Limited knowledge about indications of antibiotics and antibiotic resistance as well as attitudes towards completing the course of antibiotics (theme four)

Responses from the participants made the researcher aware of topics that should be addressed while creating and developing the intervention in study three.

Interestingly, the main message provided by participants' responses was that knowledge and awareness alone is not sufficient to change participants' behaviour towards using antibiotics with prescription. Behavioural change requires multiple approaches of which the researcher should be aware in order to get enhance the likelihood of a successful intervention in study three. In total, both the interviews and the main survey study indicated that a desire to save money and an urgent need of use are two factors that contribute to using antibiotics without prescriptions among healthcare students. To the best of our knowledge, no qualitative interview study exploring the knowledge, attitude, belief and experience of university's students towards using antibiotics without prescriptions has been previously performed. However, our findings are broadly consistent with other qualitative study among the public in addition to quantitative surveys among university students.

To summarise, this qualitative study offered a deeper insight into the reasons why students in the UAE use antibiotics without a prescription, their self-medication habits, how they manage to access antibiotics without a prescription and their knowledge gaps concerning antibiotics resistance. The information gathered is further used in constructing the intervention study.

5.6. Recommendations

The aim of the semi-structured interview thematic analysis was to explore the opinions participants concerning the role of the healthcare professionals in approaching the issue of use of antibiotics without prescription. This chapter also addressed the role that the university has in raising students' awareness regarding the use of antibiotics without a prescription. Finally, another scope of this study was to contribute to creating the educational intervention and to determine the proper approach to deliver the intervention. The recommendations listed in this section have been developed based on the results discussed under Theme 5. Data provided by the students is assessed with the scope of being integrated within the intervention to be carried out in study three.

5.6.1. Recommendations for Reducing Antibiotics Misuse

During the interviews, the participants specified a number of approaches that could result in the reduction of the use of antibiotics without prescription, while also indicating the important roles physicians and pharmacists have in attaining this reduction. Fourteen participants indicated that physicians in the UAE would need to approach antibiotics prescriptions with more care, as they tend to overprescribe these medicines. This practice impacts on the patients, who believe antibiotics are a solution for any condition, often using them without a prescription. This results in the development of antibiotic-resistant organisms which lead to severe infections. Furthermore, the thematic analysis revealed that there is a miscommunication between patients and physicians, as physicians feel pressured to prescribe antibiotics. Also, the interview participants agreed that physicians should be more assertive in their relation to the patient, attempting to educate them concerning the use of antibiotics, instead of simply issuing a prescription according to the patient's request. The participants argued that it is recommended that the physician uses his or her knowledge and training to explain to the patient why antibiotics are inefficient in certain situations. The physician can determine if an infection is microbial or viral, explaining to the patient why antibiotics are more effective in bacterial infections, and antiviral drugs are effective in viral infections.

Moreover, the thematic analysis revealed that participants believe pharmacists also play an important role in the reducing use of antibiotics without prescription. Pharmacists are advised not to release antibiotics to clients without a valid medical prescription and use their knowledge and expertise to advise the client on what is more appropriate for their condition, explaining why the use of antibiotics may be ineffective in their condition. Participants also suggested printing informative flyers and leaflets to help better educate the population concerning the misuse of prescription medication, with a specific focus on antibiotics. Also, pharmacists should recommend natural and home remedies in situations where there is no use for antibiotics (a mild cold for example). This recommendation is in line with the WHO (2001) suggestions for reducing antibiotics overuse, as shown in Chapter Three.

Another recommendation stemming from the thematic analysis of the interviews concerns the institutions that should become involved in building awareness regarding the risks of the use of antibiotics without prescription. There was a consensus that actions for spreading awareness should be taken both at the macro (government and the public sector) and the micro level (physicians and pharmacists).

5.6.2. Recommendations for Spreading Awareness Regarding Irrational Antibiotics Use and Resistance

During the semi-structured interviews, the topic of strategies for combating the rise of antibiotic resistance was also approached. As listed under Theme 5, a preference was expressed by participants for using new media to spread awareness. Their suggestions included videos and animation tools, whether they are delivered in the form of online ads or informative videos distributed over social media. Both students and the general public should be targeted by these informative pieces, according to the participants. Still, despite the preference for a technological delivery system for messages aimed at raising awareness regarding antibiotic resistance, participants concluded that delivery via text messages would be ineffective. Participant 1 suggested implementing short ads appearing before YouTube videos for example, as a viable approach to raising awareness. Moreover, participant 1 argued that an informative video where multiple medical terms are used can be difficult to understand and can bore the audience, a solution to this being making the video more entertaining and amusing, by using animated characters for example.

Another recommendation for spreading awareness about the dangers of the use of antibiotics without prescription and resistance, as indicated by the thematic analysis, was advertising on other media. Four participants agreed that advertisements (on television or radio) can also be used in order to raise awareness.

Moreover, participants discussed the importance of school education in reducing the use of antibiotics without prescription. Participant 11 explained that in their personal experience, it was useful to learn about the role of antibiotics during an A level course, as this helped change their perspective on antibiotic use and furthered their understanding the biology behind antibiotic-resistant bacteria. Another participant suggested the implementation of presentations in schools as part of biology courses, teaching the population about the role of antibiotics, the importance of receiving the correct prescription and questions that people should ask physicians and pharmacists before using antibiotics.

Another recommendation was to hold public events and presentations on the theme of antibiotic resistance, or distribute flyers and put up posters in medical units and community pharmacies. It is also significant to take into consideration the recommendation made by participant 9, who made an argument that multiple approaches are needed in order to achieve a higher level of public awareness regarding the use of antibiotics without prescription and antibiotic resistance.

5.6.3. Recommendations Concerning the Involvement of University Stakeholders in Reducing Irrational Antibiotics Use

Participants also discussed the best practices and methods used to inform and train students regarding the use of antibiotics without prescription and antibiotic resistance. Considering the fact that the analysis of semi-structured interviews revealed that in the majority of cases, physicians recommend antibiotics when they are not needed, which happens for reasons varying from patient preference for antibiotics, to lack of proper training, it was therefore deemed necessary to improve the education of healthcare students receive regarding antibiotic-resistant bacteria. The use of video or animation technologies was a recurring recommendation throughout multiple interviews, which suggests that it is the participants' opinion that students may respond easier to humour and visual aids, retaining the information better. Among the advantages identified by the participants in using video media were the fact that the students can have the chance to interact better with the medium, becoming more interested, and that videos can explain medical theory to participants in a more "eye grabbing way" (Participant 15).

While the use of PowerPoint presentations or text messages that would explain the effects of the use of antibiotics without prescription was deemed ineffective by the majority of participants, their recommendation for improving education was to use entertainment and humour in order to deliver the message. The justification for this was that doing sketches or plays that would approach the risks of antibiotics resistance in a humorous manner would appeal more to the students, stimulating their desire to learn.

5.6.4. Recommendations for the Educational Intervention

Finally, the thematic analysis of the semi-structured interviews produced a number of good practice recommendations that were used in the quasi-experimental educational intervention (study three). As the participants all agreed that videos would be the most effective approach to educating students, as entertainment and humour would catch their attention, it was recommended to use entertaining videos in the educational intervention planned for study three.

While fewer participants preferred the PowerPoint presentation as an educational material, some argued that even though students may perceive a PowerPoint presentation as boring or uninteresting, if it has numerous visual aids and less information and if it is accompanied by an effective speech, it could be a useful educational tool. The majority of the participants did not recommend the use of text messages as an educational tool, as they were deemed highly ineffective. This was because students may perceive them as spam or they may not read them in an attentive manner.

The majority of participants recommended that the educational intervention would take place in the form of a lecture accompanied by various visual aids (PowerPoint presentations or videos) during public health activities held at the Ajman University. There are numerous activities organised by this university, such as Breast Cancer Awareness Day, Prostate Cancer Awareness Day and Oral Health Awareness Day, therefore it was recommended to have a similar event for raising student awareness regarding antibiotic resistance and taking antibiotics uncontrollably. Moreover, some of the participants suggested lectures about the rational use of antibiotics could be more appealing to students if they were considered credit hours (i.e. attendance would be mandatory to achieve the credit needed for the semester), a system already applied by the Ajman University.

Other recommendations included using educational posters placed in the university or on the university's website. One of the participants suggested that these posters should raise positive fear in relation to antibiotic resistance. Thus, the message should be built to emphasise the dangers of antibiotic resistance, while also offering the solution to diminish the effects. Positive fear can also be used in campaign held within the university, aiming to accentuate the way each physician recommending unnecessary antibiotics would contribute to the creation of super bacteria, with inherent antibiotic resistance. Raising awareness and inducing a sense of responsibility were valid approaches to be considered in building the educational intervention for study three.

5.7. Strengths and Limitations of the Interview Study

5.7.1. Strengths

This qualitative study provided insight into the students' experience with regard to self-medicating with antibiotics without an appropriate prescription from a physician. In order to understand the motivations for using antibiotics without prescriptions, it was necessary to understand the points of view of those who have engaged in this behaviour. This research is the first research in the UAE or the Gulf region, and therefore it fills a gap in the literature with regard to this phenomenon. Moreover, the interview study identified six new reasons for using antibiotics without prescriptions compared to the main survey study and elaborates more on another reason identified from the survey study (i.e., urgency of use) which cannot be fully explained by a single quantitative study.

5.7.2. Limitations of the Interview Study

The best approach for this study was to conduct follow-up interviews with first-year healthcare participants that already participated in the main survey study. Nevertheless, at the time of conducting the interview study, those first-year participants were in their fourth year of study and they were considered at a lower risk of using antibiotics without prescriptions based on the findings achieved from the main survey study.

Another limitation of this study reflects the qualitative research. Consequently, the transferability of the results obtained from this sample may be limited. In this case, transferability is considered as explained by Smith (2017), by questioning to what extent are the results obtained in this study transferable to other settings. As a result, the knowledge, attitudes, experiences and behaviours of the students in this sample may not be applicable to the whole population of healthcare students. The survey study did demonstrate that not all students use NPD or antibiotics without prescription. Therefore the results in this study clearly do not apply to all medical student populations. Other confounding factors may be considered. Firstly, students will eventually study pharmacology in senior years, which may therefore increase their rational use of antibiotics. Because the current study did not compare the aspects of antibiotic use from first-year students with seniors, it cannot be argued that these behaviours will be maintained. As a result, these behaviours may be changed solely through accumulating medical knowledge over an extended period of time. This aspect thus implies that results may not be transferable to healthcare students in senior college years. Secondly, other students may seek medical consultations if they meet certain demographic criteria, such as being UAE nationals and having a medical insurance. The result's transferability may thus also be limited for this population.

Other limitations associated with this research included the sample size of the study, the selection process, cultural issues and sensitivities regarding revealing socially undesirable behaviours. The purposive selection process resulted in a small sample size of students who were younger than the average students of the university.

Culture sensitivity may also be considered a limitation. Variables relating to the interviewer can have an effect on comfort or discomfort of subjects, affecting participation and results. The fact that the interview was conducted by a male foreigner and not associated with the university may have also had an impact relating to culture and sensitivities to openly and freely speak about their experience of using antibiotics without prescriptions.

Another limitation refers to the fact that socioeconomic status was not captured in the interview or selection process. However, this variable may have had correlations that were relevant to the study, such as family income and its potential association with using antibiotics without a prescription. Cultural issues and sensitivities regarding the reveal of socially undesirable behaviours related to self-prescribing of antibiotics also had an influence on the self-selection of subjects.

The interviewer requested information about citizenship, as well as identifying information that may have decreased the comfort of the participants in answering socially undesirable questions about the self-prescribing of antibiotics without prescription. One example of this potential impact is the fact that only one citizen of the UAE consented to participating in this study.

There are limitations with regard to the validity of the results as there are many barriers to accuracy when using self-reported information regarding socially undesirable behaviours. The face-to-face setting of the interview may also have influenced the behaviour of the respondents owing to the phenomenon of trying to please the researcher.

The nature of semi-structured interviews is that they defy standardisation, which can impact on the ability to assess variables across subjects and interviews. The same questions may be asked in a different way or with a differing focus, resulting in responses that are not recognised as being similar. The capacity of the interviewer is also a major characteristic that affects the interviews and results, and this is dependent on training, background, effort and the extent to which the respondents and the interviewer were able to relate.

5.8. Conclusion

This study provides valuable data on the irrational use of antibiotics. Healthcare students in the UAE are influenced by several factors including parents, friends, successful previous experience and investment of time and money to visit a physician. There is misconception about the use of antibiotics. While many participants reported some knowledge of antibiotic resistance, there was little elaboration on secondary infections or consideration of misdiagnosis among the participants. The finding of the interviews is consistent with the extant literature in that there is a need for conducting an educational intervention among university's students surrounding the self-prescription of antibiotics.

The majority of participants in the interview study indicated that they believed that more public awareness was needed about the danger of self-prescribing and antibiotic resistance. Video and to a lower extent PowerPoint, rather than text messages were the methods of choice when conferring education messages to first-year healthcare students. Participants expressed a desire to see a policy-level change surrounding the prescribing and dispensing of antibiotics. More research is needed to determine the effectiveness of policy change on individual self-prescribing behaviours. Nevertheless, a parallel awareness campaign aimed at training physicians could help address the over-prescribing of antibiotics as perceived by the participants.

5.9. Summary

This study presented a qualitative investigation of self-medication habits of first-year healthcare students in a University within the UAE. A total sample of 15 participants was purposively selected for this study. Some participants in this research also took part in the third intervention study. Semi-structured interviews were developed based on data extracted from the survey investigation. Probing was also used when the topic was deemed important for further exploration. Five main themes were extracted based on the interview transcript analysis. The general conclusions indicate that while first-year healthcare students are aware of the risks associated with antibiotic use, they are also overconfident in their skills for using antibiotics which results in them not consulting a physician for their symptoms. From the descriptions of symptoms provided by participants, it was observed that these participants displayed inappropriate drug selection, inappropriate self-diagnosis, inappropriate dose and inappropriate frequency. Finally, theme five of this study determined potential pathways for addressing the use of antibiotics without prescription among healthcare students. Therefore, this data was used to develop the educational intervention.

Chapter Six: Intervention Study

6.1. Introduction

This chapter presents a quasi-experimental study in which an intervention is developed and tested with the purpose of reducing the irrational use of antibiotics among healthcare students. To determine if the intervention tested had any efficacy, a group comparison test was performed, with a control versus intervention group. Firstly, details of the study design are provided, including sample selection and sample size calculations. Methods of data collection and data analysis are described. The processes involved in the development of the intervention are presented, alongside the conceptual framework used in this study. Elements of academic rigour and study limitations have also been addressed. Finally, the results from this study are presented alongside an analysis and discussion of findings.

6.2. Research Questions

Research Question 1

What are the baseline levels of knowledge, awareness, attitude and practice as related to antibiotic use without prescription in the intervention and control group?

Research Question 2

What is the efficacy of the educational intervention in improving levels of knowledge, awareness, attitude and practice of antibiotic use with prescription (rational use) in the intervention group?

Research Question 3

To what extent do the knowledge, awareness, attitudes and practice of antibiotics use vary in the intervention group with respect to their demographic characteristics?

6.2.1. Objectives

(1) To measure the baseline knowledge, awareness, attitude and practice of the intervention and control groups regarding the use of antibiotics without a prescription

(2) To create, develop and distribute an intervention consisting of educational materials

(3) To measure the efficacy of the intervention by comparatively assessing baseline measures and post-intervention measures of knowledge, awareness, attitude and practice of antibiotic use in the intervention versus control groups.

6.3. Comparison

The respondents were divided into a control group, and an intervention group. A comparison between two groups of students is conducted on the test scores measured with an assessment tool.

As discussed in Chapter One, the use of antibiotic without prescription is used in this thesis to indicate irrational use of medication. This is because of the fact that antibiotic resistance can be caused by inappropriate dosage, inappropriate administration time and inappropriate self-diagnosis (the use of antibiotics for non-bacterial diseases). In this context, the use of antibiotics in self-medication practice is a significant contributor to antibiotic resistance (Bennadi, 2014; p.19; WHO 2001, p.21). Within the UAE, policies regarding antibiotic use do specify that these types of drugs are to be used only based on medical prescriptions. However, these regulations are not enforced, which therefore allows the general public broad access to antibiotics (Yeboah and Yeboah, 2014). At the same time, several studies (Pan et al., 2012; Abbo et al., 2013; Dyar et al., 2014) point to the fact that the use of antibiotics without prescription is more prevalent among healthcare students. Therefore, this is a high-risk population for developing antibiotic resistant bacterial diseases.

Considering these aspects, in the present study, the scope of the intervention was to reduce the use of antibiotics without prescription. As a measure of the intervention's efficacy, the use of antibiotics without prescription is expected to drop in the intervention group after the exposure.

The secondary outcomes measured in this investigation were the scores obtained pre and post-intervention in knowledge, awareness and attitudes. Several studies (Al‑Hussaini et al., 2014; Aljaouni et al., 2015; Sharif and Sharif, 2014; Pan et al., 2012) note that when these elements of cognition are improved through educational intervention, then the use of antibiotics without prescription is decreased. In Chapter Five, the interview study confirmed these domains as related to antibiotic use. As a result, knowledge, awareness and attitudes were assessed pre and post the intervention in order to determine the impact that the intervention had on each of these domains.

The research hypothesis is that, in the intervention group, there will be a significant improvement in the practices, knowledge, awareness and attitudes regarding the use of antibiotics without prescription, compared to the control group. The null hypothesis is that there will be no significant improvement in the practices, knowledge, awareness, and attitudes regarding the use of antibiotics without prescription, compared to the control group.

6.4. Method

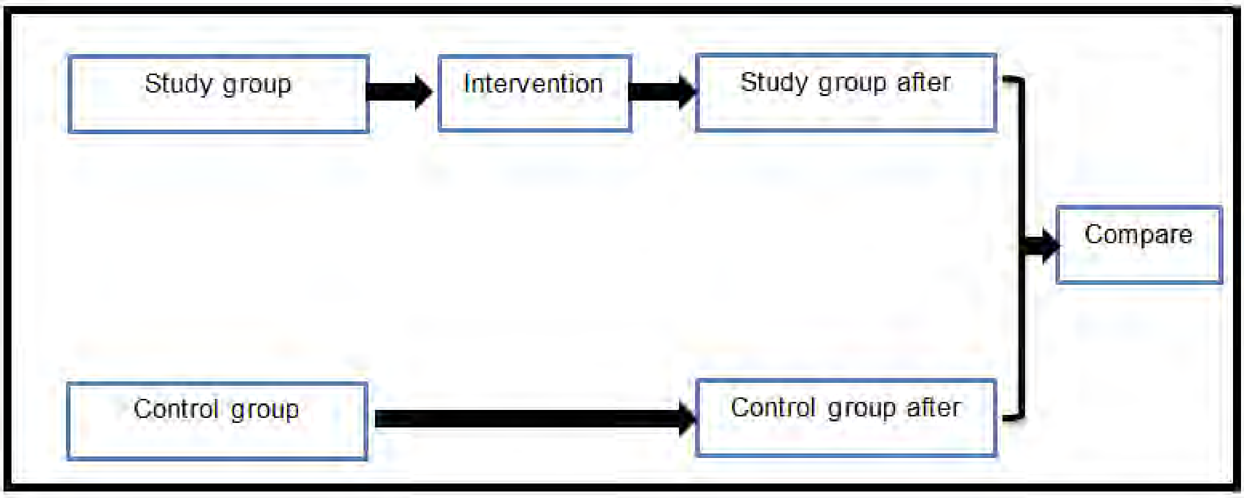
Varkevisser et al., (1993) explain that there are two types of interventional studies: experimental and quasi-experimental. The experimental study design focuses on the random assignment of participants to the intervention or experiment group(s) and the control group, and then measures the effect of the intervention on the outcome variables (problems). In the quasi-experimental study design, either the random allocation of participants into the intervention and the control group(s), or the use of a control group is missing (Varkevisser et al., 1993).

6.4.1. Research Design

Since in this study it was not possible to match participants in both groups, nor to randomly assign participants into both intervention and control groups because of cross-contamination, the quasi-experimental design "pre-test post-test non-equivalent group design" was used (Fraenkel & Wallen, 2010). As explained above, one characteristic of a true experiment that is missing in a quasi-experimental study is the random allocation. Nevertheless, manipulation of the independent variable is always possible, which is achieved in the intervention (Varkevisser et al., 1993).

One of the most commonly used designs of quasi-experimental study is the pre-test post-test non-equivalent group design (Glasper, and Rees, 2016; Fraenkel & Wallen, 2010). In this design, the experimental and control groups are different prior to assigning participants and that difference may have an impact on the outcome of the study (Glasper, and Rees, 2016). Observation of both groups takes place before and after the intervention to measure if the intervention has made any difference to both groups (Glasper, and Rees, 2016) as shown in Figure 6.1.

Figure 6.1 Diagram of a quasi-experimental design with two groups (Varkevisser et al., 1993, p.129)



6.4.2 Population and Sample

Several studies (Simpson et al., 2007; Heaton et al., 2008; Pan et al., 2012; Abbo et al., 2013; Dyar et al., 2014) point to the fact that healthcare students are more inclined to use antibiotics without prescription. The reasons for this type of irrational use are noted by this literature as easy access to antibiotics and medical knowledge. Considering this aspect, a purposive sampling procedure was employed, in which students with a medical background were considered as the sampling population.

Purposive sampling involves the selection of the participants in a study based on specific criteria developed by the researcher (Daymon and Holloway, 2010). The scope of this non-probabilistic sampling technique is not generalisability, as in the case of random sampling, but to focus on a population of interest (Teddlie and Tashakkori, 2009). Considering that the literature indicates that healthcare students are more prone to use antibiotics without prescription, the current study seeks to reduce irrational use in this population. The intervention is thus tested in this group.

In the present study, the main criteria for inclusion relied on a population of healthcare students. Students in other domains were therefore excluded. Sample homogeneity was not assumed. Although these students shared a common characteristic, in that that they are all medical-background students, their demographic characteristics differed. These variations included nationality, age and gender. Because of this, sample heterogeneity was assumed.

A significant limitation of purposive sampling is researcher bias in determining the criteria for inclusion of the study participants and the limited generalisability of result (Teddlie and Tashakkori, 2009). In this study, the criterion for selection has been justified by the literature as previously explained. Therefore, the study sample is comprised of healthcare students because this is a high-risk population for using antibiotics. Another potential bias identified by the researcher in selecting this sample was the probability that some of the students that matched this inclusion criterion may not be using or may have not used antibiotics without prescription. For the purpose of this study, another selection criterion was the usage of antibiotics without prescription. As a result, a pre-screen questionnaire was provided to potential participants to ensure eligibility based on antibiotic use without prescription criterion.

The study site was Ajman University Colleges of Pharmacy and Dentistry in the UAE. The sample consisted of 140 users of antibiotics without prescription, who were enrolled in the College of Dentistry and the College of Pharmacy, Ajman University. The 140 students were divided into a control group and an intervention group, with 70 respondents in each group. A power analysis was conducted to determine if 70 in each group provided sufficient power to detect a mean difference of 25% between the two groups of students in the practice of using antibiotics without prescription. The minimum sample size in each group (*n*) was calculated using the following formula (Charan & Biswas, 2013):

$n = (u + v)^2 \times (\delta_1^2 + \delta_2^2)/(\mu_1 – \mu_0)^2$

Where:

- u = one sided percentage point of the normal distribution corresponding to 100%, minus an acceptable level of power. Using an acceptable level of 80% power (i.e., a probability of 0.8 that a Type II error will not occur) then u = 0.84[292].
- v = two-sided percentage point of the normal distribution corresponding to the two-sided statistical significance level (α). Using the conventional α level = 0.5, then v = 1.96.
- μ_1-μ_0 = difference between the two means of the primary outcome measure across the two groups of students. 25% was the difference between the two

means that was considered to be significant for the purpose of this study. Therefore, $\mu_1 - \mu_0 = 2.5$ (on a scale from 1 to 10).

- δ_1 *and* δ_2 = standard deviations of the primary outcome measure in the two groups. Assuming a moderate effect size (Cohen's d = difference between the two means divided by the pooled standard deviations) of 0.5 (as indicated in previous studies, e.g., Shehadeh et al., 2015). Therefore, the pooled standard deviations for the primary outcome measure in each group was2.5/0.5 = 5.

The calculation to determine the minimum sample size is:

$n = (0.84 + 1.96)^2 \times (5^2 + 5^2)/(2.5)^2 = 392/6.25 = 62.7$ (i.e., 63 in each group)

The calculated sample size was inflated to account for anticipated dropouts. The dropout rate was set at 10%, and this was multiplied by the number of subjects (126 x 0.1) = 12.6. The final sample was 126 + 12.6 = 138.6, which was rounded to 140 (70 in each group).

6.4.3. Inclusion and Exclusion Criteria

The inclusion criteria were any pharmacy and dental students currently enrolled in winter academic semester 2016–2017 who met the English proficiency admission requirements and had used antibiotics without physician's prescription during the last year. Non-healthcare students and non-users of antibiotics without prescription were excluded from the study.

6.4.4. Subject Recruitment and Consent

Participants were recruited from university college campuses (pharmacy and dental) using a brief screening questionnaire to ensure eligibility. An information sheet was used to explain the study and study details were clarified to each invited student. Participants who agreed to take part in the study were recorded as participants. Students who had consented to participate were informed about the study phases and were given detailed study information. The invitation sheet (Appendix 21) about the study and the consent form (Appendix 22) were used for the invited and accepted participants.

6.4.5. Description of the Intervention

The intervention was based on a multifaceted approach. In general, multifaceted approaches are more effective by contrast with approaches based on a single method (Bero et al., 1998). Development of the educational intervention was guided by the findings of the survey study and interview study, baseline assessment of the intervention study and the core components of previous educational interventions (Azevedo et al., 2013; Croft et al., 2007; Lecky et al., 2011; Madle, et al., 2009; Shehadeh et al., 2015; Trepka et al. 2001). Furthermore, the intervention is also guided by recommendations of WHO (2013) and other health campaigns for symptoms management (National Prescribing Service (NPS), 2016).

The components of the intervention focused on:

Medication knowledge about the use of antibiotics that decreases the risk of non-rational use of antibiotics

Previous experience for treating repetitive or familiar symptoms that increases the risk of non-rational use of antibiotics

An emergency theoretically (or actually) requiring the use of antibiotics,

The presence of left-over antibiotics

From both the survey and interview studies, all these factors are recognized as major reasons for the use of antibiotics without prescription among university's students. Consequently, the educational intervention was formulated to teach students the basic difference between bacteria and viruses. Also, it described which illnesses are usually caused by viruses rather than bacteria, explaining that antibiotics are inefficient in treating viral infections. Furthermore, the intervention study focused on certain symptoms — such as fever and pains — that might lead to antibiotic use for an emergency. More sessions were devoted to explaining to students the differences between analgesics and antibacterial drugs and identifying for students which types of pain killers can be used to reduce specific types of pain.

The intervention worked to instruct students on how to treat the most common symptoms that might lead to use of antibiotics without prescription such as the common cold, fever, sore throat and infection (both prevention and control). Moreover, the topics covered during the sessions were also those topics where respondents had less knowledge, and both poor attitude and practice as identified from responses to the questionnaire of the pre-test measure (Jha et al., 2013). The educational materials were adopted from accepted already-published resources for pharmacists and the public [Buttercups Training, 2011; Centers for Disease Control and Prevention (CDCP), 2016; Do Bugs Need Drugs (DBND), 2016; FDA]. The components of the interventions are summarised in Appendix 23 and 24

The intervention included both educational and behavioural components. The educational component consisted of the presentation of slide shows using PowerPoint software for approximately 15 minutes and guided discussion of up to 10 minutes after the presentation on a weekly basis for 14 weeks. Also, it was extended through the presentation of videos and distribution of pamphlets presenting information and directing participants to online resources. This component was tailored based on participant feedback — to the interview study and the pre-test questionnaire — which was used to identify the topics in which participants were not knowledgeable or otherwise unlikely to succeed. Furthermore, some of the participants from the interview study were also included in the intervention study. Based on the findings of the interview study, more videos were incorporated into the educational materials, more colourful posters were employed, and the use of text messaging was eliminated.

The behavioural intervention, which aimed to give participants more appropriate resources for mitigating their fear of bacterial infections, consisted of a training session about sanitation practices that could reduce or prevent the spread of infectious diseases in daily life. This training session was led by a nurse, who guided the participants in practicing the behaviour. Face-to-face communication is essential for boosting behaviour change, because it is considered as the most direct form of communication (WHO, 2007, p.25). Therefore, the researcher delivered the educational material by himself during laboratory sessions, every week for 14 weeks. Furthermore, this mode of delivery enabled effective discussion between the researcher and the participants. This approach allowed participants to ask questions freely, seek clarification and make contributions based on their previous knowledge and experience. Thus, it facilitated knowledge acquisition and retention because of active involvement rather than just passive reception. Moreover, historical stories about viruses, bacteria and famous icons were incorporated during discussions to keep sessions interesting and engaging, as recommended by Lecky et al. (2011).

The brochures and factsheets were given to participants who then had the opportunity to look through them. The researcher discussed the contents of the printed materials with participants and encouraged them to ask questions. Each week, participants were asked whether they had any further questions after reading the printed materials; this reminded them to make use of the intervention. Previous research has demonstrated the effectiveness of web-based teaching resources for improving knowledge of and attitudes towards antibiotics use (Madle, et al., 2009; Madle, et al., 2004). Therefore, a website was initiated and developed by a professional web development team in the College of Information Technology at Ajman University. The researcher provided the content of the website with the aim and objectives. The website was then modified through multiple meetings with members of the team to discuss the technical requirements for the site. This site was offered only for the intervention group with password access. The study website can be viewed at:

- www.antibiotics-wiseuse.com
- User name: >khalid
- Password: >khalid123

A month after starting the intervention, the researcher considered the feedback and evaluation provided by students regarding the teaching quality. Data was collected via an internationally validated questionnaire [The Students' Evaluation of Educational Quality (SEEQ) Appendix 25], which was confirmed by other researchers (Marsh and Roche, 1992; Coffey and Gibbs, 2000). Students responded anonymously to 24 closed-ended statements that addressed or were related to teaching, using a six-point Likert-type scale that ranged from “strongly agree” to “not applicable”. Moreover, three additional closed-ended questions were asked by means of a six-point Likert-type scale that ranged from “very good” to “not applicable.” The last question was an open-ended one designed to retrieve any extra comments. The main remarks were “time of starting the session is better to be in the first 25 minutes of the lab” and “please, more practical examples about the symptoms and their self-management.” With the collaborative help of the laboratory instructors in the College of Dentistry, the educational sessions were started at the beginning of each lab.

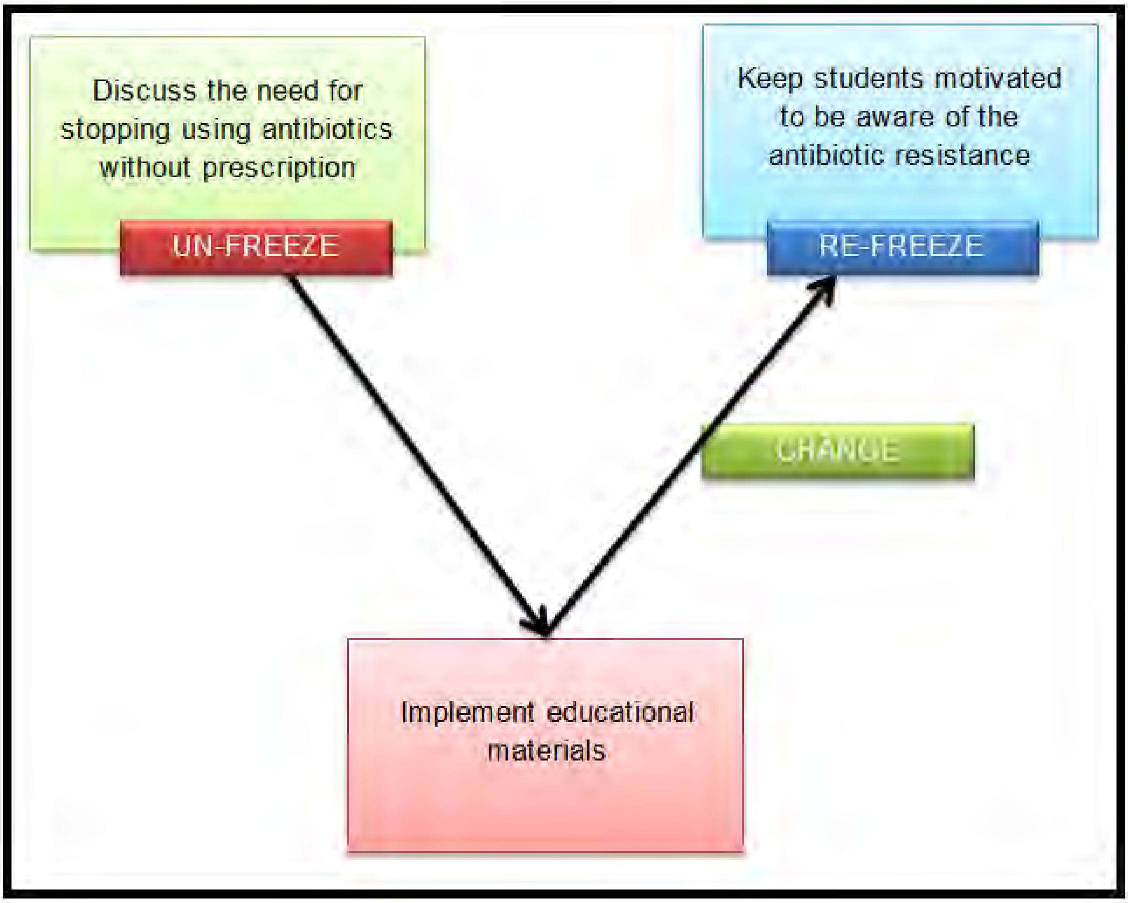
In addition to this and based on feedback from the participants, videos were incorporated into the educational material. In a similar way, educational mini-posters, which included more visual pictures and less writing, were used and given to the respondents in order to provide them with the necessary information. Moreover, the researcher made quizzes from time to time to determine the retention of the educational materials among participants. Furthermore, laboratory instructors were requested each month to gather informal comments from the students regarding the researcher and the quality of the educational materials provided during the stage of intervention. A quiz-based approach was employed from time to time to determine topics that needed additional emphasis (e.g. true-false questions and short-answer questions).

6.4.6. Theoretical Framework: Lewin's Change Model

Various theories could be used in determining the effectiveness of the educational process for enhancing the knowledge and tendency of students to lower their utilisation of antibiotics without prescriptions from medical practitioners in self-medication practice. Nevertheless, this study is primarily guided by single-level oriented models, with particular focus on Lewin's three-step theory of change (Lewin, 1951; Lewin, 1958).

The model was deemed appropriate for this study for several reasons. Firstly, it provides a framework for preparing individuals for change in regard to their health tendencies (the unfreeze phase). Secondly, the model has paid substantial attention to the preparation and acceptance of the change which makes it easier to be adopted in various change processes (Sharma, 2007). Thirdly, the model is acknowledged as considerably simple, which makes it easy for individual use, even in cases where individuals are not particularly accustomed to the process of change management. Fourth, the adoption of this model allows individuals to psychologically identify with, as well as sustain, the change. For individuals to embrace change, this has to be planned and implemented in a manner that is sensitive to the emotional reactions of individuals. This is an element that this model incorporates. Figure 6.2 shows the implementation of Lewin's three-step theory of change in this intervention.

Figure 6.2 Theoretical Framework adopted in the intervention study



6.4.7. Validity of the Study

Numerous threats to the internal validity of a pre-test post-test non-equivalent group design were identified (Dimitrov and Rumrill, 2003; Fraenkel and Wallen, 2010). The outcomes of the present study could potentially suffer from several threats to internal validity, including selection bias, attrition and regression effect (Krefetz, 2015). Selection bias occurs when experimental and control groups are not equivalent at the start of an experiment (Krefetz, 2015). The ANCOVA model is constructed to take into account the non-equivalent baseline characteristics of the two groups. These characteristics are held mathematically constant as part of the statistical analysis so that they do not confound the comparison of the outcomes between the two groups (Rutherford, 2001; Belin & Norman, 2005; Pocock et al., 2002). However, the ANCOVA model is not valid if the empirical data violates its theoretical assumptions, including (a) homogeneity of regression slopes and (b) equality of variance. Tests for these assumptions are conducted using SPSS software (Field, 2011). The use of an ANCOVA model helps to reduce the bias caused by the regression toward the mean because the mean of the pre-test test scores is statistically adjusted to remain constant at the baseline (Barnett et al., 2004).

Internal validity threats affect the researcher's ability to conclude that changes in the outcome variables are attributed to the intervention sessions (Shadish, et al., 2002). Quasi-experimental designs are rather susceptible to such threats due to the lack of randomisation (Shadish, et al., 2002). Appendix 26 shows common threats to internal validity in experimental designs and steps taken to minimise their effects in the present study. In addition, external validity pertains to the ability of the study's findings to be generalised and applied to other populations and settings beyond those of the experiment itself (Cohen et al., 2007).

6.4.8. Reliability

As Mertens (2010) notes, unsystematic errors that cause variation across data collection points can generate unreliable data, undermining the findings of a study. To protect against such errors, the research took several steps:

Participants in both settings completed the measures in the same environment.

Valid and reliable measures were utilised.

It must be acknowledged that participants' individual characteristics, such as mood, motivation and social desirability bias, might have affected the data that was gathered.

Considering that this study is carried out as a further investigation deriving from the interview study presented in Chapter five, data triangulation with this qualitative study was conducted. Data triangulation can increase the reliability of a study especially when different methodological approaches are used (Jupp, 2010). In this particular case, data emerging from the themes uncovered in Chapter Five will be compared with the quantitative data extracted in this study.

6.4.9. Limitations of the Design

Randomisation is the signature of a "true experiments" (Polit and Beck, 2008). Although Quasi-experiments involve an intervention, similarly to true experiments, randomization is absent. Thus, this type of research design may involve more threats to internal validity compared to true experiments, such as pre-existing differences among participants. Nonetheless, using quality control checks can minimise these threats (Singh, 2016).

6.4.10. Data Collection

6.4.10.1. Data Collection Tools

A self-administered questionnaire (Scaioli, 2015) was deployed for data collection (Appendix 27). The validity and reliability of this tool were recently confirmed by a survey in Italy measured the practices, knowledge and attitudes regarding antibiotic use among healthcare students (Scaioli, 2015). The questionnaire is composed of the following sections:

Section One: Demography and Socio-demographic

This section includes seven questions in relation to age, gender, nationality, college, study year of student, living status and family that were coded numerically.

Section Two: Practice of Using Antibiotics without Prescription Domain (Frequency of Use)

This domain has two questions. Q1 has dichotomous answers (yes/no), then dichotomised into “correct” vs. “incorrect” (Scaioli, 2015, p.3). Q2 is the number of times that respondents use antibiotics without prescriptions in the previous year were coded as 1 for 1–2 times, 2 for 3–5 times and 3 for more than 5 times.

Section Three: Knowledge Domain

This domain has nine questions. The outcomes of knowledge were described with numbers and percentages, then dichotomised into “correct” vs. “incorrect”, grouping the four-point Likert scale into: “strongly agree” and “agree” for correct answers, versus “strongly disagree” and “disagree” for incorrect answers for all questions except Q.4, Q.5, Q.7 and Q.8 (Scaioli, 2015, p.3). For Q.4, Q.5, Q.7 and Q.8, the correct answers are “Strongly Disagree/Disagree”. For the remaining Questions, the correct answers are “Strongly Agree/Agree”.

Section Four: Awareness Domain

This section contains three questions (Q.12, Q.13 and Q.14) with dichotomous answers (yes/no). For Q.12, Q.13, Q.14, the correct answers are yes. There are three more awareness questions in the four-point Likert-scale (Q.15, Q.16

and Q.17) where the answers were coded (Likert scale from 1 to 4). The outcomes of awareness domain were described with numbers and percentages, then dichotomised into “correct” vs. “incorrect”, grouping the four-point Likert scale into: “strongly agree” and “agree” for correct answers, versus “strongly disagree” and “disagree” for incorrect answers (Scaioli, 2015, p.3). For Q.17, the correct answers are “Strongly Disagree/Disagree”.

Section Five: Attitude Domain

This contains eight questions with dichotomous answers (yes/no). All were inversely coded as 1 for no and 0 for yes, except for Q.21. They were then dichotomised as “correct” versus “incorrect” (Scaioli, 2015). The correct answers for all questions except Q.21 were no.

Outcome Measures

The primary endpoint was the change in the frequency of use of antibiotics without a physician’s prescription (behavioural outcome). The outcome was to reduce antibiotic use. The secondary endpoint was the mean per cent change in knowledge, awareness and attitude scores. The data were analysed at baseline and after five months post-intervention for both study groups.

6.4.10.2. Statistical Analysis

All the statistical analyses were carried out using Statistical Package for Social Sciences (SPSS), version 22 (SPSS Inc., Cary, NC, USA). Descriptive statistics were presented using means with standard deviation (±SDs) and percentages (%). Pearson’s chi-squared test was used for the three nominal categorical variables (gender, living, and family). Independent-sample t-tests were used to compare the baseline knowledge, awareness, and attitude scores of the intervention and the control groups. A Mann–Whitney U test was conducted to determine if there was a significant difference between the grouped median ages of the students in the intervention group vs. the control group.

Descriptive statistics are commonly present in all quantitative designs and allow for a general presentation of the variables within the studies sample (Boslaugh, 2013). In this particular case, percentages listed enabled the display of data regarding gender, age, living environment, and family. Primary outcome percentages were also displayed prior to and after the intervention. The use of standard deviation (SD) enabled the display of results in relation to the normal distribution of data. In this regard, this approach was used to understand if the data measured within the sample is normally distributed. Substantial differences between SD and mean values indicate that the data is not normally distributed within a studied group.

The Pearson Chi-Square test was carried out on nominal variables (gender, living and family) in order to determine if the differences observed between groups are attributed to chance (Salazar et al., 2015). This test was carried out because in the present investigation, a purposive sampling procedure was used, without random allocation of participants to intervention and control groups. Because only convenience was used for group allocation, it was important to determine if researcher bias could have impacted on the way in which participants were distributed to intervention and control.

An independent t-test was conducted to assess the mean values of the secondary outcomes in the control and the intervention group (Pagano, 2007). Variance was assumed normal in both groups as per the descriptive statistics, with values deviating from SD within normal ranges (Pagano, 2007). In this particular case, the control and the intervention group was considered to be the dependent variable, while the independent variables were considered to be knowledge, awareness and attitude. This test was performed because of similar reasons for which the Pearson Chi-Square test was conducted. Given the fact that purposive sampling was conducted, this test verified whether or not there are any differences between the intervention and control group in terms of knowledge, awareness and attitude at baseline. The A Mann–Whitney U was conducted due to similar reasons, in relation to the variable related with age. Normal distribution was not assumed in this case. Therefore this non-parametric test was used.

A McNemar test was performed for the main outcome measured, specifically the use of antibiotics without prescription, pre and post-intervention. A chi-square test or a paired t-test was not applicable since the tested variables were not independent and the means of pre and post-scores in both groups were not calculated. This is because a score of 100% was determined pre-intervention (all participants had used antibiotics without prescription). In the present study, the comparison was therefore made against the baseline score of 100% in antibiotic use without prescription, in both the control and intervention groups.

The McNemar test verifies if there is a statistical difference between a dichotomous variable measured in two groups that are clearly differentiated by an assessed characteristic. The test therefore can be used to measure the effect on an intervention in a binary assessment (Ahn et al., 2015).

For this test to be performed, three conditions are generally necessary. Firstly, one categorical dependable variable must be testable within two categories (Holmes, 2014). In the present study, this is applicable because the dependent variable tested is the use of antibiotic without prescription. The two categories in which this variable is tested refer to the intervention and control group. In this case, the dichotomous variable is measured by a simple “yes” or “no” answer to the question of: “Have you used antibiotics without prescription in the past five months”. Therefore, it is assumed that the dichotomous variable will display statistically different results between groups. The two categories are represented by the two groups tested: intervention and control.

Another assumption of the McNemar test is that units (participants) from one group cannot be a part of the other group. Consequently, participants cannot overlap. Since the study participants were separated in intervention and control groups from the beginning of the study, no such overlaps occurred (Holmes, 2012). Finally, the McNemar test assumes that the sample in the study was randomly selected, although other strategies are permitted especially due to the fact that this test is common in quasi-experimental designs (Ahn et al., 2015; Holmes, 2012). In the present study, although purposive sampling was used to select participants, their allocation to intervention and control was set on convenience rather than randomisation.

ANCOVA analysis was used to test the differences between the intervention and control group in terms of attitude and awareness. This type of statistical test was chosen due to the fact that there were baseline differences in these variables between the intervention group and the control group. This difference was therefore accounted as a covariate element. Since no differences were observed in relation to the knowledge variable, differences in the means of the intervention versus the control group were assessed via ANOVA. The same statistical analysis was applied to test the effect of demographics on knowledge, awareness and attitudes.

6.4.11. Ethical Considerations

6.4.11.1. Informed Consent

The research handed out the following information: consent forms, study invitation letter and information sheets, which provided information about the study. This study had ethical approval from Ajman University and approval from the colleges of dentistry and college of pharmacy (Appendix 20). The student information sheet was read aloud at the beginning of the laboratory session. Furthermore, the researcher provided the participants with an opportunity to ask questions to make sure that the details of the study were clear.

6.4.11.2. Right to Withdraw

Both the consent forms and the information sheets stated explicitly that respondents had the right to withdraw from the study. This was verbally reiterated to the participants prior to the start of the pre-assessment. All parties involved in the research were provided with the researcher's contact details should any of the parties decide to withdraw.

6.4.11.3. Confidentiality

In order to maintain anonymity, participants were referred to by a coded identifier, which was included on all written data. The privacy of the participants was ensured. All data collected was securely stored in a locked filing cabinet or on an encrypted memory stick.

6.4.11.4. Protection from Potential Harm

Because two questions (Q1 and Q2) on both of the measures used could be considered sensitive, namely those participants who chose to use antibiotics without a physician's prescription, it was entirely likely that some participants might be concerned about reporting such activities or may experience internal conflicts about making such disclosures. In anticipation of such circumstances, the researcher developed a plan whereby participants were asked if they wished to continue the survey and were reminded of their right to withdraw from the study at any time.

However, it was the general practice of the researcher to remind the participants at the outset of the study that they could end their participation in the survey at any time as well as skipping certain questions at their own discretion. Although this plan was not ultimately needed, a provisional plan was created to make sure that participants had access to a university-based support system to the extent that such resources were needed.

6.4.11.5. Debriefing

Following the completion of the data analysis procedures, all participants and facilitators involved in the research were provided with a summary of the findings. The contact details of the researcher were also provided should the participants or facilitators wish to discuss anything further pertaining to the study.

6.5. Results of the Intervention Study

The first section of the results summarises the demographic characteristics of the respondents. In the subsequent three sections, the three research questions and their associated hypothesis displayed in section 6.2. are presented.

6.5.1. Demographic Characteristics

The total sample size was n = 140 students, with an equal number (n = 70) in the control and intervention groups. The frequencies of the categories within each group are compared in Table 6.1. The Pearson's chi-square test statistics for the three nominal categorical variables (gender, living and family) indicated statistically significant ($p< 0.05$) associations between the frequencies in the columns (intervention vs. control group) vs. the frequencies in the rows (demographic categories). Consequently, the demographic characteristics were not randomly distributed but were dependent on the two groups.

Table 6.1 Demographic characteristics of intervention and control groups

Demographic characteristic	Category	Intervention group		Control group		Chi-square	*p*
		n	% within group	*n*	% within group		
Gender	Male	33	45.7%	20	25.7%	5.131	0.023*
	Female	37	54.3%	50	74.3%		
Living	Inside campus	25	35.7%	8	11.4%	11.459	0.001*
	Outside campus	45	64.3%	62	88.6%		
Family	Yes	32	45.7%	18	25.7%	6.098	0.014*
	No	38	54.3%	52	74.3%		
Age	17	22	31.4%	5	7.1%	Not applicable	
	18	37	52.9%	44	62.9%		
	19	9	12.9%	13	18.6%		
	20	2	2.9%	6	8.6%		
	21	0	0.0%	2	2.9%		

Note: * Significant ($p < 0 .05$)

As indicated by *Table 6.1*, the proportion of male and females were relatively similar in the intervention group. A total of 33 males and 37 females were included in this group, which translated to a percentage of 45.7% respectively 54.3%. This balance was however not achieved in the control group, where only 20 males were included and 50 females. In this case, percentages were 25.7% and 74.3% respectively. Previous investigations (Al Rasheed et al., 2016) found that males are more likely to self-medicate with antibiotics. This sample distribution based on gender could therefore impact on the final results as there is a smaller portion of males present in the control group. Therefore, this may limit the effects observed of using antibiotics without prescription.

Considering that the qualitative study carried through this investigation and others studies (Zaghloul et al., 2014), living in campus could negatively impact on using ONPD. Contrasting data is presented by Pan et al. (2012), who argue that this living environment had positive effects on minimising the use of ONPD. Similar to the gender variable, the living environment differed significantly within and between groups. In the control group, only 8 participants lived on campus, which led to a distribution of percentages of 11.4% students in the control group living on campus and 88.6% living outside campus. In the intervention group, 25 students lived on campus, being equivalent to a percentage of 35.7%. A total of 45 students lived outside campus, corresponding to a percentage of 64.3%. Determining the exact cause for which the living conditions of students impacted on the use of antibiotics was beyond the scope of this study. This investigation only attempted to determine whether or not this variable impacted on the use of antibiotics without prescription. Because some investigations did suggest that this is the case, this variable was tested in this experiment.

Finally, considering that some investigations point to the fact that family has an influence on the use of antibiotics this variable was also tested. A relatively equal proportion of students in the intervention group lived with or away from their families (32 vs. 38, corresponding to 45.7% and 54.3% respectively). In the control group, the numerical difference between those living with and without their family was higher, with 25.5% living with their families and 74.3% living with their families.

These variables were further tested through a Pearson Chi-Square to determine if the differences observed between the intervention and the control group could be attributed to chance. The level of statistical significance tested in this case was $p<0.05$, whereby data lower than this value was considered statistically significant. For all nominal categories tested (gender, living, family), the Chi-Square values obtained were lower than the statistical threshold, respectively $p<0.023$ for gender, $p<0.001$ for living conditions and $p<0.014$ for family. This data indicates that the differences between the groups cannot be attributed to chance.

Because age was not a nominal category, a Mann–Whitney U test was conducted to determine if there was a significant difference between the grouped median ages of the students in the intervention group vs. those in the control group. The results of the Mann–Whitney test ($U = 1683.5$, $p < .001$) indicated that the median age of the students the control group was 18.28 years ($SD = 0.835$) which was significantly higher than the median age of the students in the intervention group (17.81 years).

The study found that the intervention and control groups were not equivalent in terms of the frequency distributions of their demographic characteristics, classified by gender, living and family, and also that the two groups were not equivalent in terms of their median ages.

Table 6.2 Nationality in the sample

Nationality		Intervention group	Control Group	Total
Syrian	*n*	16	20	36
	%	44.4%	55.6%	100.0%
Iraqi	*n*	14	24	38
	%	36.8%	63.2%	100.0%
Sudanese	*n*	1	1	2
	%	50.0%	50.0%	100.0%
Palestine	*n*	6	2	8
	%	75.0%	25.0%	100.0%
Iran	*n*	1	2	3
	%	33.3%	66.7%	100.0%
Egyptian	*n*	12	15	27
	%	44.4%	55.6%	100.0%
Bahraini	*n*	1	0	1
	%	100.0%	0.0%	100.0%
UAE	*n*	2	0	2
	%	100.0%	0.0%	100.0%
Algerian	n	1	0	1
	%	100.0%	0.0%	100.0%
Yemen	*n*	1	1	2
	%	50.0%	50.0%	100.0%
Jordanian	*n*	13	3	16
	%	81.3%	18.8%	100.0%
Saudi	n	0	1	1
	%	0.0%	100.0%	100.0%
Canadian	n	1	0	1
	%	100.0%	0.0%	100.0%
Indian	n	0	1	1
	%	0.0%	100.0%	100.0%
Libya	n	1	0	1
	%	100.0%	0.0%	100.0%
Total	n	70	70	140
	%	50.0%	50.0%	100.0%

For nationality (Table 6.2), many of the participants in the intervention group were Syrian (16; 44.4%), Iraqi (14; 36.8%), Egyptian (12; 44.4%) and Jordanian (13; 81.3%). In the control group, many of the participants were Syrian (20; 55.6%), Iraqi (24; 36.2%) and Egyptian (15; 55.6%). The Pearson Chi-Square test statistics for the nationality showed no statistically significant difference between intervention and control groups (p=0.130). For student year, all participants were in their first-year.

6.5.2. Baseline Knowledge, Awareness, Attitudes and Practices of Students

This section presents the statistical evidence to address RQ1: What are the baseline knowledge, awareness, attitudes and practices of students on the use of antibiotics without a prescription? Table 6.1 present the descriptive statistics to compare the baseline knowledge, awareness and attitude scores of the control and intervention groups. Table 6.2 presents the results of independent sample t-tests to compare the baseline knowledge, awareness and attitude scores of the intervention group (n = 70) and the control group (n = 70). Equal variances were assumed because $p > 0.05$ for Levene's F statistics to test for equality of variances.

The mean difference between the baseline knowledge of the control group and the intervention group at the pre-test (-0.086) was not significantly different from zero at the 0.05 level (t (138) = 0.460, p = 0.646). The mean difference between the awareness of the control group and the intervention group at the pre-test (-0.614) was, however, significantly different from zero at the 0.05 level (t (138) = -2.101, p = 0.037). The mean difference between the attitude of the control group and the intervention group at the pre-test (0.457) was also significantly different from zero at the 0.05 level (t (138) = -2.240, p = 0.027).

Table 6.3 Descriptive statistics for the baseline knowledge, awareness and attitude scores

	Pre-test knowledge		Pre-test awareness		Pre-test attitude	
	Intervention	Control	Intervention	Control	Intervention	Control
n	70	70	70	70	70	70
Mean	5.96	6.04	2.77	3.39	3.39	2.93
SD	1.042	1.160	1.436	1.980	1.183	1.231

It is important to point out that as illustrated in *Table 6.4*, knowledge and awareness scores as related to the use of antibiotics have a higher mean value in the control group as compared to the intervention group. In relation to attitudes, scores were higher in the intervention group. This indicates that although there are differences at baseline in regards to the tested variables between the control group and the intervention group, these differences should provide an advantage to the control group, since their knowledge scores and awareness scores are higher. An independent t-test was performed where variances were considered to determine if these differences are statistically significant. The table below displays these results.

Table 6.4 Independent sample t-tests determine if group baseline differences for secondary outcomes are statistically significant

	Levene's test for equality of variances		Independent samples t-test			
	F	p	t	*df*	*p*	Mean Difference
Pre-test knowledge	0.506	0.478	-0.460	138	0.646	-0.086
Pre-test awareness	1.763	0.186	-2.101	138	0.037*	-0.614
Pre-test attitude	0.002	0.961	2.240	138	0.027*	0.457

Note: * Significant ($p < 0 .05$)

The p value considered for statistical significance was set at <0.05. As it can be observed from the above table, only differences in knowledge did not have statistical significance, with p<0.646. Awareness was statistically significant different between groups, with a p value of <0.037, while awareness was statistically significant different at a p value of <0.027.

Table 6.6 presents the cross-tabulation of the frequencies of the responses to the baseline question "Have you used antibiotics without prescription in the past year?" The intervention and control groups were equivalent because 100% of the students in both groups answered "Yes". The pre-screening questionnaire for participant eligibility verified that all participants in this study did take antibiotics without prescription within the past five months leading to this study.

Table 6.5 Cross-tabulation of baseline use of antibiotics without prescription vs. group

Question	Response	Intervention group		Control group	
		n	% within group	*n*	% within group
Have you used antibiotics without prescription in the previous year?	Yes	70	100.0%	70	100.0%
	No	0	0.0%	0	0.0%

This data was collected in order to ensure that all participants met the inclusion criteria for using antibiotics without prescription within the past five months. The results showed that the statistical evidence was not consistent with the research hypothesis H1 because the baseline awareness and attitudes of the students in the control group were significantly different from the baseline awareness and attitudes of the students in the intervention group. However, the baseline knowledge and practices on the use of antibiotics were equal in the control and intervention groups. Table 6.4 summarises the participants' knowledge about antibiotics in the intervention and control groups.

Table 6.6 Participants' knowledge in relation to antibiotics

Statements			Group		Total
			Intervention	Control	
Penicillin and amoxicillin are antibiotics.	1.00 Strongly agree	*n*	31	25	56
		%	44.28%	35.71%	40.00%
	2.00 Agree	*n*	39	40	79
		%	55.71%	57.14%	56.42%
	3.00 Disagree	*n*	0	2	2
		%	0.00%	2.85%	1.42%
	4.00 Strongly Disagree	*n*	0	3	3
		%	0.00%	4.28%	2.14%
Aspirin is an antibiotic.	1.00 Strongly agree	*n*	10	3	13
		%	14.28%	4.28%	9.28%
	2.00 Agree	*n*	17	18	35
		%	24.28%	25.71%	25%
	3.00 Disagree	*n*	30	30	60
		%	42.85%	42.85%	42.85%
	4.00 Strongly Disagree	*n*	13	19	32
		%	18.57%	27.14%	22.85%
Paracetamol is an antibiotic.	1.00 Strongly agree	*n*	24	17	41
		%	34.28%	24.28%	29.28%
	2.00 Agree	*n*	39	38	77
		%	55.71%	54.28%	55%
	3.00 Disagree	*n*	6	10	16
		%	8.57%	14.28%	11.42%
	4.00 Strongly Disagree	*n*	1	5	6
		%	1.42%	7.14%	4.28%
Antibiotics are useful for bacterial infections (e.g. tuberculosis).	1.00 Strongly agree	*n*	50	19	69
		%	71.42%	27.14%	49.28%
	2.00 Agree	*n*	18	49	67
		%	25.71%	70.00%	47.85%
	3.00 Disagree	*n*	2	2	4
		%	2.85%	2.85%	2.85%
	4.00 Strongly Disagree	*n*	0	0	0
		%	0.00%	0.00%	0.00%

Table 6.6 Continued

Statements			Group		Total
			Intervention	Control	
Antibiotics are useful for viral infections (e.g. flu).	1.00 Strongly agree	*n*	18	11	29
		%	25.71%	15.71%	20.71%
	2.00 Agree	*n*	12	22	34
		%	17.14%	31.42%	24.28%
	3.00 Disagree	*n*	25	26	51
		%	35.71%	37.14%	36.42%
	4.00 Strongly Disagree	*n*	15	11	26
		%	21.42%	15.71%	18.57%
Antibiotics are indicated to reduce any kind of pain and inflammation.	1.00 Strongly agree	*n*	4	11	15
		%	5.71%	15.71%	10.71%
	2.00 Agree	*n*	18	15	33
		%	25.71%	21.42%	23.57%
	3.00 Disagree	*n*	29	34	63
		%	41.42%	48.57%	45%
	4.00 Strongly Disagree	*n*	19	10	29
		%	27.14%	14.28%	20.71%
Antibiotics can kill "good bacteria" present in our body	1.00 Strongly agree	*n*	15	14	29
		%	21.42%	20.00%	20.71%
	2.00 Agree	*n*	41	42	83
		%	58.57%	60.00%	59.28%
	3.00 Disagree	*n*	14	14	28
		%	20.00%	20.00%	20.00%
	4.00 Strongly Disagree	*n*	0	0	0
		%	0.00%	0.00%	0.00%
Antibiotics can cause secondary infections after killing good bacteria present in our body	1.00 Strongly agree	*n*	4	3	7
		%	5.71%	4.28%	5.00%
	2.00 Agree	*n*	16	24	40
		%	22.85%	34.28%	28.57%
	3.00 Disagree	*n*	40	38	78
		%	57.14%	54.28%	55.71%
	4.00 Strongly Disagree	*n*	10	5	15
		%	14.28%	7.14%	10.71%

Table 6.6 Continued

Statements			Group		Total
			Intervention	Control	
Antibiotics can cause allergic reactions.	1.00 Strongly agree	*n*	53	13	66
		%	75.71%	18.57%	47.14%
	2.00 Agree	*n*	12	49	61
		%	17.14%	70.00%	43.6%
	3.00 Disagree	*n*	5	8	13
		%	7.14%	11.42%	9.3%
	4.00 Strongly Disagree	*n*	0	0	0
		%	0.00%	0.0%	0.0%

The majority of intervention and control group participants agreed or strongly agreed with the following statements:

- Penicillin or amoxicillin are antibiotics.
- Paracetamol is an antibiotic.
- Antibiotics are useful for bacterial infections (e.g., tuberculosis).
- Antibiotics can kill "good bacteria" present in our organism.
- Antibiotics can cause allergic reactions.

Approximately two-thirds of both intervention and control group's participants disagreed or strongly disagreed with the following statements:

- Aspirin is an antibiotic (65%).
- Antibiotics are indicated to reduce any kind of pain and inflammation. (65%)
- Antibiotics can cause secondary infections after killing good bacteria present in our body (66.4%)

45% of both groups agreed or strongly agreed that antibiotics can be used to treat flu and other viral infections. The data obtained in this case indicate that the majority of the participants in both groups are not aware of the risks associated with antibiotic use and are also unaware of the actual clinical function of antibiotics. This indicates that although knowledge levels in the control group and the intervention group are similar, both groups have a low level of knowledge as related to the rational use of antibiotics. It is therefore expected that once the intervention is delivered, the participants in the intervention group would have a better understanding of the functionality of antibiotics, which would therefore impact on the attitudes and practice domain. Table 6.7 summarises the participants' awareness about antibiotics in the intervention and control groups.

Table 6.7 Baseline measurements of participants' awareness related to antibiotics use

Statements			Group		Total
			Intervention	Control	
Have you ever heard about antibiotic resistance?	No	*n*	26	18	44
		%	37.14%	25.71%	31.42%
	Yes	*n*	44	52	96
		%	62.85%	74.28%	68.57%
In particular, have you discussed the problem of antibiotic resistance during degree courses?	No	*n*	62	59	121
		%	88.57%	84.28%	86.42%
	Yes	*n*	8	11	19
		%	11.42%	15.71%	13.57%
Have you ever heard of it outside degree courses?	No	*n*	24	25	49
		%	34.28%	35.71%	35%
	Yes	*n*	46	40	86
		%	65.71%	57.14%	61.42%
If yes, where have you heard it from?	I have never heard about it	*n*	25	24	49
		%	35.71%	34.28%	35%
	General practitioner	*n*	11	5	16
		%	15.71%	7.14%	11.42%
	Television	*n*	14	28	42
		%	20.00%	40.00%	30.00%
	Newspaper	*n*	4	9	13
		%	5.71%	12.85%	9.28%
	Web	*n*	15	3	18
		%	21.42%	4.28%	12.85%
Antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic.	1.00 Strongly disagree	*n*	6	2	8
		%	8.57%	2.85%	5.71%
	2.00 Disagree	*n*	30	23	53
		%	42.85%	32.85%	37.85%
	3.00 Agree	*n*	23	37	60
		%	32.85%	52.85%	42.85%
	4.00 Strongly agree	*n*	11	8	19
		%	15.71%	11.42%	13.57%

Table 6.7 Continued

Statements			Group		Total
			Intervention	Control	
Misuse of antibiotics can lead to a loss of sensitivity of an antibiotic to a specific pathogen.	1.00 Strongly disagree	*n*	4	7	11
		%	5.71%	10.00%	7.85%
	2.00 Disagree	*n*	39	30	69
		%	55.71%	42.85%	49.28%
	3.00 Agree	*n*	22	24	46
		%	31.42%	34.28%	32.85%
	4.00 Strongly agree	*n*	5	9	14
		%	7.14%	12.85%	10.00%
If symptoms improve before the full course of antibiotics is completed, you can stop taking them.	1.00 Strongly disagree	n	10	10	20
		%	14.28%	14.28%	14.28%
	2.00 Disagree	*n*	15	14	29
		%	21.42%	20.00%	20.71%
	3.00 Agree	*n*	23	37	60
		%	32.85%	52.85%	42.85%
	4.00 Strongly agree	*n*	22	9	31
		%	31.42%	12.85%	22.14%

Just over two- thirds (68%) of the participants had heard about antibiotic resistance. Approximately 86.42% of the intervention and the control groups had not discussed the problem of antibiotic resistance during degree courses, and most of them (86.42%) had not discussed the problem of antibiotic resistance during degree courses. This indicates that current educational approaches towards healthcare students need to be improved. At the same time, this can be the result of the fact that this study used first-year students, who did not reach yet educational modules that would improve their awareness of antibiotic resistance. However, considering that responsible prescription is also pursued in the agenda to reduce antibiotic resistance (WHO, 2001), these future health professionals need to be aware of the dangers of inappropriate use of antibiotics.

On a similar note, two- third (65%) of the participants both groups agreed or strongly agreed with the following statement:

If symptoms improve before the full course of antibiotics is completed, you can stop taking them.

This is significantly problematic as participants did not understand that this type of behaviour could result in antibiotics resistance. Consequently, they also did not realise what actually occurs when a bacterium becomes resistant to antibiotics.

Less than half of the participants in the intervention and control groups (44%) disagreed or strongly disagreed that antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic. Furthermore, more than half of the participants disagreed or strongly disagreed that the use of antibiotics without prescription can lead to a loss of sensitivity of an antibiotic to a specific pathogen. As previously mentioned, all this data points towards the fact that participants not only manifest inappropriate use of antibiotics but they also do not understand how and why this results in antibiotic resistance. *Table 6.8* presents the attitudes and behaviours of participants in both groups as related to antibiotic use.

Table 6.8 Attitudes and behaviours about antibiotics in the intervention and control groups

Statements			Group		
			Intervention	Control	Total
Do you usually take antibiotics for cold or sore throat?	Yes	*n*	40	53	93
		%	57.14%	75.71%	66.42%
	No	*n*	30	17	47
		%	42.85%	24.28%	33.57%
Do you usually take antibiotics for fever?	Yes	*n*	32	34	66
		%	45.71%	48.57%	47.14%
	No	*n*	38	36	74
		%	54.28%	51.42%	52.85%
Do you usually stop taking antibiotics when you start feeling better?	Yes	*n*	24	43	67
		%	34.28%	61.42%	47.85%
	No	*n*	46	27	73
		%	65.71%	38.57%	52.14%
Do you take antibiotics only when prescribed by the doctor?	No	*n*	66	62	128
		%	94.28%	88.57%	91.42%
	Yes	*n*	4	8	12
		%	5.71%	11.42%	8.57%
Do you keep leftover antibiotics at home because they might be useful in the future?	Yes	*n*	37	33	70
		%	52.85%	47.14%	50.00%
	No	*n*	33	37	70
		%	47.14%	52.85%	50.00%
Do you use leftover antibiotics when you have a cold, sore throat or flu without consulting your doctor?	Yes	*n*	52	58	110
		%	74.28%	82.85%	78.57%
	No	*n*	18	12	30
		%	25.71%	17.14%	21.42%
Do you buy antibiotics without a medical Prescription?	Yes	*n*	35	36	71
		%	50.00%	51.42%	50.71%
	No	*n*	35	34	69
		%	50.00%	48.57%	49.28%
Have you ever started antibiotic therapy after a simple doctor’s call, without a proper medical examination?	Yes	*n*	37	36	73
		%	52.85%	51.42%	52.14%
	No	*n*	33	34	67
		%	47.14%	48.57%	47.85%

The majority of the participants demonstrated an unhealthy attitude through their responses. Almost two thirds (66.42%) of them usually take antibiotics for colds or sore throats and just under a half (47.14%) usually take antibiotics for fever.

The baseline data retrieved in regards the first and second statement (as listed in Table 6.8) indicates that the participants engage in an irrational use of medication through inappropriate use of antibiotics characterised by inappropriate self-diagnosis and inappropriate selection of medication to treat their symptoms. Because laws in relation to selling antibiotics are not enforced in the UAE, these participants are able to acquire antibiotics, in the same manner in which they would acquire ONPD. This enables them to use antibiotics to treat potential viral infections, such as common colds and sore throat. This is the most common misconception encountered among the general public as related to the use of antibiotic, whereby people use antibiotics to treat viral infections (Tanday, 2016).

For the third statement used to test attitudes and behaviours on antibiotic use “Do you usually stop taking antibiotics when you start feeling better”, 47.85% of participants answered “Yes” and 52.14% answered “No”. In the intervention group, 34.28% answered “Yes” while 61.42% answered the same in the control group. At baseline, 65.71% of the participants in the intervention group did not interrupt their course of antibiotics if they felt better, while 52.14% in the control group did the same. In the independent t-test listed in *Table 6.6*, these differences were found to be statistically significant, with mean scores listed in *Table 6.5* indicating that attitudes and behaviours were more negative in the control group, although awareness and knowledge scores were higher. This may indicate, as suggested by previous literature, that knowledge and awareness alone are not sufficient to illicit a behavioural change in relation to the rational use of antibiotics.

As previously discussed, antibiotic use is considered to be rational when rational prescribing is employed and when people take antibiotics with a medical prescription (WHO, 2001). In this case, the condition in which participants take antibiotics with or without a prescription was assessed. Therefore, the fourth statement asked participants if they take antibiotics only when prescribed by a physician. 94.28% of the intervention group answered with “No”, and 88.75% in the control group gave the same answer. A very small percentage of the total participants (8.57%) took antibiotics only when prescribed. Some participant recall bias may be observed in this case as all participants in both groups were selected based on the fact that they had taken antibiotics without prescription. Initial pre-screen selection scores were 100%, which indicates that 0% should have answered “Yes” to “Do you take antibiotics only when prescribed by the doctor”.

Half of the participants reported in statement five that they keep leftovers antibiotics at home because they might be useful in the future. The sixth statement demonstrates that answers provided to statement five are justified by the fact that participants use leftover antibiotics to self-medicate when they have a cold or a sore throat. 74.28% of the participants in the intervention group and 82.85% of the participants in the control group engaged in this practice.

In relation to statement seven, 50% of the participants in the intervention group stated that they buy antibiotics without a prescription while 51.42% of the participants in the control group provided the same answer. Considering the high rates of participants that use antibiotics without prescription (91.42%) it can be argued that participants who do not buy antibiotics without prescription, use left-over antibiotics from other sources, such as family or friends.

Finally, for the eighth statement, 52.14% of the participants answered “Yes” to taking antibiotics without a proper medical examination. 47.85% of participants answered “No”. In the control group, 51.42% of participants took antibiotics without proper medical examination, while in the intervention group, 52.85% exhibited the same behaviour. Considering the high rate of participants in both groups who had answered “Yes” to taking antibiotics without prescription, the responses received for this statement may be subjected to recall bias or response bias.

Results extracted from baseline measurements of knowledge, awareness and attitudes indicate that although the sample is comprised of healthcare students, a significantly high portion of participants use antibiotics without prescription and in doing so, also exhibit inappropriate self-diagnosis, inappropriate dose and timing by interrupting the use of antibiotic when symptoms disappear, and inappropriate drug selection as participants were noted to take antibiotics for common colds. More surprisingly, in relation to knowledge, it was observed that participants from both groups had difficulties identifying medication that is or is not an antibiotic. Although these were first-year healthcare students, the results indicate a significant need for education in relation to antibiotics. When triangulated with data obtained in the interview study, these results produce similar outcomes.

6.6. Triangulation with the Interview Study

When triangulated with data obtained in the interview study, these results produce similar outcomes. As discussed in Chapter Five, four main themes emerged from the interviews: Medication Habits and Practices; Reasons for Self-Medication; Access to Antibiotics without a Prescription and Perceptions of antibiotic and antibiotic resistance.

In terms of medication habits, as noted in the interview study, these baseline measurements also provide similar data in relation to the frequency of use behaviour. In this sense, both the interview study as the baseline measures noted that participants used antibiotics to treat the common could or when they get a fever. Moreover, from the interviews it was concluded that awareness and knowledge are not sufficient to change attitudes in relation to antibiotic use. This was also confirmed by the baseline measurements, whereby it was noted even though awareness was high in the control group, their attitudes were significantly lower by contrast with the intervention group.

For theme two, reasons for self-medication, this study found that family has no impact on the use of antibiotics without prescription. At the other end of the line, the interview survey found that family and financial reasons do contribute to the use of antibiotics without prescription. In the present investigation, when assessing attitudes and behaviours on antibiotic use, it was observed that antibiotic left-overs were kept and reused while antibiotic therapy was commenced without prior physician consultation. 38 participants in the intervention group and 52 participants in the control group did not live with their family. This may imply that the effect of family was reduced, while the effect of friends may have been more pronounced and observed through the increased use of antibiotic left-overs.

Data from theme three “Access to Antibiotics without a Prescription” is aligned with the data obtained in the intervention study in relation to attitudes and behaviours on purchasing antibiotics without a prescription. In this case, as it can be observed in *Table 6.8*, a significant number of participants do buy antibiotics without a prescription or have access to leftover antibiotics.

Finally, theme four ‘Perceptions of Antibiotic and Antibiotic Resistance” were poor. Similar data was obtained in the intervention study whereby over a quarter of the sample did not agree that antibiotic resistance occurs when a bacterium loses its sensitivity to an antibiotic. Additionally, over half of the sample in both intervention and control group did not believe that the use of antibiotics without prescription leads to antibiotic resistance.

6.6.1. Efficacy of Educational Intervention

The following four sections present the statistical evidence to address RQ2: What is the efficacy of the educational intervention in improving levels of knowledge, awareness, attitude and practice of antibiotic use with prescription (rational use) in the intervention group? Because the control and intervention groups were not equivalent at the baseline, simple univariate statistics (e.g., independent sample t-tests) were not appropriate to compare the mean pre-test scores for the knowledge, awareness and attitudes of students before the intervention and the post-test scores collected five months after the intervention. Multivariate statistics were appropriate, using analysis of covariance (ANCOVA). ANCOVA is a combination of ANOVA and multiple regression analysis that is commonly applied to analyse the changes in the test scores measured in pre-test post-test designs in medical and psychological research (Belin & Normand, 2009; Brace, et al., 2009; Dimitrov & Rumrill, 2003; Knapp & Schafer, 2009).

As it was demonstrated during baseline measurements, the intervention and control group were not homogenous in relation to the mean values displayed for awareness and attitudes. This indicates that for these two tested variables, the data is not normally distributed. A t-test could have been performed after the logarithmic normalisation of the data. However, this process predisposes the t-test to a significant risk of error, in which the variation between the data sets could have been increased rather than normalised (Feng et al., 2014). Another approach that was considered was conducting an ANOVA analysis without data normalisation. However, since this analysis compares the means in the datasets, the potential for error was significant since the mean values were statistically different in the pre-test.

Considering these aspects, ANCOVA was used as a statistical analysis method to assess the secondary measured outcomes. Due to analysis consistency considerations, the variables pre-post-intervention related to knowledge were assessed via this ANOVA. ANCOVA is a statistical test similar to ANAOVA, however this type of analysis can account for a confounding variable within the analysis (confounding variable) (Rutherford, 2012). In the present study, the confounding variable is considered to be the pre-test scores.

ANCOVA was conducted using the General Linear Model (GLM) approach with: (a) the post-test scores as the dependent variable; (b) the baseline or pre-test scores as the covariate; and (c) the group (intervention vs. control) as the fixed factor. The reason for conducting ANCOVA was that the non-equivalence of the two groups at the baseline was statistically controlled, by adjusting the mean scores, so that they were held constant for all students at the baseline. Consequently, the non-equivalence of the two groups at the baseline did not bias the analysis to determine the extent to which the knowledge, awareness and attitudes of the students in the intervention group were improved after the educational intervention, relative to the control group. The theoretical assumptions of ANCOVA are that (a) the pre-test and post-test scores are significantly linearly correlated; (b) there is homogeneity of regression slopes between the covariate and the groups; and (c) the variances of the dependent variable are homogenous across the groups (Rutherford, 2001).

6.6.2. Improvement in Knowledge

The theoretical assumptions of ANCOVA were tested for the knowledge scores. The pre- and post-test knowledge scores were significantly linearly correlated in both the intervention group (Pearson's $r = 0.535$, $p < 0.001$) and the control group (Pearson's $r = 0.242$, $p < 0.044$). Homogeneity of regression slopes was indicated by the non-significant covariate *x* group interaction term in the ANCOVA model (F (1, 136) = 0 .033, p = 0 .857). Levene's test for homogeneity of variance ($p < 0.05$) indicated that the variances of the knowledge scores were not homogenous across the two groups (Levene's F (1, 138) = 43.054, $p < 0.001$); however, ANCOVA using the GLM approach computed with Type III sum of squares is robust to violation of the assumption of homogeneity of variance so long as the group sizes are equal (Rutherford, 2001).

Tables 6.9 and 6.10 present the ANCOVA results using the post-test knowledge scores as the dependent variable and the pre-test scores as the covariate. The results of ANCOVA were statistically significant at the 0.001 level. The pre-test knowledge scores had a significant effect on the post-test knowledge scores (F (1, 137) = 14.549, $p < 0.001$) with a small effect size (Partial Eta Squared = 0.096) indicating that 9.6% of the variance was explained by the covariate. The intervention had a significant effect on the post-test knowledge scores (F (1, 137) = 139.118, *p*< 0.001) with a moderate effect size (Partial Eta Squared = 0 .504), indicating that 50.4% of the variance was explained by the intervention. After controlling for the non-equivalence of the pre-test scores (mean = 6.00) the improvement in the knowledge scores of the intervention group (mean = 2.640) was significantly greater than the improvement in the knowledge scores of the control group (mean = 0.760). The conclusion is that the statistical evidence supported H2 because the knowledge of the students in the intervention group was significantly improved after the educational intervention, to a greater extent than the control group.

Table 6.9 ANCOVA to test for improvement in knowledge

Source of variance	Type III Sum of Squares	*df*	Mean Square	F	p	Partial Eta Squared
Pre-test knowledge	12.930	1	12.930	14.549	<0.001 *	0.096
Group (intervention vs. control)	123.638	1	123.638	139.118	<0.001 *	0.504
Error	121.756	137	0.889			
Total	8556.000	140				

Note: * Significant (*p*< 0.001).

Based on the results obtained in relation to knowledge post-intervention, it can be argued that the intervention group did benefit from improved knowledge after the intervention.

The following table displays the results of adjusted mean scores for improvements in knowledge obtained after the intervention.

Table 6.10 Adjusted mean scores to test for improvement in knowledge

Group	Mean post-test score	SD	Improvement (post-test minus pre-test)
Intervention	8.640[a]	0.945	8.640 – 6.00 = 2.640
Control	6.760[a]	0.945	6.760 – 6.00 = 0.760

Note: [a] Pre-test knowledge scores were kept constant (mean = 6.00).

6.6.3. Improvement in Awareness

The theoretical assumptions of ANCOVA were tested for the awareness scores. The pre- and post-test awareness scores were significantly linearly correlated in both the intervention group (Pearson's r = .382, p = 0.001) and the control group (Pearson's r = .332, p = 0.005). Homogeneity of the regression slopes was indicated by the non-significant covariate *x* group interaction term (F (1, 136) = 0.390, p = 0.533) in the ANCOVA model. Levene's test for homogeneity of variance (p< 0.05) indicated that the variances of the awareness scores were not homogenous across the two groups (Levene's F (1, 138) = 22.403, p< 0.001); however, the violation of the assumption of homogeneity of variance was ignored because the group sizes were equal (Rutherford, 2001).

Tables 6.11 and 6.12 present the ANCOVA results using the post-test awareness scores as the dependent variable and the pre-test scores as the covariate. The ANCOVA results were statistically significant at the 0.001 level. The pre-test awareness scores had a significant effect on the post-test awareness scores (F (1, 137) = 17.552, p< 0.001) with a small effect size (Partial Eta Squared = 0.114) indicating that 11.4% of the variance was explained by the covariate. The intervention had a significant effect on the post-test awareness scores (F (1, 137) = 72.157, p< 0.001) with a moderate effect size (Partial Eta Squared = 0.345) indicating that 34.5% of the variance was explained by the intervention. After controlling for the non-equivalence of the pre-test scores (mean = 3.080) the improvement in the awareness scores of the intervention group (mean = 2.343) was significantly greater than the improvement in the awareness scores of the control group (mean = 0.497). The conclusion is that the statistical evidence supported H2 because the awareness of the students in the intervention group was improved after the educational intervention, significantly more than the control group.

Table 6.11 ANCOVA to test for improvement in awareness

Source of variance	Type III Sum of squares	*df*	Mean square	F	*p*	Partial Eta Squared
Pre-test awareness	28.113	1	28.113	17.552	<0.001*	0.114
Group (intervention vs. control)	115.573	1	115.573	72.157	<0.001*	0.345
Error	219.430	137	1.602			
Total	3182.000	140				

Note: * Significant ($p < 0.05$).

Table 6.12 Adjusted mean scores to test for improvement in awareness

Group	Mean post-test score	SD	Improvement (post-test minus pre-test)
Intervention	5.423[a]	1.271	5.423 – 3.080 = 2.343
Control	3.577[a]	1.271	6.760 – 3.080 = 0.497

Note: [a] Pre-test awareness scores were held constant (mean = 3.080).

6.6.4. Improvement in Attitude

The theoretical assumptions of ANCOVA were tested for the attitude scores. The pre- and post-test attitude scores were significantly linearly correlated in the intervention group (Pearson's r = 0.218, p = 0.010) and the control group (Pearson's r = 0.218, p = 0.010). Homogeneity of the regression slopes was indicated by the non-significant covariate x group interaction term (F (1, 136) = 0.265, p = 0.608) in the ANCOVA model. Levene's test for homogeneity of variance (p> 0.05) indicated that the variances of the awareness scores were homogenous across the two groups (Levene's F (1, 138) = 1.063, p = 0.304).

Tables 6.12 and 6.13 present the ANCOVA results using the post-test attitude scores as the dependent variable and the pre-test scores as the covariate. The pre-test attitude scores had no significant effect on the post-test attitude scores (F (1, 137)

= 1.950, *p* = 0.165) with a negligible effect size (Partial Eta Squared = 0.014) indicating that only 1.4% of the variance was explained by the covariate. The intervention had a significant effect on the post-test attitude scores at the 0.001 level (F (1, 137) = 188.276, *p*< 0.001) with a moderate effect size (Partial Eta Squared = 0.579) indicating that 57.9% of the variance was explained by the intervention. After controlling for the non-equivalence of the pre-test scores (mean = 3.160) the improvement in the attitude scores of the intervention group (mean = 2.770) was significantly greater than the change in the attitude scores of the control group (mean = -0.118). The conclusion is that the statistical evidence supported H2, because the attitude of students in the intervention group was significantly improved after the educational intervention compared to the attitudes in the control group.

Table 6.13 ANCOVA to test for improvement in attitude

Source of variance	Type III sum of squares	*df*	Mean square	F	p	Partial Eta Squared
Pre-test awareness	2.917	1	2.917	1.950	0.165	0.014
Group (intervention vs. control)	281.645	1	281.645	188.276	<0.001*	0.579
Error	204.940	137	1.496			
Total	3328.000	140				

Note: * Significant (*p*< 0.05).

Table 6.14 Adjusted mean scores to test for improvement in attitude

Group	Mean post-test score	SD	Improvement (post-test minus pre-test)
Intervention	5.930	1.238	5.930 – 3.160 = 2.770
Control	3.042	1.238	3.042 – 3.160 = -0.118

Note: [a] Pre-test awareness scores were held constant (mean = 3.160).

6.6.5. Improvement in Practice

Improvement in the practice of the use of antibiotics was analysed using answers retrieved for the question: “Have you used antibiotics without prescription in the past 5 months?” The cross-tabulation of the frequencies of the students in the two groups who answered “Yes” and “No” to this question at the post-test is presented in Table 6.15. After the intervention, a higher proportion of the students in the control group (n = 57, 81%) answered “Yes” than in the intervention group (n = 44, 63%).

Table 6.15 Cross-tabulation of post-test use of antibiotics without prescription by group

Question	Response	Intervention group		Control group	
		n	% within group	*n*	% within group
Have you used antibiotics without prescription in the past 5 months?	Yes	44	63%	57	81%
	No	26	37%	13	19%

The post-test frequencies, of the practice of the use of antibiotics in each group, were dependent on the pre-test frequencies, in which 100% of the students in each group used antibiotics without a prescription (see Table 6.5). A Chi-Square test (which assumes that the frequencies are independent) was not applicable (Agresti, 2013).

A McNemar test was used to analyse the primary outcome measured. As previously mentioned, both groups had a 100% rate of use of antibiotics without prescription. This made impossible the use of Chi-Square testing or the use of paired-test to assess the mean differences between groups in pre-and post-intervention conditions.

The McNemar test for two related frequencies was conducted to determine if there were differences in the frequency of use of antibiotics without prescription between the two groups before and after the intervention. About 37% of intervention group did not use antibiotics compared to control group only 19%. The results of this test were statistically significant (McNemar-x^2= 37.026, p< 0.001). Therefore, the statistical evidence supported Hypothesis 2 because the use of antibiotics without prescription among students in the intervention group was significantly improved after the educational intervention compared to the control group.

6.6.6. Knowledge, Awareness, Attitudes, Practices and Demographic Characteristics

This section presents the statistical evidence to address RQ3: To what extent do the knowledge, awareness, attitudes and practice of antibiotics use vary in the intervention group with respect to their demographic characteristics?

Table 6.16 presents the results of multifactorial analysis of variance (ANOVA) using the GLM approach with Type III sum of squares in order to compare the post-test knowledge scores of the intervention and control groups with respect to four demographic factors. The only demographic factor that had a significant ($p< 0.05$) effect on the post-test knowledge scores was gender in both the intervention group (F (1, 63 = 35.791, $p< 0.001$) and the control group (F (1, 63 = 4.232, $p = 0.004$); however the effect of gender was not consistent between the two groups. The effect size for gender was moderate in the intervention group (Partial Eta Squared = 0.362) but small in the control group (Partial Eta Squared = 0.064). The descriptive statistics in Table 6.19 indicate that, in the intervention group, the post-test knowledge scores of the male students (mean = 9.00, SD = 0.500) were greater than those for female students (mean = 8.30, SD = 0.618). In the control group, however, the post-test knowledge scores of the male students (mean = 6.00, SD = 0.973) were lower than those for the female students (mean = 7.08, SD = 1.259).

Table 6.16 ANOVA to test for differences in post-test knowledge scores

Group	Factor	Type III Sum of Squares	*df*	Mean Square	F	*p*	Partial Eta Squared
Intervention	Gender	6.772	1	6.772	35.791	<0.001*	0.362
	Age	1.401	3	0.467	2.468	0.070	0.105
	Living	0.071	1	0.071	0.376	0.542	0.006
	Family	0.514	1	0.514	2.717	0.104	0.041
	Error	11.920	63	0.189			
	Total	5234.000	70				
Control	Gender	5.513	1	5.513	4.232	0.044*	0.064
	Age	5.951	4	1.488	1.142	0.345	0.069
	Living	9.977	1	9.977	1.658	0.117	0.011
	Family	0.477	1	0.477	0.366	0.547	0.006
	Error	80.773	62	1.303			
	Total	3322.000	70				

Note: * Significant ($p< 0.05$).

Table 6.17 Descriptive statistics for post-test knowledge scores by gender

Group	Gender	Mean	SD
Intervention	Male	9.00	0.500
	Female	8.30	0.618
Control	Male	6.00	0.973
	Female	7.08	1.259

In Table 6.18 the results of multifactorial ANOVA using the GLM procedure are presented, to compare the post-test awareness scores of the intervention and control groups with respect to four demographic factors. The only demographic factor that had a significant (*p*< 0.05) effect on the post-test awareness scores was gender in the intervention group (F(1, 63 = 46.848, *p*< 0.001) with a moderate effect size (Partial Eta Squared = 0.426). The descriptive statistics in Table 6.21 indicate that, in the intervention group, the post-test awareness scores of the male students (mean = 3.24, SD = 1.542) were greater than those for the female students (mean = 2.35, SD = 1.207). In the control group, however, the post-test awareness scores of the male students (mean = 3.70, SD = 2.273) were not significantly different to those for the female students (mean = 3.26, SD = 1.861).

Table 6.18 ANOVA to test for differences in post-test awareness scores

Group	Factor	Type III Sum of Squares	*df*	Mean Square	F	*p*	Partial Eta Squared
Intervention	Gender	15.720	1	15.720	46.848	<.001*	.426
	Age	.538	3	.179	.535	.660	.025
	Living	.003	1	.003	.010	.921	.000
	Family	1.625	1	1.625	4.843	.031	.071
	Error	21.139	63	.336			
	Total	2040.000	70				
Control	Gender	.101	1	.101	.031	.861	.000
	Age	1.790	4	.447	.137	.968	.009
	Living	.498	1	.498	.152	.698	.002
	Family	.861	1	.861	.263	.610	.004
	Error	202.583	62	3.267			
	Total	1142.000	70				

Note: * Significant (*p*< 0.001).

Table 6.19 Descriptive statistics for post-test Awareness scores by gender

Group	Gender	Mean	SD
Intervention	Male	3.24	1.542
	Female	2.35	1.207
Control	Male	3.70	2.273
	Female	3.26	1.861

Table 6.20 presents the results of the multifactorial ANOVA using the GLM to compare the post-test attitude scores of the intervention and control groups with respect to four demographic factors. All of the *p*-values for the F statistics were >0.05. None of the demographic factors had a significant (p< 0.05) effect on the post-test attitude scores.

Table 6.20 ANOVA to test for differences in post-test attitude scores

Group	Factor	Type III Sum of Squares	*df*	Mean Square	F	*p*	Partial Eta Squared
Intervention	Gender	0.188	1	0.188	0.141	0.708	0.002
	Age	3.760	3	1.253	0.940	0.427	0.043
	Living	2.394	1	2.394	1.796	0.185	0.028
	Family	0.104	1	0.104	0.078	0.781	0.001
	Error	84.000	63	1.333			
	Total	2575.000	70				
Control	Gender	0.268	1	0.268	0.158	0.692	0.003
	Age	0.402	4	0.101	0.059	0.993	0.004
	Living	0.001	1	0.001	0.000	0.984	0.000
	Family	8.340	1	8.340	5.926	0.060	0.074
	Error	104.968	62	1.693			
	Total	0.188	1	0.188	0.141	0.708	0.002

Chi-square tests using logarithmic linear analysis for multi-way cross-tabulations were conducted to determine if there were any significant associations between the practice of using antibiotics without prescription and the four demographic variables. Only one significant association was found among the intervention group, with respect to gender (chi-square (1) = 4.387, p = 0.036). The cross-tabulation in Table 6.22 indicated that a higher proportion of male students (n = 25, 75.8%) than female students (n = 19, 51.4%) had used antibiotics without prescription in the past 5 months. This was despite of the fact that gender showed to be correlated with knowledge and awareness post-intervention, whereby male students exhibited higher levels of knowledge and awareness. Therefore, it is observed that although male students had improved more in terms of knowledge and awareness on antibiotic use after the intervention, their improvement in attitude and behaviour in relation to antibiotic use was not greater than for female participants. This is in line with other literature findings, indicating that males are more at risk of using antibiotics without prescription.

Table 6.21 Cross-tabulation of post-test use of antibiotics without prescription by gender

Question	Response	Male		Female	
		n	% within gender	*n*	% within gender
Have you used antibiotics without prescription in the past 5 months?	No	8	24.2%	18	48.6%
	Yes	25	75.8%	19	51.4%

The conclusion is that the statistical evidence did not entirely support H3 because the knowledge, awareness, attitudes and practices of the students on the use of antibiotics after the intervention did not all vary with respect to (a) gender, (b) age, (c) living inside or outside campus or (d) family. Gender was the only demographic characteristic found to have a significant effect on the post-test scores for knowledge, awareness and use of antibiotics without a prescription.

In terms of data generalisability, this study holds significant limitations due to the sampling procedure used. Some of the data obtained falls in line with previous literature while other results do not follow the same lines. In relation to demographic factors impacting on notions of knowledge, awareness and attitudes, this study found that only gender impacted on these aspects. Other investigations, including the interview study presented in Chapter Five, indicate that family does have an effect on the use of antibiotic without prescription. Moreover, a significant portion of the sample used in this study lived with their families. This effect should have therefore been observed. Because in this investigation all other demographics except gender, were not connected to use of antibiotics without prescription, this can be considered to be a limitation derived from the sampling procedures.

This aspect is not evident in relation to living ion campus, whereby in the interview study, financial aspects as quoted by Pan et al. (2012) were not expressed as one of the reasons for which antibiotics are used without prescription. In this case, other studies (Zaghloul et al., 2014) did found that living in campus could impact on the inappropriate use of antibiotics. Based on these findings it may be argued that the living environment is a complex factor affecting the use of antibiotics, which also holds some financial and social influence power. This further indicates that this dimension is complex enough to be examined on its own, and its lack of connection with antibiotic use present in this study is not necessarily a limitation of the sampling procedures.

Some investigations (Al Rasheed et al., 2016) noted that age, not only gender influences the use of antibiotic without prescription, albeit in the investigation data referred to older males. In this case, this study had first-year students which may have limited such findings. Nevertheless, gender was found to impact on antibiotic use. This effect was observed to be different in the control versus the intervention group. In the control group, males did not engage in poorer antibiotic use attitudes and practices by contrast with females. This effect was observed only in the intervention group. As indicated by descriptive statistics listed in *Table 6.3*, gender in the intervention group was more homogenous while in the control group, this distribution was significantly more heterogeneous. The effects of this distribution have not been calculated for statistical significance, albeit results should have indicated a more positive attitude and behaviour in the group dominated by females (control group). This was not the case, as shown by the results displayed in *Table 6.5*, attitudes were poorer in the control group. This can be regarded as a limitation caused by purposive sampling and by the fact that group distribution did not account for gender.

6.7. Discussion of the intervention study

The aim of the current study was to develop and test an intervention for improving the knowledge, attitudes and awareness of antibiotics-without-prescription use among healthcare students in a UAE university. This study set out to answer three main research questions: “What are the baseline levels of knowledge, awareness, attitude and practice as related to antibiotic use without prescription in the intervention and control group?”; What is the efficacy of the educational intervention in improving levels of knowledge, awareness, attitude and practice of antibiotic use with prescription (rational use) in the intervention group?" and "To what extent do the knowledge, awareness, attitudes and practice of antibiotics use vary in the intervention group with respect to their demographic characteristics?" A total sample of 140 healthcare students was purposively selected to take part in the study. Students were assigned at a ratio of 1:1 in intervention and control groups.

The first question focused on assessing baseline scores on knowledge, awareness, attitude and practice of antibiotic use among the selected sample. Data collected in this sense revealed that participants in both groups had limited knowledge and awareness of antibiotic correct use and were also very likely to engage in inappropriate use. At baseline, when these scores were compared, it was revealed that while knowledge was the same, attitudes and awareness differed statistically significant between the groups, whereby the control group had a better awareness of antibiotics but poorer attitudes in comparison to the intervention group. This is in line with previous findings (Azevedo et al., 2013; Shehadeh et al., 2015) according to which knowledge and awareness may not be sufficient to change behaviour. Because of this, the intervention tested in this study also included behavioural components.

The second question sought to determine the efficacy of the intervention delivered to the intervention group, by comparing knowledge, awareness, and attitudes in relation to the control group. Results extracted from these measurements determined that a significant improvement had been achieved in the intervention group by contrast with the control group. In relation to attitudes, improvements were observed only between the intervention versus control group, but not between the intervention pre-test scores and post-test scores. This indicates that the behaviour of participants in the intervention group did not improve by a statistically significant value as compared to their pre-intervention scores. Additionally, although the scores of the intervention group did improve statistically significant by contrast to the control group, the control group already manifested at baseline poorer attitudes in comparison to the intervention group. However, the use of ANCOVA enabled the data analysis process to account for this difference at baseline. As a result, the difference between the intervention and the control group in relation to attitudes can be considered as an indication of the efficacy of the intervention.

The final question of this study sought to determine if knowledge, awareness, attitudes and practice of antibiotics use vary in the intervention group with respect to their demographic characteristics. In this analysis, only gender was found to be statistically significant correlated with variances in knowledge, awareness and attitudes in relation to antibiotic use. In this case, male participants exhibited higher levels of knowledge and awareness, but poorer attitudes in relation to antibiotic use.

The practical implications of this study can be connected with the expanding pharmacological market in the country which provides the possibility to access antibiotics without prescription and with the high rates of physician prescriptions of antibiotics (Abasaeed et al., 2009; Al Akshar et al., 2014). Therefore, the intervention aimed to improve the knowledge of healthcare students about antibiotics use without prescription, make them aware of the risks associated with the use of antibiotics without prescription and self-administration and potentially limit the excessive prescriptions of this medication in the future by educating soon-to-be physicians.

A pre-test questionnaire was used to carry out baseline measurements in both groups. The results indicated that at baseline, there was a statistical difference in awareness (mean difference -0.614) and attitude (mean difference=0.457) between the control group and the intervention group but no difference in knowledge and practice ($p>0.05$) for the use of antibiotics without prescriptions. Because there was no statistical difference in knowledge and practice it can be speculated that the intervention group may have had a more careless attitude towards antibiotic use. Another potential explanation for the difference in both groups may be attributed to demographics statistics. Thus the difference might be attributed to the fact that participants in the control group were older than the intervention group. As a result, it is possible that although in the same year of study, more awareness has been acquired by the students in the control group which may account for the difference in attitude over the investigated topic (Ibrahim et al., 2015). However, considering that both groups scored the same on knowledge and practice, this may indicate that awareness is not sufficient to improve knowledge and practice. As a result, the intervention devised focused on both educational as well as behavioural strategies. As demonstrated by the literature review, various studies (Welschen et al., 2004; Ashe et al., 2006; Martens et al., 2006; Francis et al., 2009; Cals et al., 2009;

Monette et al., 2007; Le Corvoisier et al, 2013; Gjelstad et al., 2013 Lee et al., 2015) focused on interventions that encompassed a single component which addressed either a behavioural intervention or an educational one. The current study thus seeks to eliminate this limitation, by collecting data beforehand from the same participants and devising a multi-approach intervention that addressed both behavioural as educational perspectives.

To develop the intervention, data collected and analysed in the previous two studies was used. As described by Herbert (2005) using this technique not only aids in eliminating limitations of quantitative and qualitative methodologies but it also assists in developing informed interventions which are tailored to the population investigated. This strategy also aids in targeting behaviours and attitudes that are intended to be changed. Consequently, the initial study used a quantitative design in order to extract risk factors characteristic of the studied population for using antibiotics without prescription. Nevertheless, a quantitative design only provides a numerical understanding of the issue investigated, therefore, a qualitative study using interviews to deepen the understanding of the investigated issue was used (Vogt et al., 2012). The results of the two surveys were subsequently used to devise the intervention which contains educational as well as behavioural strategies for improving knowledge, awareness and attitudes over antibiotic use in the targeted population. Because previous studies have not used this strategy, to the best of the author's knowledge, this is the first study that encompasses all these elements.

To ensure the success of the developed strategies, evidence-based (Lujan and DiCarlo, 2006; WHO, 2007; Lecky et al., 2011; Norris et al., 2013) strategies were also applied. These involved the implication of the researcher in the intervention process, the environment in which the intervention was delivered, incorporation of student feedback and discussions that highlighted knowledge gaps in student awareness of antibiotic use and collaboration with the participants for developing informational materials. To the best of the researcher's knowledge, this study is the first to use this ample strategy to attempt to assess the ability of an intervention to modify behaviour around antibiotic use for healthcare students.

6.7.1. Knowledge

The initial baseline measurements taken from students in both groups indicated that knowledge about antibiotic use, effects, and recommendations was limited. The majority of the participants from both groups were misinformed in regards to what type of medication is considered to be an antibiotic (paracetamol was considered to be an antibiotic) while 35% considered that antibiotics can reduce inflammation and pain and 66.4% disagreed with the idea that antibiotics may kill beneficial bacteria and lead to secondary infections. 45% of participants in both groups agreed that antibiotics can be used to treat viral infections such as the flu. The findings of baseline measurements resonate with previous international literature (Shehadeh et al., 2016; Al Rasheed et al., 2016; Belkina et al., 2014; Shehnaz et al. 2014) analysing public and student awareness of antibiotics.

Studies carried out over a decade ago by Gonzales et al. (1997), Ochoa et al. (2000), Vanden et al. (2003) and Cebotarenco and Bush (2008) indicated that antibiotics are excessively used to treat upper respiratory tract infections, which are predominantly caused by viral infections. This indicates a lack of knowledge into how this medication should be used. Similar behaviours were noted among the healthcare students participating in this study. Oh et al. (2011) argued through a cross-sectional study conducted in Malaysia that people have unrealistic expectations of antibiotics to treat the common cold. The participants in this study also exhibited a similar attitude, by taking antibiotics when having a cold or a fever. Similar findings attesting to misconceptions over antibiotic resistance have been put forward by Brookes-Howell et al. (2013) in a study using participants from nine European countries. Taking a different approach Abbot et al. (2013) argue that education in relation to antimicrobial agents is particularly relevant in how healthcare students, who will become future prescribers of antibiotics, will manage prescriptions and reduce unnecessary use of antibiotics. However, Scaioli et al. (2015) found through a cross-sectional design study carried out in Italy that 20% of the 1050 sample of medical and nursing students believed that antibiotics can be used to treat viral infections. This indicates that antibiotic knowledge among healthcare students may be problematic. The current study also displays similar results prior to the intervention. On an international level, Rather et al. (2017) argue that self-medication, lack of knowledge on antibiotic use in relation to completing the course of antibiotics, over-dosages and actual need significantly contribute to the existence of superbugs. This research thus indicates that on a global level there is still a significant lack of knowledge both within the general population and among healthcare students into how antibiotic resistance develops, when antibiotics should be used and what medication has an antimicrobial effect. The baseline measurements that were taken in the current study thus obtained results that echo the international research in relation to antibiotic knowledge. Once these baselines measurements were registered, the intervention group was subjected to the developed educational and behavioural strategies.

Results following the intervention procedures showed that the intervention group achieved a statistically significant increase ($p<0.01$) in the level of knowledge on antibiotics compared to the control group. Some contrast with previous literature has been found. In the study conducted by Scaioli et al. (2015), the majority of students knew the significance and meaning of antibiotic resistance while in the present study, the students did not have a good knowledge of this issue. Other than the potential differences in educational curriculums which according to Abbot et al. (2013) may result in different levels of knowledge on antibiotics, the study conducted by Scaioli et al. (2015) included only 44% first-year students in their sample. By contrast, the present study used only first-year medical studies, which may thus account for the difference registered in level of knowledge. The same aspects apply to the study conducted by Harakeh et al. (2015), where ¾ of the participating students acknowledged that antibiotics are to be used only for bacterial infections. In this case only 7.4% of the sample was comprised of first-year students. Other differences may emerge from the recall period used by the researchers, whereby participants may report data which is inaccurate, especially when using an extended recall period (Kjellsson et al., 2014). Different baseline measurements, as well as specific methods, such as sample size and population variants, may also impact on final outcomes.

Additionally, the data collected following the intervention showed a significant improvement over the importance of finishing the course of antibiotics even if symptoms improved. These results were similar to the data obtained by Azevedo et al. (2013) in designing an intervention to improve knowledge on antibiotic use by ninth-grade students in school in Portugal. Additional similarities with this study include the environment in which the intervention was administered as well as the use of materials employed for educational purposes. Additional interventional studies carried out by Fonseca et al. (2012) and Shehadeh et al. (2015) also found significant improvements in knowledge of antibiotics following educational strategies, which may indicate (as suggested by one of our own participants in the interview-qualitative study) that antibiotic education should begin in school and not be delayed until university. Nevertheless, a cohort study by Gonzalez-Gonzalez (2015) indicates that knowledge is not sufficient to ensure that misuse or inadequate prescription of antibiotic does not occur. As suggested by this study, interventions that target behavioural patterns such as attitudes and practices are also needed.

6.7.2. Awareness

The levels of participants' awareness on antibiotics use during thepre-intervention phase were significantly low (mean=2.77 in the intervention group and mean=3.39 in the control group). As previously indicated, the participants in both groups had issues in identifying the action of antibiotics as well as identifying the necessity of finishing an antibiotic treatment and not renouncing it once symptoms had regressed. After the intervention was delivered, a statistically significant increase in awareness was noted in the intervention group (mean=5.423) in contrast with the control group (mean=3.577). This is particularly relevant since on initial measurements, the control group had a higher awareness of antibiotics compared with the intervention group. Nevertheless, after the intervention, the intervention group surpassed, by a statistically significant value, the awareness registered by the control group (mean diff=1.846, ($p< 0.05$). Thus, it can be observed that although the pre-test scores showed higher awareness in the control group, after the intervention, this value was surpassed by a statistically significant difference. Awareness was assessed by looking at participants' knowledge of implications of antibiotic resistance and connection with self-medication, urgency of use, lack of prescription and potential side effects of antibiotics. These results indicate that there was a significant difference in awareness between the intervention group and the control group in the post-test.

Some contrast has been observed with the study of Scaioli et al. (2015). This contrast was explained above as being potentially related to the demographics of the participants but it can also be attributed to awareness campaigns (European Commission, 2010; Formoso et al., 2013; Filippini, et al, 2013; Earnshaw et al., 2014;) that were conducted in Italy since 1997. Furthermore, in 2008, the European Union (2010) issued awareness campaigns coordinated by the European Centre for Disease Prevention and Control (ECDC) in 47 countries, including Italy, in an effort to tackle misconceptions over the use of antibiotics. As a result, it is possible that participants in the study of Scaioli et al. (2015) had an increased awareness over incorrect antibiotic use due to exposure to these campaigns. During the development of this study, one global campaign of responsible antibiotic use was led by WHO (2016). The campaign addressed health workers and the general public, but not students in particular. In the present study, the student participants from UAE may not have experienced the same exposure to awareness campaigns; hence this might have contributed to the difference registered in awareness between our study and the results reported by Scaioli et al. (2015).

The fact that the students in the Italian study were more aware of the risks of using antibiotics without prescription can therefore be attributed to conclusions drawn by Moradi et al. (2007) and Chang et al. (2000), arguing that increase in medical knowledge leads to better awareness and subsequently better medical practice in antibiotic prescription and use. However, the results of this investigation however indicate that the situation is reversed: when medical knowledge is present, awareness and knowledge do exist but can result in poor practice. This was observed in both the intervention study as well as within the interview study. The fact that the findings of these researchers are in contrast with the results obtained by Gonzalez-Gonzalez (2015) can be connected to the type of intervention devised to improve practice. As previously discussed in this section, other studies that examined interventions for improving attitude, knowledge and/or awareness over antibiotic use have used singular interventions. Therefore, it is more likely that these studies would get a lower significance in results. Moreover, due to the short period in which the intervention took place, it is also more likely that other studies would fail to allow participants sufficient time for learning and behavioural change to occur. Hence, this may be a main cause of the difference in results obtained. Additionally, it is important to keep in mind that this study used a multi-intervention strategy was not applied by Gonzalez-Gonzalez (2015) and can mostly explain the difference in results.

Another element to be brought forward into this discussion is the difference between knowledge and awareness as measured in this study. Sinclair (1951) argued in the Theory of Knowledge that knowledge implies the existence of data on to which a specific judgement can be brought while awareness is simply being aware of this data. For the present study, this signifies that while students may have been aware of antibiotic resistance, prior to the intervention they did not have the necessary knowledge to judge how antibiotic resistance occurs and that their own practices contribute to this phenomenon. This can also be observed in the study conducted by Brookes-Howell et al. (2013), where patients did have awareness of antibiotic resistance, but in lack of adequate knowledge, they believed that it was their bodies that became used to the antibiotic rather than bacteria developing resistance.

Similar observations can be made by looking at the research conducted by Sharif and Sharif (2013). In the study conducted by these authors, no intervention was applied however, initial assessments showed that 64.5% of student participants were aware of antibiotic resistance yet 62.5% of the same sample did not complete a course of antibiotics taken without prescription. This indicates that being simply aware of some elements of antibiotic use does not contribute to renouncing the use of antibiotics without prescription in the absence of adequate knowledge and understanding of antimicrobial functionality. Considering this aspect, it is important to point out that the study conducted by Sharif and Sharif (2013) did not assess the actual knowledge and understanding of antibiotic use among the participants, which may have therefore contributed to dissonance in the results obtained. To avoid such limitations, the present study assessed through two previous qualitative and quantitative inquiries the level of knowledge and awareness of the participants over antibiotic use. This dissonance was also observed in our own measurements, whereby the control group had a higher awareness of antibiotics yet there was no difference between this group and the intervention group in terms of knowledge and practice. However, in the post-test phase, the intervention group managed to attain an improvement in awareness by contrast with the control group were values were maintained virtually the same.

Additional studies that focused on improving awareness over antibiotic use (Shehadeh et al.; 2015; Trepka et al., 2001) by using educational materials also concluded that such actions are effective. The studies used far simpler techniques in comparison to the techniques used in this study yet the research still obtained statistically significant results. The lack of cohort investigations can be considered as a major downside of these studies. Such research designs could assess the duration through time of behaviours over antibiotic use once an increase in knowledge and awareness was achieved post-intervention. As a result, any follow-up procedures should be focused on assessing the behavioural change in terms of behaviour improvement and maintenance. Looking at Lewin's model of change, it is important to acknowledge that push-pull forces are always in motion, which may thus imply that old behaviours may re-emerge. It is important to point out that the cohort carried out by Gonzalez-Gonzalez (2015) did underline the fact that knowledge is not sufficient to produce a change that would remain constant through time in antibiotic use and prescription. Therefore, certain circumstances may hinder the received education in favour of a rapid solution for a sore throat or a fever. Future research should thus assess how knowledge and awareness over antibiotic use and the risks involved can impact on behaviours of use on the long term.

Our study looked at behaviour change maintenance five months following the intervention and concluded that in practice, this behaviour was kept. However, even longer times should be comprised in order to verify behaviour resistance throughout seasons. For example, the study conducted by Bolaños (2005) looked at this aspect and included all seasons to account for potential medication use picking during cold seasons. Additional research should also uncover circumstances in which, despite knowledge and awareness, the use of antibiotics without prescription would still occur. Findings from the qualitative study as well as findings put forward by Abbot et al. (2013) indicate that the risk of taking antibiotics without prescription is linked to having a friend or family member working in a clinical setting, and thus with access to such medication. This evidence contrasts with the findings of Harakeh et al. (2015) according to which healthcare students from various years were aware of the risk of using antibiotics without prescription. Looking at this evidence it can be argued that while the knowledge and awareness is there, particularly for people who are already employed in health care, certain circumstances may result in antibiotics being prescribed outside the normal framework of. However, as it was demonstrated, an improvement in awareness is not sufficient to produce change. Therefore, all areas must be addressed in order to obtain a behavioural change.

6.7.3. Attitude

The current study demonstrated that for the targeted population results of measurements taken on attitudes for using antibiotics reflected low levels of knowledge and awareness over the correct use of this medication as well as over the risks of using this type of treatment. Previous literature investigating attitudes of healthcare students on antibiotic use (Dyar et al., 2013; Jones et al., 2012; Khan et al., 2013) indicate that once information has been delivered, students are more likely to adopt an engaged attitude and request more information. This was also true for the present study, where during feed-back assessment students asked for more practical examples on how to address symptoms without the use of antibiotics. In the literature, renouncing medication once symptoms have stopped seems to be a common attitude among users of antibiotics without prescription. In the present study, this attitude was commonly encountered in pre-assessment data which resonate with the findings of Harakeh et al. (2015). Additional negative attitudes in antibiotic use, such as the use of antibiotic for fevers or not taking the full prescribed course are also similar to the results obtained by Suaifan et al. (2012) in a cross-sectional study carried out with Jordanian healthcare and non-healthcare l students.

To achieve a change in attitude, educational materials were used and access to a website for information acquirement was also provided. Similar approaches were reported by Madle, et al. (2009) and Madle, et al. (2004) indicating that the use of educational materials and web-based interventions can improve attitudes on antibiotic use. A study conducted by Taylor et al. (2003) did not find any significant improvements in attitudes over antibiotics use once the intervention was delivered. Nevertheless, if comparing the intervention developed for the present study with the intervention delivered by Taylor et al. (2003) it can be observed that the intervention developed by them is substantially less complex than the intervention delivered in this study. Taylor et al. (2003) exposed participants only once to video materials meant to improve attitudes, while in our study, through the course of 14 weeks, students were exposed to a variety of materials and their knowledge tested. Consequently, this may explain why our study achieved a change in attitudes, while Taylor et al. (2003) did not. Furthermore, our study focused on delivering an educational intervention alongside with a behavioural intervention. This implies that the current study also looked at and applied ways in which knowledge could be improved, which may have also generated a change in attitudes. Another important difference refers to the collection of data from the same sample prior to applying the intervention. This enabled a tailored approach which in the case of Taylor et al. (2003) was missing.

Compared to baseline measurements, the intervention group achieved a statistically significant improvement in attitudes towards antibiotic use. This included attitudes towards using left-over antibiotics, finishing a course of treatment and use for viral infections. The improvement can be attributed to the educational materials that explained the difference between bacteria and viruses which coherently connected to reasons why antibiotics are not effective for viral infections. Additional connections were made with explanations on the development of antibiotic resistance, as well as on information of how behaviour of users can contribute to the development of super-bacteria which can withstand significantly powerful antibiotics.

6.7.4. Practice

As discussed above, the present study accounted for the fact that educational strategies may not be sufficient to change behaviour. For this reason, several behavioural alternatives to the use of antibiotics have been provided to students. These included traditional and rapid remedies for urgent symptoms and infection prevention and control by using proper sanitation techniques. Because one of the main goals of the intervention was to achieve a change in behaviour, the current study measured this change five months following the intervention delivery. To inform our intervention development, previous research (WHO, 2007; Edgar et al., 2009; CDCP), 2016; NHS IPC, 2016; WHO, 2016) on the effectiveness of strategies has been used to extract behavioural strategies that are easy to implement and do not cause a significant difference between the initial behaviour and the behaviour that is intended to be achieved (i.e. washing hands). As argued by Edgar et al. (2009) multiple-behavioural interventions and complex schemes are more likely to be disregarded by students who may return to previous behaviours. To enhance these strategies, additional approaches that were tested and verified for effectiveness by previous research (Parimi et al., 2002; Finch et al., 2004; Mainous et al., 2008; Huttner et al., 2010; Shehadeh et al., 2015; WHO, 2015) were also employed. These included stimulating positive fear among students by reinforcing messages on the negative side-effects of antibiotics and risks on health and antibiotic resistance. As indicated by these resources, such messages are able to provide a positive behavioural change and induce rational use.

Five months following the delivery of the intervention, to assess if behaviours have indeed changed, a closed-ended question with a simple “yes” or no answer was used, namely “Have you used antibiotics without prescription in the past 5 months?” was applied as pre and post-assessment. Before the intervention, the control group had already registered a higher percentage of usage (100%) of antibiotics without prescription by contrast with the intervention group (70%). If not accounting for the five months period, all of the participants, in both groups, had been using antibiotics without prescription. After the delivery of the intervention only 33.3% of the intervention group participants used antibiotics without prescription. However, 66.7% of the participants in the control group had used antibiotics after the intervention. A limitation of this assessment is that it did not account for additional factors which may have resulted in the increase in participants that did not take antibiotics without prescription. Reasons external to the intervention may have also contributed to this aspect. This includes lack of any symptoms during the five months which would have been treated with antibiotics in line with previous behaviour and even social desirability bias which may have contributed to students that did use antibiotics to answer in a way that was expected by the researcher (Hawthorn effect) (Marsden and Wright, 2011).

Another limitation of the intervention study refers to the fact that the assessment of practice was carried out after five months, which may be considered a limited period of time. However, descriptive assessments carried out by McKay et al. (2013) in relation to the effects of an intervention aimed at reducing antibiotic prescription among physicians, notes that when physicians are better trained in acknowledging the risks of antibiotics and the correct use of these drugs, the population is more likely to take antibiotics when adequately needed and thus avoid over-use and misuse. Considering that the study looked at these practices for a period of four years, it can be argued that the behaviour acquired through education can be maintained through time and may result in improvements on adequate use.

Evidence contrasting the results of this study is presented by Jha et al. (2013) and Taylor et al. (2003) who found no statistically significant improvements in renouncing the use of antibiotics without prescription following the delivery of an intervention aimed to increase knowledge and awareness and with it, safe practice. The reasons for which these authors found no significant changes may be related to the simplistic approach taken in their intervention and to the fact that no previous studies have been carried out by the authors to deliver a tailored intervention. Although it can be argued that technology advancements may have aided our intervention by providing constant access to a website where students could review the materials, the contrasted studies are relatively recent and thus had access to the same technological advancements. Some significant differences in methodology between the present study and the study conducted by Taylor et al. (2003) and research conducted by Jha et al. (2013) may account for the different result. These include the absence of a pre-test phase through qualitative and quantitative inquiries, the short duration of the intervention (1 hour) and the absence of a feedback mechanism and quizzes through which participant involvement may be achieved. These contrasts have been observed in other literature, such as in the studies conducted by Fonseca et al. (2012) and Shehadeh et al. (2015) and Gonzalez-Gonzalez (2015). Looking at intervention delivery methodologies in this research it can be concluded that the complexity of the intervention is crucial to its success for practice applications.

An additional aspect that may have contributed to the practical success of the developed intervention can be connected with the fact that this study used an authority figure in presenting sanitation techniques to students. A qualified nurse in this domain discussed with students the importance of washing hands for infection prevention and control. A similar strategy focusing on hand wash and infection prevention control was developed by the Directorate-General for Health in Portugal (Avô et al., 2011) and France (Toubou et al., 2011) while an e-version for teaching children was rated as successful in three UK schools (Farrell et al., 2011). In our study, students in the intervention group were made aware of the qualifications of the nurse prior to the lecture. This element was not used by other interventional researches (Trepka et al., 2001; Azevedo et al., 2013; Jha et al., 2013; Shehadeh et al., 2015; Heydartabar et al., 2016). Furthermore, in an Iranian study conducted by Heydartabar et al., (2016) where a similar complex intervention was used with results collected after 4 months succeeding the intervention, the results attained resembled the outcomes of the current study. Hence it can be argued that interventions to reduce inadequate antibiotic consumption need complexly developed interventions yet simple learner applications in order to be successful.

As argued through this section, there is an irrefutable connection between the acquisition of knowledge and awareness and how these elements become translated into practice. Research shows that simply having awareness of risks associated with using medication without prescription, is not sufficient to ensure that in practice this behaviour will not take place. Moreover, when there is a lack of knowledge on how the biological mechanism functions, awareness of the risk becomes a blurred out notion with no practical application. In this sense, it can be argued that knowledge, especially for the population studied, surpasses in importance the notion of awareness. This can be seen in the baseline results of our own study but also when looking at research conducted by Scaioli et al. (2015) and Harakeh et al. (2015), where students from higher levels of the curriculum had more knowledge on misuse and antibiotic resistance.

Therefore, it can be reasoned that awareness of the risks of using medication without prescription can function only as a fundament for further acquisition of knowledge into why such risks are present. Once this element has been achieved, a change in attitude is most likely to follow. In our study, once students began to acquire some knowledge they requested more information on how to manage without the use of antibiotics thus a shift in attitude was noted. In practical terms, this behaviour seems to have been maintained five months after the intervention. Nevertheless, future research should look into applying complex interventions such as the ones developed in this case and measure effects on longer periods of time. Another consideration to be made is that this intervention may only function in an academic context with students as this was a central piece of the intervention delivery which focused on having it delivered in a controlled environment. As a result, the intervention cannot be applied for the general public although in the long-term, future healthcare students educated by these means may prevent the use of antibiotics without prescription.

6.7.5. Knowledge, Awareness, Attitudes, Practices and Demographic Characteristics

The demographic characteristics of the sample involved in this study seemed to have an impact on the success of the intervention as well as on the level of awareness and attitudes in regards to antibiotic use without prescriptions. Baseline measurements indicated that awareness and attitudes were different in the control group as opposed to the intervention group. Additional differences which have not been correlated were reflected by the mean age of both groups, whereby the mean age of the control group was higher. However, since this difference was not statistically significant it was considered that age did not have an impact on the effects of the intervention. Furthermore, the baseline results did not have an impact on the final outcomes, since the intervention group had a lower level of awareness on the risks associated with the use of antibiotics without prescription which was substantially improved following the intervention.

Additional demographic characteristics which seem to have an effect on the final measured outcomes referred to gender. In our study, male participants scored a statistically significant higher result on knowledge by contrast with female participants in the post-intervention assessment. Similar results were achieved in awareness assessment. The effect was however not noted in attitudes. Several authors (Lujan and DiCarlo, 2006; Slater et al., 2007; Wehrwein et al., 2007; Choudhary et al., 2011) link this difference in results with different learning styles of males and females. Therefore, it is possible that the researcher’s involvement in the lectures and the video-audio materials used may have benefit male students’ learning styles rather than female learning styles. Another study conducted in Saudi Arabia by Yousif, et al. (2014) also uncovered similar differences in learning styles of male and female pharmacology students. Therefore, this element may suggest that future research should account for this difference by integrating feedback from male and female student’s learning style preferences.

In relation to practice, following the intervention, male students had higher rates of using antibiotics without prescription. This phenomenon underlines the fact that although higher levels of knowledge acquisition and awareness were present among male students, in practical assessment these results were not mirrored as male students used antibiotics without prescription following the intervention in a higher number by contrast with females. Internalising the information received thus seems to be problematic for male students. Brinsley et al. (2005) argued in their study that physicians saw the issue of antimicrobial resistance as a national issue rather than an issue within their own clinical setting although having treated patients with such conditions. This may therefore suggest the need for interventions that would aid in personally connecting the issue of antibiotic resistance with the individual and reinforcing the idea that such behaviours may have serious negative effects for the entire population. Brookes-Howell et al. (2013) demonstrated that patients believed that it was their bodies that became used to the antibiotic; hence their behaviour in relation to antibiotic use could not have affected others. Stimulating a sense of responsibility in medical studies to prevent antimicrobial resistance may therefore be used.

6.7.6. Data Triangulation

Data triangulation between the baseline assessment of the intervention study and the interview study revealed a high level of agreement in the findings. This increases the credibility of the findings as it indicates that the data was less likely to be unduly misrepresented in interpretation. Both the baseline assessment of the intervention study and the interview studies revealed that participants had a high level of ignorance surrounding the basic use and effects of antibiotics. Participants in both studies either directly confirmed that they believed antibiotics could be used to treat viral infections or alluded to as much.

Participants in the interview and in the baseline assessment of the intervention study also seemed unaware of the potential dangers of antibiotics. Participants in the baseline survey assessment of the intervention study indicated that they did not believe that antibiotics could kill “good bacteria” present in the body nor that antibiotics could lead to dangerous secondary infections. While participants in the interview study did not use those precise words, several stated that antibiotics posed no danger as they were good for curing illness. This belief indicates the participants were probably unaware of the negative consequences of antibiotic use.

6.8. Conclusions

The finding of our study revealed that using multifaceted approaches of delivering the educational materials through face-to-face communication, discussion, feedback, and using a web site educational resource for 14 weeks is a useful approach to improve the knowledge, awareness, and attitudes of university students with respect to antibiotic use. Ultimately, this may limit the practice of misusing antibiotics among a young and educated segment of the community.

6.8.1. Strengths of the Intervention

This study is the first project in the Gulf region to examine the potential benefits of an educational and behavioural intervention to reduce the use of antibiotics without prescriptions. The most significant issue of the intervention used in this study is that it was developed based on the findings of the survey study and interview study, baseline assessment of the intervention study. To the best of the researcher knowledge, it is the first study that developed its intervention regarding antibiotic use employing mixed method research design.

A main aim of the study was to see whether an intervention trial was feasible to be implemented by using a student sample. Burns and Grove (2009) indicate that initial interventional studies are highly valuable because of their ability to shape future research. More importantly, the current study provides a quantifiable evidence base to support the use of educational and behavioural interventions to reduce the use of antibiotics without a physician's prescription. The importance of the study is that it targeted healthcare students are the antibiotic prescriber of tomorrow, as it is essential to invest in their education focusing on their current knowledge, awareness and attitude toward decreasing the practice of misusing antibiotics. Additionally, the study was conducted with participants from diverse geographical and cultural backgrounds, and therefore encompassed a variety of attitudes towards antibiotic use. Furthermore, the study showed that university interventions offer a significant advantage: they offer the opportunity to contact students in their normal education environment.

The multifaceted nature of this intervention is the strength of this study. This intervention is broader, longer and more multifaceted than those of other studies (Azevedo et al, 2013; Jha et al., 2013; Ashe, 2005; Taylor, et al. 2003; Shehadeh et al., 2015; Trepka et al., 2001; Bauchner et al., 2001).

This study's intervention period and follow-up period were both longer than those of similar studies. This study used a period of 5 months to collect follow-up data. Other studies about the effects of antibiotics education had shorter follow-up periods, e.g. 15 days (Jha et al., 2013), 30 days (Croft et al., 2007), 6 weeks (Ashe, 2005), 6 weeks (Taylor, et al., 2003), and 2 months (Azevedo et al., 2013; Bauchner et al., 2001). Perhaps the greatest strength of this study was the high continued participation rate throughout the intervention. No participants withdrew from the study before completion, and no students who participated in the study until the end of the intervention refused to respond or provided incomplete questionnaires. The breadth of the survey was further enhanced by the research design, in which the instrument was self-administered during university practical classes, enhancing the very high response rate compared to telephone and email surveys. Moreover, by educating students, it might be possible to access other family members. Thus, it might be expected that the influence of our intervention is beyond participated students.

6.8.2. Limitations of the Intervention Study

Limitations in this study specific to the research design refer to issues in trustworthiness as identified by criteria of reliability, validity and generalisability (Heale and Twycross, 2015). Firstly, limitations in reliability, specifically in the accuracy of the instruments used for data collection are to be considered. Although details have been provided in relation to the way in which the intervention was carried out and data collected and assessed, the statistical tests used do pose some limitations. Firstly, due to data inconsistencies between groups, each set of variables had to be analysed via different methods. Secondly, the secondary outcome could not be assessed via a simple ANOVA approach due to the confounding variable. This resulted in the use of ANCOVA in order to account for this covariate. Finally, the McNemar test was applied to assess the primary outcome due to the limitations of the data collected in the pre-test. This test may be prone to error due to the lack of random allocation to intervention and control groups of the participants. Secondly, while validity was considered in this study, self-administered questionnaires do present general issues in relation to participant bias. Notions of generalisability are also problematic due to the sampling procedure used. Additional limitations are listed below.

The research design used was a quasi-experimental design rather than a true experiment. In the current research, matching the participants in the control and experimental groups was not possible. This presents some difficulties in interpreting the findings of this study because of the possible introduction of unknown confounding variables (Robson, 2011), In particular, the possibility of pre-test differences in the experimental and control groups (Mertens, 2010). However, reliable measurement checks were employed to attenuate such effects.

Another limitation of this study refers to the sample used as this was not a representative sample of healthcare students in the Persian Gulf in generally or even of similarly aged students in the UAE. This limits the extent to which findings may be generalised; however, the consistency of these findings with other, similar studies (Jha et al., 2013; Azevedo et al., 2013; Croft et al., 2007) on distinct populations gives some reason to believe that the findings may be confidently generalised, at least to similar populations in other areas

A further limitation is that this study used a single framework to illicit change, specifically Lewin’s Change Theory. This method is more appropriate for inducing organisational change rather than behavioural change. Social Cognitive Theory may have been more appropriate for this study because of its emphasis on the use of a combination of individual behaviour interventions and broad-scale environmental interventions to support those behavioural changes (Bandura, 1986). However, it was considered that these students will be part of health care organisations, and may therefore be able to act as change agents in relation to antibiotic use within the UAE.

Before the intervention was delivered, baseline measurements of the primary and secondary outcomes were taken from participants. After this process, the intervention was delivered each week for a total period of 14 weeks, accounting for a total period of 3.5 months. Measures of the primary and secondary outcome were not taken during the intervention. As discussed in this chapter, this time was considered to be sufficient for participants to assimilate the new knowledge. A total period of five months was allowed to elapse from the final week of the intervention, to a new session of data collection. It was considered that in order to assess the efficacy of the intervention developed in creating a durable behavioural change, a longer period is to elapse between intervention and assessment. Other studies used shorter periods; however, their scope was to modify knowledge or awareness or/and attitudes with limited implications for behavioural change. A simple comparison test with an extended period of time pre and post-intervention was therefore considered adequate to assess efficacy. If no changes or non-statistically significant changes would have been observed, then the scope of the intervention, which was to induce life-long behavioural change, was not achieved. However, this extended period may be considered as a limitation due to the fact that the effects of the intervention could have been reduced in time.

Self-administration questionnaire might also have introduced recall bias for the respondents, leading to over- or under-reporting of individually correct or inappropriate attitudes and behaviours (Ficarra et al., 2011; Gualano et al., 2011).

The best approach for this study was to conduct follow-up interventions with first-year healthcare participants that had already participated in the main survey study. Nevertheless, at the time of conducting the intervention study (study three), those first-year participants of the survey study were in their fourth year of study and they were considered at a lower risk of using antibiotics without prescriptions based on the findings achieved from the main survey study (study one).

Despite of employing multifactorial approach to deliver our intervention, workshops have not been used. Peer-education workshops have been shown to improve school-aged children about antibiotics microbes and hygiene (Young et al., 2017)

Cost-effectiveness of the intervention used in this study has not been assessed. This study did not investigate brand names of antibiotics that are commonly used without a prescription by participants

6.9. Summary

This chapter presented the study conducted for testing the efficacy of an intervention to reduce the use of antibiotics without prescription in a sample of first-year healthcare students. Because this population has been identified as a high-risk group for using antibiotics without prescription, a purposive sampling procedure was employed. Two main criteria were used to select the participants; participants had to be healthcare students and had to have used antibiotics without prescription five months prior to the intervention. Participants selected were assigned to intervention and control groups in a ratio of 1:1. Data was collected pre and post-intervention in relation to their knowledge, awareness, attitudes and behaviours of antibiotic use, as well as in relation to the use of antibiotics five months before the intervention (baseline) and five months following the intervention.

Results indicated that the intervention was successful in improving knowledge and awareness of antibiotic use, as well as in reducing the use of antibiotics without prescription. Limitations of this study were considered throughout this chapter, including limitations related to sampling procedures, study generalisability, limitations related to the design of the study, as well as limitations emerging from the data collected as related to drawing final conclusions.

Chapter Seven: Summary Discussion

7.1. Summary of the Main Findings

The results of the main survey study showed that 85.9% of the eligible students (n = 2875) reported self-using of ONPD in their lifetimes. Moreover, 57.2 % (n = 1348) of those participants who completed the questionnaire in full (n = 2355) reported using ONPD in the 3 months prior to conducting the study. Of those ONPD users, 22.2% were incautious users, 8% were inappropriate ONPD users for self-treating the most recent symptom, 28.6% were either incautious or inappropriate ONPD users, 38.6% used antibiotics in SMP and 34.1% admitted polypharmacy behaviour. It is important to note that only 27.3% of the responsible ONPD users (n = 1049) reported reading everything on the drug information leaflets and this might explain why only 32.3% of those responsible ONPD users identified that reading the drug information leaflets made them change the way they used their drugs. Altogether, this prevalence highlights the need for an effective intervention to enhance the safe and effective use of NPD among students in the UAE.

The most common reasons for using ONPD among students were minor illnesses that do not need a physician's visit (78.7%), saving time (54.5%), previous experience (42.4%) and emergency use (24.5%). Moreover, the most common sources of ONPD information reported by participants was pharmacists (61.9%), physicians (54.7%), family (48.3%), previous experience (38.9%), drug information leaflets (30.9%) and the internet (24.3%). Furthermore, private pharmacies were the most common source of ONPD acquisition for the majority of the participants (86.1%), followed by supermarkets (30%), leftover from previous use (23.7%), and friends and neighbours (17.5%). The most commonly used ONPD categories among users were analgesic and antipyretic (84.9%) followed by non-steroidal anti-inflammatory drugs (NSAIDs) at 76.3% and then drugs used for coughs and colds (41.7%).

In total, the present study identified 30 newly reported risk factors: eleven risk factors for incautious drug use, three risk factors for inappropriate ONPD use, nine risk factors for using antibiotics without prescription and seven risk factors for polypharmacy behaviour. The risk factors for incautious ONPD use were younger age, gender, expiry date checking behaviour, polypharmacy behaviour, trust in health care professionals, medical advice seeking behaviour, professional- source of ONPD information, informal- source of ONPD information, reading medical books/ the internet- source of ONPD information, self-care orientation and being a healthcare student. In addition, polypharmacy behaviour, belief about safe use of ONPD, and medication knowledge were risk factors for inappropriate ONPD use. Risk factors for using antibiotics without prescription were:

- nationality
- cost influence
- behaviour
- cost-effectiveness belief
- medication knowledge
- year of study
- being a healthcare student
- saving money
- emergency use
- self-care orientation

Factors associated with polypharmacy behaviour were: frequency of use,

- advice-seeking behaviour
- effectiveness-belief
- informal source
- self-care orientation
- perceived-health
- appropriateness of drug use
- likelihood of using antibiotics without a prescription

The interview study consisted of 15 participants and explored their views, opinions and experience on the use of antibiotics without prescriptions. The main goal was to explore the factors that contribute to use antibiotics without prescriptions among first-year healthcare students in the UAE. The analysis identified five key themes which reflect the knowledge, awareness, attitude, belief, experience and behaviour of participants regarding the using antibiotics without prescription. These themes also reflect their understanding of the relationship between self-medication with antibiotics and the development of antibiotic resistance. Furthermore, five subthemes were recognized and subsequently targeted in the intervention study three. These subthemes are successful previous experience with the use of antibiotics for repetitive or familiar symptoms; the urgency of situation and financial reasons; leftover antibiotics; inadequate knowledge about indications of antibiotics and antibiotic resistance, as well as attitudes towards completing the course of antibiotics.

Participants reported that they kept leftover prescription antibiotics and took them at a later date when they had a similar illness. This was the most prevalent way students gained access to prescription antibiotics without a prescription. While less prevalent, some students reported getting antibiotics from their friends and family. According to these participants, this method of gaining antibiotics was more time efficient than scheduling and attending a physician's appointment. Time was reported as the biggest barrier to utilising traditional methods to gain antibiotics through physicians' prescriptions. As students, many had a demanding schedule that made seeing the physician during normal business hours difficult. Urgency was another reason in students' decisions to self-medicate. Participants reported that if they were concerned about a sudden illness, sometimes they treated themselves with antibiotics that were available to them out of concern that their symptoms would get worse before they could visit the physician. In the UAE, non-emergency patients would generally be consulted following a prior appointment within 48 after requesting medical services (The National, 2018).

While many participants said they would not recommend self-medicating to their friends and family, they also reported that it was not seen as an unacceptable behaviour. Previous experience of using antibiotics for specific symptoms was another reason for using antibiotics without prescription. The majority of participants agreed that agency-level change would help reduce the use of antibiotics without prescription. Several participants believed that prescription requirements should be strengthened to prevent overuse. Most students who participated in the interview study also participated in the intervention study to enhance the reliability of the findings.

Based on the findings of the main survey in study one and study two, the knowledge, awareness, attitudes and practices of a sample of healthcare students at high risk of self-prescribing of antibiotics without prescriptions were evaluated before and after an educational intervention. The purpose of the intervention was to examine changes in knowledge, awareness, attitudes and practices of students regarding the use of antibiotics without prescription. The association of these measures with demographic variables was also explored. A pre-test to post-test quasi-experimental research design was implemented, with an equal number (n = 70) of healthcare participants in the control group and the intervention group. The results showed that the knowledge, awareness, attitudes and practices of the students in the intervention group were significantly improved after the educational intervention relative to the control group. Furthermore, the gender of the respondents had a significant effect on knowledge, awareness and practices. The male students in the intervention group scored higher (Mean=9.00 versus 8.30) than the female students. Knowledge, awareness, attitudes and practices did not vary with respect to age, living inside on campus, or family living status (living with or without family).

Based on the results of this intervention study, it can be argued that the intervention employed in this thesis could potentially address the issue of antibiotic use without prescription among healthcare students. It appears that this educational programme could be easily replicated or adapted for use at other universities with higher education students, complemented by experimental research, as a means of developing and promoting the long-term retention of knowledge, such as has been seen with the e-Bug program (Avô et al., 2011).

7.2. Data Triangulation

Data triangulation in this investigation was achieved by corroborating data from the survey study with data retrieved from the interview study. As a result of this procedure, specific areas to be addressed in the intervention study (knowledge, awareness, and attitudes) were uncovered. Based on the data collected from the survey study it could be determined that the prevalence of ONPD use is high among university students. Although this may not represent an issue on its own, when corroborated by data related to rational use, the survey study determined that students not only excessively used NPD, but also used them irrationally. Almost a quarter of these students also took antibiotics without prescription. Based on WHO criteria, this was determined to be a critical aspect of irrational use of medication. Considering this aspect, the interview study investigated in more depth this behaviour. However, this does not signify that NPD irrational use is not an issue to be further addressed by researchers, the local government and even universities. Throughout the investigation, this study found that NPD use is problematic not only in terms of antibiotic use without prescription but also in terms of side effects resulted from polypharmacy and consumer lack of awareness on rational use. These two domains were however not investigated and should represent an area of focus for further studies.

In the interview study, the results related to the use of antibiotics without prescription as emerging from the survey study was further examined. Given the qualitative nature of the second study the total of 38.6% of people (using antibiotics without prescription as emerging from the survey) could be interviewed. Considering that the total initial sample was 2875, this percentage totalled over 700 students. This type of sample in a qualitative interview study would have produced data that would have required a significant time to be analysed. A limitation of this study, therefore, derives from the fact that students who have been identified as using antibiotics without prescription were not interviewed, but a new sample was selected. Including this entire sample may have produced themes which may have been disregarded, especially since theoretical sample saturation was approached via purposive sampling.

By triangulating data from the survey study and the interview study it can be observed that reasons for using antibiotics without prescription are similar to reasons for using NPD. Most participants quoted a lack of time for not visiting the physician, previous experience, and fear of aggravating symptoms. Antibiotics were however perceived to be more strong that NPD and used only in situations in which participants believed the condition to be serious. These participants were also more likely to engage in polypharmacy behaviour. Consequently, the data indicates that while some reasons for using NPD are similar to those for using antibiotics, people who were more inclined towards self-care and respectively self-medication were actually the ones who subjected themselves to the highest risks of irrational medication use. Considering these aspects, the intervention study sought to generate better knowledge and awareness on antibiotic use and through this determine behaviour and attitude change as related to using antibiotics without prescription.

While the intervention was found to bring statistically significant changes as assessed by eliminating antibiotic use after the intervention, a significant number of participants did not experience a behavioural change. By looking back at the data emerging from the survey and the interview study, some hypotheses may be issued in relation to the results of the intervention. Firstly, although knowledge and awareness may be increased, this does not address the reasons identified for antibiotic use, specifically lack of time or costs associated with medical examinations. This also does not address the fact that participants had previous experiences which resulted in symptom amelioration. Secondly, because of this implication, it may be argued that educational-behavioural interventions are not sufficient to eliminate antibiotic use without prescription. Wider system approaches would be necessary, such as free or affordable healthcare or university free days to facilitate student access to medical care and address both costs as lack of time.

7.3. Study Implications

To the best of the author's knowledge, this is the first study to define operational terms for investigating the multi-facets of the irrational use of medication. As defined by the current investigation, this research assessed irrational use of medication from the perspective of four main behaviours: incautious use, inappropriate use, using antibiotics without and polypharmacy. Through a narrative analysis of previous literature studying consumer NPD behaviour, this study concluded that the terminology is highly inconsistent, which therefore makes the analysis of current NPD consumption behaviours difficult. Furthermore, for some forms of behaviour that has been reported previously in the literature, there was no defining operational term. For example, in the literature, there was no definition of incautious use of ONPD medication, as opposed to cautious use. Incautious use was therefore defined in other publications issued by the author of the thesis (Al-Kubaisi et al., 2017b; Al-Kubaisi et al., 2017c). With no objections to this terminology, incautious use was applied in this thesis to describe people who take NPD for the first time without reading the information leaflet.

By accessing data from multiple sources of literature it was determined that irrational use is a complex phenomenon, which cannot be understood from a single behavioural assessment. Therefore, an important implication of this study is related to how future investigations can use this terminology in order to investigate how irrational use of medication occurs, how it is assessed and how it may be addressed.

Other implications of this investigation emerge not only from the individual studies carried out, but also from triangulating the results of these studies. Firstly, the survey study demonstrated that the prevalence of NPD medication use among the student population in the UAE is significant. This indicates that at any given point, students will be using these medications to treat headaches, colds and inflammations. NPD use is a significant contributor to decreasing the burden on the medical care system, by allowing people to be empowered and address their own minor symptoms. The context in which NPD becomes a risk can be directly connected with irrational use. As the survey study demonstrated, the prevalence of NPD use is high but at the same time, the knowledge on how these should be used, as related to appropriate use, cautious use, antibiotic use and polypharmacy is problematic.

Therefore, the results obtained from the survey study demonstrate that NPD use is high among student populations in the UAE and that these medications are not used rationally. This further may expose these young people to significant health risks. As previously noted, NPD increased prevalence may indicate that patients can treat their own symptoms without additional medical consultations and associated costs. However, when corroborated by irrational use NPD becomes a risk for health, which may instead increase the burden on the health care system and produce permanent health issues for young people. Hence this study provides a justification for awareness campaigns and potentially for changing the NPD package information to address incautious use. Where user information is listed on the NPD package, incautious use is significantly reduced (Gharibyar et al., 2013).

In addition, the survey study determined that a large portion of participants received information on NPD use from pharmacists. This indicates that improving pharmacist counselling skills could potentially reduce irrational use of NPD. Two previous studies (Neto, 2003; Berger et al, 2005) used pseudo-consumer techniques to test interventions for pharmacists counselling improvement. This indicates that methods for improved pharmacists counselling do exist and these could be used to improve knowledge on NPD use via pharmacists counselling. In the present study, the interview investigation revealed that some participants would seek information from the pharmacists in relation to antibiotic use. As a result, having pharmacists trained in explaining the importance of medical consultations prior to antibiotic use may reduce irrational use.

The survey study also demonstrated that students in the UAE exhibit one of the most dangerous forms of self-medication and irrational use, specifically the use of antibiotics without prescription. The interview study analysed this and determined that healthcare students are inclined to believe that they have good knowledge on how to use antibiotics. However, the investigation determined that they do not, especially if they are first or second year students. The implications of these findings seem to suggest that antibiotic education should be taught to first-year healthcare students in order to avoid irrational use. It is to be noted that this investigation showed that students in the fourth academic year were less likely to engage in this behaviour. This implies that as students accumulate more knowledge and awareness on the mechanisms of antibiotic resistance, they are also less likely to use antibiotics without prescription. Therefore, this has significant implications for rational prescribing of antibiotics and for medical Universities that should be aware of the fact that superficial knowledge and the title of healthcare student may result in irrational use of antibiotics for this class of people. This study demonstrated that this is particularly the case for first-year healthcare students, who overestimate their knowledge and awareness of antibiotic use.

Additional implications refer to the roles of pharmacists not only in educating the public and selling antibiotics only with a prescription, but also tracking the use of antibiotics and advising people on how to dispense of left-overs (ECDC, 2017). Since many of the participants took left-over antibiotics from their friends and even their parents, this study therefore found that these recommendations are not applied in practice.

Finally, the implications of the intervention study refer to practical measures for reducing the use of antibiotics without prescription. Although a multi-strategy intervention was used, which determined statistically significant reductions in antibiotic use without prescription; it has to be acknowledged that from the 70 participants, 44 still used antibiotics without prescription. This implies that for 63% of the participants the intervention did not work to eliminate antibiotic use without prescription. Albeit the intervention was successful for the remaining participants, these results imply that other types of strategies may be necessary. Some indications (Barrett et al., 2011) point to the fact that people experience placebo-like effects when taking antibiotics to treat a non-infectious condition. This may further contribute to positive use experience which thus renders the habit of taking antibiotics without prescription hard to break. This may further imply that strategies to alter this perception and thus dismiss the placebo effects could be further tested. It is to be noted however that during the intervention, students had a significant number of questions and contributed to the discussion on antibiotic use and antibiotic resistance. Therefore, it is the opinion of the author that future interventions should use this type of approach as this may facilitate understanding and learning. This strategy is known within educational practices as “interactive teaching”, and it is believed to have a significant advantage over classical educational techniques such as presentations (Le Corvoisier et al, 2013).

Both the survey study and the interview study demonstrate significant healthcare implications for the student population in the UAE. The majority of the participants quoted the lack of time for not visiting the physician to get a prescription. Further examinations to determine the reasons for which students quoted a lack of time for visiting the physician were not carried out. At the same time, it was observed that most students who used NPD and used antibiotics without prescription were not UAE residents, but had different nationalities. The UAE health care system does not cover health insurances for foreigners, even though they are students. Combined with the lack of time, this issue determined students to often treat themselves in order to avoid medical expenses. Hence, the data emerging from this study indicates that the academic environment can be a contributor to the irrational use of medication.

Other practical implications emerge when the results of the three investigations are interpreted concomitantly. Firstly, there is a high prevalence of NPD use among student populations, from which antibiotic use risk is the most significant issue related to irrational use. Secondly, students tend to use these medications irrationally. Finally, education alone, although multi-facet, cannot fully address this issue. Based on these aspects, it may be implied that governmental intervention is not only required but also necessary. Pharmacist education on advising consumers for rational use is also needed.

7.4. Recommendations

This study determined that the vast majority of students, especially healthcare students, use antibiotics without prescription. Considering these findings, the first recommendation refers to enforcement of regulations in relation to antibiotic sales within the UAE. Secondly, policies should focus on extending medical coverage to all UAE students. This is because the current investigation found that the use of antibiotics without prescription is more prevalent for foreign students. This study determined that although irrational use of medication may be assessed via a series of behaviours, irrational use also arises from the healthcare system. Students attempted to reduce medical costs by avoiding physician consultations. As a result, this study recommends that free or affordable healthcare should be provided to students in order to avoid creating an environment that facilitates irrational NPD and the use of antibiotics without prescription. This is relevant for the future health of young people as a severe disease may have mild symptoms and may only be detected by a medical consultation. Treating these symptoms with NPD can result in a short-span amelioration thus allowing for the disease to progress. Additionally, using antibiotics without medical consultation can result in severe side effects and microbial resistance due to improper use. Having free or affordable care, students could access medical consultations without having to avoid such circumstances because of costs. Extending medical coverage to all students in the UAE, regardless of nationality, may prevent irrational use.

This study demonstrated that the prevalence of irrational use of NPD among the surveyed sample is significant. In this sense, the fact that in the UAE drug use information is not printed on the box may contribute to incautious use. Based on the results from this investigation, it is therefore recommended for pharmaceutical companies to consider printing this information on the package. Furthermore, the local government should also initiate new regulations in this sense. Printing on the box information in relation to: symptom to be addressed, dose to be used and frequency (e.g. to be used for headaches, one pill every 6 hours) can significantly reduce at least several facets of inappropriate use (Gharibyar et al., 2013).

Results obtained in the survey study determined that the vast majority of participants obtain information on NPD use from pharmacists. This provides a significant opportunity to address both inappropriate as well as incautious use of NPD. Educating local pharmacists, especially those employed in pharmacies in the proximity of Universities can increase the rational use of medication among students through improved quality advice from pharmacists.

This study determined that medical consultations are not only avoided because of costs, but also because of lack of time, due to mandatory lecture participations. University policy should thus address these issues by allowing students at least one day off, justified with medical consultation documents, to attend to their health.

The current investigation determined that using antibiotics without prescription is more common among healthcare students in the first and second year of study. At the same time, these students were found to be very confident in their ability to use antibiotics correctly, although assessments of knowledge and awareness demonstrated that this is not the case. Considering these findings, the current study recommends that Universities should implement antibiotic education from the first-year of study to avoid irrational use.

Community pharmacies could design and display clear posters related to warnings on ONPD inappropriate use and the risks of antibiotic use without prescriptions. This recommendation was made by a participant in the interview study. However, it must also be considered that poster display was found to be highly ineffective in modifying inappropriate use of medication behaviours (Ashe et al., 2006).

Future studies could employ the educational tool developed by this study to elicit behavioural change in the way in which students and other populations use antibiotics. This study demonstrated that with improvements in knowledge and awareness of antibiotic use, the behaviour of using antibiotics without prescription also changed. This indicates that the use of antibiotics without prescription and by extrapolation, a major contributor to global antibiotic resistance, can be tackled through educational interventions that seek behavioural modifications. Because the tool was intended to also address first-year healthcare students, which have limited knowledge on antibiotic resistance, the tool may also be adapted and used by other studies using different populations (e.g. non-healthcare students).

7.5. Areas of Future Research

Some findings in the survey study indicate the need for more investigations to be carried out into self-medication behaviour. One of the most relevant issues to address in future research is the connection between polypharmacy behaviour and the use of antibiotics without prescription. Another area for further investigation refers to the connection between the perceived health status and polypharmacy behaviour. Qualitative investigations should assess the root cause of the effects to aid in developing strategies for minimising this behaviour. Additionally, other studies should assess self-medication behaviour among student populations in other regions, possibly through a qualitative investigation looking at perceptions, attitudes, knowledge and behaviours. Another area that deserves further exploration refers to knowledge and use of antibiotics. Hence in this circumstance participants with poor-to-moderate medical knowledge were less likely to use antibiotics without prescription in comparison to participants who had good medical knowledge

The present study provides evidence that reading the drug information leaflets (cautious use of a drug) is not associated with appropriate use of that drug, which means that both behaviours are not dependent on each other. These findings reveal that reading the drug information leaflet does not ensure appropriate drug use among the individuals. The relationship between cautious and appropriate non-prescription drug use requires further investigation.

The present study provides realistic evidence that the category of the programme offered in the college (medical versus non-medical) has an influence on the cautious use of drugs and the use of antibiotics without a prescription. The findings reveal that incautious use of drugs and using antibiotics without a prescription were highly associated with respondents of medical colleges, which is an area that requires further research.

Investigating polypharmacy within the present study and its potential influence on cautious drug use, appropriate drug use and using antibiotics without prescription were crucial. It is striking to discover that there is a relationship between the behaviour of reading the drug leaflet (i.e., cautious use) and the use of multiple drugs for a single ailment (i.e., polypharmacy). Nevertheless, it is much more striking to find that the likelihood of using a drug inappropriately is associated with polypharmacy behaviour. The findings of the present study also revealed that polypharmacy behaviour is related to misusing antibiotics without a physician's prescription. Other studies should seek to replicate these findings using UAE student population but also different populations to determine if demographics play any part in these connections.

It was not surprising to discover that the length of the leaflet (i.e., too long) is the primary reason for not reading the drug information leaflet for the majority of the respondents in the present study. Nevertheless, it was striking to discover that family and friends are an obstacle to reading the leaflet among almost 40% of respondents as those respondents consult their close circle of relatives and friends. Consulting family and friends to get information about drug use requires further investigation to have a better understanding of the reasons behind such behaviour. The quality of the internet sources consulted by participants was not assessed. Future studies could assess this area of information for NPD use. Some of the factors associated with ONPD use identified in the present study, such as cost-effectiveness belief, are new factors. Future studies should investigate their relevance to ONPD use, as well as to using antibiotics without prescription.

Approximately 40% of the respondents stated that previous experience was the main reason for using drugs in self-medication practice. This is not a surprising finding; however, there is a need for a further qualitative investigation to gain more information about the nature and the outcome of that cumulative experience of using non-prescription drugs. The present study should be replicated within universities in other countries and among other segments of the UAE society beyond university students. Of particular interest might be high school students, thereby fostering appropriate and cautious non-prescription drug use in students prior to entry into university in the UAE. Additionally, graduate students, adult professionals and the uneducated segments of society in the UAE may differ from undergraduate students in the risk factors for incautious non-prescription drug use, inappropriate ONPD use, antibiotic use without prescriptions and polypharmacy behaviour, which is an important area for future research.

Future studies should be designed to investigate other risk factors that might be related to irresponsible ONPD use, inappropriate ONPD use, antibiotic use without prescription and polypharmacy behaviour in the UAE among university students beyond those identified in the present study. While one strength of the present investigation was the inclusion of more than 40 potential explanatory variables, the predictive power of the models was modest, indicating that there may be additional explanatory variables that can be identified towards promoting healthy ONPD use among students in UAE. Further variable testing may be employed by future research based on the five themes emerging from the interview study. Future studies could assess contextual factors, such as waiting times, medical coverage, health care policy and consumer previous experience with the medical health system.

Future studies should investigate the effect of the recall period on both the prevalence of use and the risk factors identified for the four different outcome variables (cautious ONPD use, appropriate ONPD use, antibiotic use without prescriptions and polypharmacy behaviour). The reason for that is to compare the prevalence of ONPD use and the risk factors between two time periods (90 days and lifetime use).

The present study was focused on the oral dosage form; therefore, future research is needed towards assessing appropriate drug use of other dosage forms and including other drug categories, such as topical agents, herbal drugs, and nutritional supplements.

In relation to the sale of antibiotics without a prescription, pharmacists' knowledge and perceptions is an area of research that should also be explored further. The use of the qualitative analysis approach allows the researcher to explore the reasons behind the practice.

More research is necessary to fully understand the medication experiences of students and young adults who frequently take antibiotics without a physician's prescription. An analysis should be conducted to examine how these practices might be used to optimise consumers' medication-taking behaviours; asking the important questions to determine whether there are stages of the medication experience that consumers pass through (Shoemaker and De Oliveira, 2008).

Future studies should test the intervention developed and determine improvements that can be brought to generate even more reduction in the use of antibiotics without prescription. For example, the session time and discussion time could be expanded in a study using a similar population and design. This would help in determining if longer session times are more effective in producing behavioural change.

7.6. Conclusion

This thesis is built on WHO guidelines for developing a process so that effective interventions can be designed to make drug use more rational. The objective was to create and develop an educational intervention to improve rational use of ONPD among university students in the UAE with the hope of being successively used in other universities. The first step in this process was to investigate the current trends and practices in the use of Oral Non-Prescription Drugs (ONPD) among university students. The first study conducted as part of this research — a survey study — explored university students' current knowledge, attitudes, behaviour and practices with respect to ONPD. The irrational use of non-prescription drug was found to be high among university students in the UAE. The survey recognized four types of problems relating to irrational use of drugs: incautious use, inappropriate use, polypharmacy and the use of antibiotics without prescription. A qualitative study was then carried out to further explore the reasons behind the use of antibiotics without prescription among healthcare students in the UAE. Rating these problems via the Severity Risk Matrix, encouraged the researcher approach the matter of using antibiotics without prescription as an urgent priority through an intervention.

The interview study was conducted to further investigate the reasons behind using antibiotics without a prescription and to help create, develop and conduct an educational intervention. It explored common themes associated with knowledge, awareness, attitude, opinions, and perceptions related to the use of antibiotics without prescription in the UAE and also identified possible strategies to limit this problem.

Finally, an intervention study was conducted to improve knowledge, awareness, attitudes and practices regarding the use of antibiotics without prescriptions among students who were at high risk of self-medicating. The intervention, which had both educational and behavioural components, was found to be effective in significantly improving practice, knowledge, awareness and attitude scores. The educational intervention motivates students to use NPD more wisely. This successful pilot intervention highlights the need for more interventional research on other types of irrational drug use to enhance the safe and effective use of NPD. However, despite its explicit effect, our intervention had some limitations that might restrict its use in other universities. The mixed methods approach adopted in this research provides a broader perspective to healthcare professionals, policy makers, and universities.

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Appendices

Appendix 1: Information letter to students

UNIVERSITY OF GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

To Whom It May Concern – **Participation in a research study**

Title: ***Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor (s) of Irresponsible/Inappropriate OTCD Use.***

Dear Sir/Madam,

My name is Khalid Ayoob. I am a resident of the Emirates and a registered PhD student with the University of Gloucestershire, Gloucester, United Kingdom. The purpose of this letter is to request your kind participation in my PhD research.

I ask that you complete a survey regarding the use of Oral over the counter drugs. The survey takes 10-15 min. to complete.

All participation will be completely voluntary, and data will only be obtained after getting your participation approval. Participant privacy and confidentiality will be assured because names will not be requested at any time. All data will be kept private and secret in a locked office so that only I will have access to the data. Data will be destroyed five years after the study has finished.

By taking part in this study, you may help future students to become more responsible users of OTC drugs. This study involves no deception. The data will be published as a doctoral dissertation. There are no known risks associated with taking part in this study. The research is supervised by professors Walid El Ansari and Dr. Don Vinson *(if you have any queries you can contact them on: professor Walid on Tel: +44 (0) 1242 715274, Email: walidansari@glos.ac.uk. And Dr. Don on Tel: +44 (0)1242 715277, Email: dvinson@glos.ac.uk).*

Ethical approval has been provided from the University of Gloucestershire, Gloucester, United Kingdom. Please contact Dr Malcolm MacLean, chair of the research ethics subcommittee for the Faculty of Applied Sciences at the University of Gloucestershire, if you have any ethical concerns. (*Tel: 01242 715200, Email: mmaclean@glos.ac.uk*).

Your participation in this study will be greatly appreciated.

Yours sincerely,

[redacted]

Khalid A Ayoob

Appendix 2: Cover letter of the questionnaire

UNIVERSITY OF GLOUCESTERSHIRE

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Tel: 01242 715132

Title of the Study: Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor (s) of Irresponsible/Inappropriate OTCD Use.

Dear participant,

I am Khalid Ayoob, a registered PhD student with the University of Gloucestershire, Faculty of Applied Sciences, and United Kingdom. I am conducting the attached survey as the fieldwork for my doctoral thesis. I would like to know your opinions and experiences with the use of 'Oral Over-The-Counter Drugs (OTCD) or what is called <u>oral</u> non-prescription drugs that are used for the prevention/ treatment of minor illness and symptoms which do not require a doctor's consultation. The University of Gloucestershire faculty research ethics panel has approved this study.

Many thanks in advance for taking the time to fill out this survey. It will take approximately 10-15 minutes of your time. Your participation is voluntary and confidential. Participant privacy and confidentiality will be assured because names will not be requested at any time. All answers will be collected and analysed together as a group and will be used for research purposes only. You are under no obligation to take part in this study and you are free to withdraw without giving a reason at any stage before completing the survey. ***By completing the questionnaire, you do agree to participate in the study***.

<u>Instructions for filling out this questionnaire</u>

<u>Oral</u> non-prescription drugs are those drugs that you can buy/use without a need for a doctor's prescription for the prevention/treatment of minor illness and symptoms. Oral non-prescription drugs **can be purchased from pharmacies and supermarkets.** There are many types of oral non-prescription drugs, **for example, Panadol® for headache and fever.**

Please **<u>answer all the questions</u>** below as honestly and completely as you can.

Please use a black or dark blue pen to write your answers. Answer the questions by ticking the answer or writing down in the blank space.

Please tick the boxes the most closely match your personal opinion, attitudes, and experience:

√

To change your answer, please cross out the wrong choice and then tick the correct one:

X

Appendix 3: The questionnaire of the main survey

1. Below is a list of oral non-prescription drugs that is used for self-medication of minor illness. Which of the following categories do you **most commonly** use? Please Tick all that apply

Category	Answer
Anti-Allergic drugs/Antihistamine like Claritin® الادويه المضادة للحساسيه	☐
Analgesic/ Antipyretics like Panadol® الادويه خافضة الحرارة/ المسكنات	☐
Antacids /Acid Reducers like Gavisicon® الادويه المخفضه لحموضة المعدة	☐
Antibiotics like Augmentin® المضادات الحيويه	☐
Anti-diarrheal like Imoduim® الادويه المضادة لل الاسهال	☐
Anti-nausea & vomiting drugs like Motilium® مضادات القيء والغثيان	☐
Cough & cold drugs like Sinecod® syrup مضادات السعال	☐
Laxatives drugs like Dulcolax® الادويه الملينه - المسهلات	☐
Pain relief like Voltarine® مسكنات الالم	☐
Stomach & abdominal spasm drugs like Buscopan® مضادات المغص المعوي	☐

2. Where do you most often obtain/ gain/ buy oral non-prescription drugs from? Tick all that apply

Private Pharmacy ☐	Hospital ☐	Left over from previous use ☐
Supermarket ☐	Friends/ neighbor ☐	Others (specify).........

3. How do you gain the information about the use of oral non-prescription drugs ?Tick all that apply

Doctor/Physician ☐	Nurse ☐	Drug information leaflet ☐
Pharmacist ☐	Friends/ neighbor ☐	Previous experience ☐
Radio, television ☐	Family ☐	Newspapers or magazines dvertisment ☐
Medical books ☐	Internet ☐	Other(specify)...............

4. How many oral non-prescription drugs do you usually take for self-treating <u>a single illness</u> per day?

   One drug ☐ Two drugs ☐ Three drugs ☐ Four drugs ☐ Five or more drugs ☐

5. How frequently do you take oral non-prescription drugs for self-medication?

   Daily- use ☐ Weekly-use ☐ Monthly- use ☐ Yearly-use ☐

6. Have you ever experienced a negative reaction or side effect from taking oral non-prescription drugs?

   Yes ☐ NO ☐ Not sure ☐

7. Does the price of oral non-prescription drugs affect your decision to use/take it?

   Always ☐ Often ☐ Rarely ☐ Never ☐

1

8. Do you check the expiry date on drugs before taking them? Please tick the answer, which closely reflects what you usually do.

Always ☐ Often☐ Rarely☐ Never☐

9. Have you ever taken more than the recommended dose of oral non-prescription drugs? (IF NO/ Not sure SKIP TO Q.11)

Yes☐ NO☐ Not sure☐

10. If you take more than the recommended dose, please specify why? Tick all that apply

Believed it would be relieved faster	☐	Did not get any better taking the recommended dose	☐
Had severe symptoms	☐	Previous experience	☐
Other (specify)......			

11. What is your common reason(s) for self-treatment with oral non-prescription drugs? Tick all that apply

It saves money	☐
It saves time (waiting time/transportation time)	☐
My illness is not serious enough to require seeing the doctor (minor illness)	☐
For prevention of diseases	☐
My previous experience of treating illness	☐
Emergency	☐
Oral non-prescription drugs are just as effective as prescription drugs	☐
Other reason, specify...................................	

12. When you use oral non-prescription drugs for the **<u>first time</u>**, DO you read the oral non-prescription drugs leaflets before use? (IF THE ANSWERS ARE "Rarely" or "Never", SKIP TO QUESTION 18)

Always ☐ Often ☐ Rarely☐ Never☐

13. What information do you read in the oral non-prescription drugs leaflet? You can tick more than one answer

Indication ☐ Dosage☐ Drug-drug interactions ☐
Cautions ☐ Adverse effects☐ Contraindications ☐
All of it / everything ☐ Not sure/ do not know ☐

14. How would you describe the information in the oral non-prescription drugs leaflet? Tick one answer only

Very easy to understand☐ Easy to understand☐
Very difficult to understand☐ Difficult to understand☐

15. How useful do you think the information in the in the oral non-prescription drugs information leaflet?

Useful☐ Not sure ☐ Not useful☐

16. Do you keep the oral non-prescription drugs information leaflet you receive for the first time?

Yes I keep it ☐ No I discard it ☐ Sometimes I keep it ☐

17. Have you ever changed the way you take your oral non-prescription drugs as a result of reading the oral non-prescription drugs information leaflet?

Yes ☐ NO ☐ Sometimes ☐

18. What is your belief about effectiveness of oral non-prescription drugs? Please tick only one answer, which closely reflects your personal experience

Effective ☐ Moderately effective ☐ Ineffective ☐ Moderately ineffective ☐

19. Which of the following statements best expresses your personal views of medications? Tick only one answer

Medications are helpful (Positive)	☐	Medications are harmful (Negative)	☐	Medications are necessary	☐

20. **<u>If</u> you do not (always/often) read** the oral non-prescription drugs information leaflet, **<u>then</u>** why? Please tick the box which reflects your personal views (you can tick more than one).

Too difficult to understand	☐
Too long; it takes too long to read	☐
Print is too small	☐
Feel that the information is not important	☐
I get information from my doctor	☐
I get information from my pharmacist	☐
I get information from my family/friends	☐
The information provided worries me	☐
Common knowledge	☐
Other; specify	☐

21. Please read the following statements and tick the answer that best reflects your personal knowledge about oral non-prescription drugs.

Statement	Yes	No	I do not know
Oral non-prescription drugs come in different strengths			
Oral non-prescription drugs can possibly cause toxic interactions with other prescription drugs			
Oral non-prescription drugs can interact with food			
Some oral non-prescription drugs should be avoided in children, pregnant mothers, breastfeeding mothers, geriatric and with some chronic diseases			

22. Please read the following statements and tick the answer that best reflects your personal knowledge. Please tick only one answer for each statement.

Statement	True	False	I do not know
Antibiotics strengthen the immune system			
Nose may be blocked up if nasal spray is used for more than 10 days in a row			
Some medications can be absorbed into the blood through the skin			
If the given instructions were 1 tablet two times a day, it means that tablets ought to be taken at 8 hours intervals.			
Adol® & Panadol® both contain the same component			
You must check the instructions before using any medication			

23. To what extent do you agree or disagree with the following statements? Please tick only one answer, which closely reflects your personal view.

Statement	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
More expensive oral non-prescription drugs are more effective					
oral non-prescription drugs are safe regardless of how frequent they are used					

24. What is your <u>first action</u> when you experience one of the following illnesses? Please tick the box for each illness, which closely reflects your personal experience.

illness	Ignore the symptoms/Rest	Self-treatment with <u>oral non-prescription drugs</u> only	Consult a doctor
Allergy			
Constipation			
Cough & cold			
Dyspepsia or upset stomach			
Earache			
Headache			
Fever			
Muscle/joint/back pain			
Nausea and Vomiting			
Sore throat			
Teeth pain			
Menstrual symptoms (if female)			

25. Did you take any oral non-prescription drugs in the past 90 days? (IF NO, SKIP TO Q.28)

Yes ☐ NO ☐

26. If yes, please mention ***the most recent illness (the last one only) that you have experienced,*** the name(s) of oral non-prescription drugs you used for self-treating the illness, dosage forms, doses, frequency and method of administration (before food/after food) as the following examples:

Illness (symptom)	Drug name	Strength (mg, mcg, units, etc.,.Not volume)	Dosage form (tablet, capsule, syrup)	Dose (Number of doses per time)	Frequency (Number of times per day)	Drug administration	
						Before food	After food
Back pain	**Voltaren®**	50mg	Tablet	1 Tablet	2 times daily		√

27. What was the result of your self-medication with oral non-prescription drugs for the illness you have experienced? Tick only one answer please.

Cured the illness ☐
Prevented the illness ☐
Improved the illness ☐
Has not cured or improved or prevented the illness ☐
Suffered with a new problem on taking the drug ☐
other (specify).......................

28. Please rate the following statements below based on your own personal opinion. Tick only one answer for each statement.

Statement	Always	Usually	Sometimes	Rarely	Never
The drug information provide by a pharmacist is trustworthy					
The drug information provide by a doctor is trustworthy					
The drug information provide by a nurse is trustworthy					
I am satisfied with the pharmacist					
I am satisfied with the doctor					
I am satisfied with the nurse					

29. When you buy oral non-prescription drugs at the pharmacy, do you ask the pharmacist for a medical- advice?

Always ☐ Often ☐ Rarely ☐ Never ☐

30. Please tick the box that best describe your situation or write your answer in the blank space.

Age (Years):

Gender: Male ☐ Female ☐

Marital status:

Single ☐ Married ☐ Divorced ☐ Other (specify) ....

Ethnic group:

UAE national ☐ Arab ☐ Asian ☐ Iranian ☐ Other (specify) ....

Year of study:

First year ☐ 2nd year ☐ 3rd year ☐ 4th year ☐ 5th year ☐ 6th year ☐

Overall family average monthly income

<10,000DH ☐ 10,000 - 20000DH ☐ 20, 0000- 50,000DH ☐ >50,000DH ☐ Don't know ☐

Overall, how would you rate your current health?

Very good ☐ Good ☐ average ☐ Poor ☐ Very poor ☐

Do you have a job?

Yes ☐ NO ☐

Thank you So Much

Appendix4: Invitation letter for the Expert panel

UNIVERSITY OF GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

21th December, 2013.

To Whom It May Concern – **Participation in an Expert Panel**

Title: *Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor (s) of Irresponsible/Inappropriate OTCD Use*

Dear Sir/Madam,

My name is Khalid Ayoob. I am a resident of the Emirates and a registered PhD student with the University of Gloucestershire, Faculty of Applied Sciences, United Kingdom. The purpose of this letter is to request your kind participation in the assessment of a new tool for assessing the appropriate use of oral over the counter drugs that will be used in my PhD study: "***Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor (s) of Irresponsible/Inappropriate OTCD Use".***

The proposed tool composed of five assessment criteria that include: appropriate self-diagnosis; appropriate selection of the drug; appropriate dose of the drug; appropriate frequency of drug used and appropriate drug-food administration.

All participation is completely voluntary and you are free to refuse to participate, or to withdraw from the panel at any time, without any consequences, and that your information will be withdrawn at your request. Participant privacy and confidentiality will be assured throughout the study because codes will be used. Data will only be obtained after informed consent is provided by the participant. All data will be kept private and secret in a locked office so that only the principal researcher and the study's supervisors will have access to the data. All data will be destroyed five years after the study termination.

By taking part in this Expert Panel, you will be participating in validating of a new tool for assessing the appropriate use of **oral OTC drugs** among undergraduate's students in higher education institutions in United Arab Emirates of age 18 years old and above. This study involves no deception. The data will be published as a doctoral dissertation. There are no known risks associated with taking part in this study. The research is supervised by Professors, Walid El Ansari and Dr. Don Vinson *(if you have any queries you can contact them: professor Walid on Tel: +44 (0) 1242 715274, Email: walidansari@glos.ac.uk. And Dr. Don on Tel: +44 (0)1242 715277, Email: dvinson@glos.ac.uk).*

Ethical approval has been granted from the University of Gloucestershire, Gloucester, United Kingdom. For any concerns, kindly, contact Dr Malcolm MacLean, Chair of the Research Ethics Subcommittee for the Faculty of Applied Sciences at the University of Gloucestershire, (*Tel: 01242 715200, Email: mmaclean@glos.ac.uk*). Dr MacLean has no direct involvement in the study. Your participation in this panel will be greatly appreciated.
Yours sincerely,

[redacted]

Khalid A.Ayoob

Appendix 5: informed consent of the Expert panel

UNIVERSITY OF GLOUCESTERSHIRE
at Cheltenham and Gloucester

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel. 01242 715132

21th December. 2013.

Informed consent form

Title: Participation In an Expert Panel for the assessment of a new scale for measure the appropriate Oral over the Counter (OTC) Drugs use in response to self-treatment of acute minor illness

I have read the participant information sheet for the above research project and understand the following statements:

1. I understand that I have been asked to participate in the expert panel for assessing the validity of a new measurement scale of appropriate OTC drug use
2. I read and received a copy of the attached information letter
3. I understand the benefits involved in taking part in this panel
4. I understand that I am free to contact the research team to take the opportunity to ask questions and discuss this study
5. I understand that I am free to refuse to participate or to withdraw from the study at any time, without consequences, and that the information will be withdrawn at my request
6. I understand that the researcher will keep my data confidential
7. I understand who will have access to my information

I wish to take part in this panel:

Name:

Signature:

Date:

Preferred Contact number:

Email:

Appendix 6: The questionnaire for validating the tool for assessing appropriate OTC-use

Please use a black or dark blue pen to completely fill in the box of your answers. Please answer all the questions by ticking the answer or by writing down in the blank space.

Please examine the following example for assessing appropriate OTC drug use by a consumer:

Symptom	**Name of drug**	**Dosage form** (tablet, capsule, syrup)	**Dose** (Number of doses per time)	**Frequency** (Number of times per day)	**Drug administration**	
					Before food	After food
Headache	Panadol	Tablet	2 Tablet	3 times daily		√

Now kindly answer the questions below based on your expertise:

1. Is the above tool valid for measuring appropriate OTC drug use?

   Yes ☐ NO ☐ Not applicable ☐

2. Are there any other assessment criteria that can be added?

   Yes ☐ NO ☐ Not applicable ☐

If yes, please identify ....

3. Are there any assessment criteria that can be deleted?

   Yes ☐ NO ☐ Not applicable ☐

If yes, please identify ....

4. How many assessment- criteria should be available to consider the OTC drug user as "appropriate "user? Please specify ......

Thank you

Appendix 7: Informed consent for physicians for test and res-test

UNIVERSITY OF GLOUCESTERSHIRE
at Cheltenham and Gloucester

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

19th March, 2014.

Informed consent form

Title: Participation in the assessment "scoring" of participants' results after a pre-post test study design used for measuring the appropriate Oral over the Counter (OTC) drugs use in response to self-treatment of acute minor illness

I have read the participant information sheet for the above research project and understand the following statements:

1. I understand that I have been asked to participate in the export panel for assessing the reliability 'Inter-Rater Reliability" of a new measurement scale of appropriate OTC drug use
2. I read and received a copy of the attached information letter
3. I understand the benefits involved in taking part in this assessment panel
4. I understand that I am free to contact the research team to take the opportunity to ask questions and discuss this study
5. I understand that I am free to refuse to participate or to withdraw from the study at any time, without consequences, and that the information will be withdrawn at my request
6. I understand that the researcher will keep my data confidential
7. I understand who will have access to my information

I wish to take part in this panel:

Name:

Signature:

Date:

Preferred Contact number:

Email:

Appendix 8: Informed consent of the second panel

UNIVERSITY OF GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

Informed consent form

Title of the Study: Participation in a Panel of Experts to Identify the Assessment Criteria used to Determine Appropriate Users of over the Counter Drugs.

I have read the participant information sheet for the above research project and understand the following statement:

1. I understand that I have been asked to participate in a panel of experts to identify the assessment criteria required categorize the to determine appropriate over the counter drugs' Users
2. I read and received a copy of the attached information letter
3. I understand the benefits involved in taking part in this study.
4. I understand that I am free to contact the researcher to ask questions and discuss this study
5. I understand that I am free to refuse to participate or to withdraw from the study at any my request
6. I understand that the researcher will keep my data confidential
7. I understand who will have access to my information

I agree to participate in this study:

Name:

Signature:

Date:

Preferred contact number:

E mail address:

Appendix 9: The tool assessing appropriate OTC-medicine use

Please examine the following example for assessing appropriate OTC medicine use by a consumer:

1 **Self-diagnosis of the Symptom**		**2** **Selection of drug**	**Dosage form** (tablet, capsule, syrup)	**3** **Dose** (Number of doses per time**)**	**4** **Frequency** (Number of times per day)	**5** **Drug administratio**	
						Before food	After food
Headache		Panadol	Tablet	2 Tablet	3 times daily		√

Now please answer the questions below based on your expertise:

1. How many assessment criteria out of the five criteria listed above are required to consider the user of the OTC medicine as appropriate user?

2. Can we classify the inappropriate user into one of the following categories based on the above assessment criteria: Most, moderate or least inappropriate user?

   Yes ☐ NO☐

   If yes, please specify the number of the criterion required for each category

   - Most inappropriate user:☐
   - Moderate inappropriate user:☐
   - Least inappropriate user:☐

Thank you

Appendix 10: Test retest invitation letter

UNIVERSITY OF GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel 01242 715132

To Whom It May Concern – **Participation in a test retest study on appropriate use of oral over- the counter drugs**

Title of the Study: Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor (s) of Irresponsible/Inappropriate OTCD Use.

Dear participant,

I am Khalid Ayoob, a registered PhD student with the University of Gloucestershire, Faculty of Applied Sciences, and United Kingdom My name is Khalid Ayoob. I am a resident of the Emirates and a registered PhD student with the University of Gloucestershire, Faculty of Applied Sciences, and United Kingdom. The purpose of this letter to invite you to participate in a in a test retest survey about the use of oral over the counter drugs that will be use in my PhD research.

You *do not* need to write your full names, all what is required is your own personal mobile numbers, and your first- name or your common- name; accordingly the researcher can contact you after 30 days from the first survey so as to request your participation again for the second time **"If you will agree to"**. The same questions will be asked again "retest" to see your response after 30 days. The first and the second responses will be coded and analysed statistically. All data will be kept private and secret in a locked office so that only the researcher will have access to the data. Data will be destroyed five years after the study has finished.

Your participation is voluntary and confidential. Participant privacy and confidentiality will be assured because full names will not be requested at any time. All answers will be collected, coded and analysed together as a group and will be used for research purposes only. **You are under no obligation to take part in this study and you are free to withdraw without giving a reason** at any stage before completing the second survey "retest". ***By completing the questionnaire, you do agree to participate in the study.***

By taking part in this study, you may help researchers in the drug utilization research to have reliable questions for evaluating appropriate use of OTC drugs. This study involves no deception. The data will be published as a doctoral dissertation. There are no known risks associated with taking part in this study. The research is supervised by professors Walid El Ansari and Dr. Don Vinson *(if you have any queries you can contact them: professor Walid on Tel: +44 (0) 1242 715274, Email: walidansari@glos.ac.uk. And Dr. Don on Tel: +44 (0)1242 715277, Email: dvinson@glos.ac.uk)*.

Ethical approval has been provided from the University of Gloucestershire, Gloucester, United Kingdom. Please contact Dr Malcolm MacLean, chair of the research ethics subcommittee for the Faculty of Applied Sciences at the University of Gloucestershire, if you have any concerns. *(Tel: 01242 715200, Email: mmaclean@glos.ac.uk)*. Dr MacLean has no direct involvement in the study. Your participation in this study will be greatly appreciated.

Yours sincerely

[redacted]

Khalid A.Ayoob
050 9487037
00447526850497

Appendix 11: Test re test questionnaire

UNIVERSITY OF
GLOUCESTERSHIRE
at Cheltenham and Gloucester

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

When you use oral non-prescription drugs for the **first time**, do you read the oral non-prescription drugs leaflets before use?

Always ☐ Often ☐ Rarely ☐ Never ☐

Thank you

Appendix 12: First version of the questionnaire

UNIVERSITY OF GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

Title of the Study: Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor (s) of Irresponsible/Inappropriate OTCD Use.

Dear participant,

I am Khalid Ayoob, a registered PhD student with the University of Gloucestershire, Faculty of Applied Sciences, and United Kingdom. I am conducting the attached survey as the fieldwork for my doctoral thesis. I would like to know your opinions and experiences with the use of Oral Over-The-Counter Drugs **(OTCD)** that are used for the prevention/ treatment of minor illness and symptoms which do not require a doctor's consultation. The University of Gloucestershire faculty research ethics panel has approved this study.

Many thanks in advance for taking the time to fill out this survey. It will take approximately 15- 20 minutes of your time. Your participation is voluntary and confidential. Participant privacy and confidentiality will be assured because names will not be requested at any time. All answers will be collected and analysed together as a group and will be used for research purposes only. You are under no obligation to take part in this study and are free to withdraw without giving a reason at any stage before completing the survey. ***By completing the questionnaire, you do agree to participate in the study***.

<u>Instructions for filling out this questionnaire</u>

Oral Over-the-counter Drugs (OTCD) are those drugs that you can buy/use without a need for a doctor's prescription for the prevention/treatment of minor illness and symptoms. OTCD products can be purchased from pharmacies and supermarkets. There are many types of OTCD, for example, Panadol® for headache and fever.

Please answer all the questions below as honestly and completely as you can.

Please use a black or dark blue pen to completely fill in the box of your answers. Answer the questions by ticking the answer or writing down in the blank space.

Please tick the boxes the most closely match your personal opinion, attitudes and experience:

√

To change your answer, please cross out the wrong choice and then tick the correct one:

X

1. Below is a list of OTCD that are used for self-treatment of minor health problems. Please rate the following OTCD below based on your frequency of use.

Category	Always	Usually	Sometimes	Rarely	Never
Allergy drugs/Antihistamine like Claritin®					
Analgesic/ Antipyretics like Panadol®					
Antacids /Acid Reducers like Gavisicon®					
Antibiotics like Augmentin®					
Anti-diarrheal like Imoduim®					
Anti-nausea & vomiting drugs like Motilium®					
Cough & cold drugs like Sinecod® syrup					
Laxatives drugs like Dulcolax®					
Pain relief like Voltarine®					
Stomach & abdominal spasm drugs like Buscopan®					

2. Where do you most often obtain/ gain/ buy OTCD from? Tick all that apply

Private Pharmacy ☐	Hospital ☐	Left over from previous use ☐
Supermarket ☐	Friends/ neighbor ☐	Others (specify).........

3. How do you gain the information about OTCD? Tick all that apply

Doctor/Physician ☐	Nurse ☐	Drug information leaflet ☐
Pharmacist ☐	Friends/ neighbor ☐	Previous experience ☐
Radio, television ☐	Family ☐	Newspapers or magazines dvertisment ☐
Medical books ☐	Internet ☐	Other(specify)...............

4. How many OTCD do you frequently use at a time?

One drug ☐ Two drugs ☐ Three drugs ☐ Four drugs ☐ five or more drugs ☐

5. How frequently do you use OTCD for self-medication?

Daily ☐ Weekly ☐ Monthly ☐ Annually ☐

6. Have you ever experienced a negative reaction or side effect from taking an OTCD?

Yes ☐ NO ☐ Not sure ☐

7. Have you ever taken more than the recommended dose of an OTCD?

Yes ☐ NO ☐ Not sure ☐

8. If you take more than the recommended dose, please specify why? Tick all that apply

Believed it would be relieved faster ☐	Did not get any better taking the recommended dose ☐
Had severe symptoms ☐	Previous experience ☐
Other (specify)……………………	

9. Below is a list of minor health problems. Please tick the box which most closely reflects your decision to self-medicate[1] with OTCD

Minor health problems	Always	Usually	Sometimes	Rarely	Never
Allergic symptoms (hay fever)					
Common cold (Flu)					
Constipation					
Diarrhoea					
Dyspepsia or upset stomach/ abdominal pain					
Earache					
General weakness					
Headache					
High temperature/ fever					
Menopausal symptom					
Muscle/joint/back pain					
Nausea and Vomiting					
Sore throat					
Stress/ anxiety					
Teeth/gum problem					

10. What is your common reason(s) for self-medicating with OTCD? Tick all that apply

It allows me to take control of my own care ☐	My doctor told me that I can manage such symptoms on my own ☐
It saves money ☐	I do not trust my doctor ☐
It saves time (waiting time) ☐	The prescribed treatment from my doctor was not successful ☐
It saves you a trip to the doctor's office ☐	Previous experience ☐
My illness is not serious enough to require seeing the doctor ☐	For prevention of diseases ☐
OTCD are just as effective as prescription drugs ☐	The prescribed treatment from my doctor was not successful ☐
OTCD are just as safe as prescription drugs ☐	Other reason, specify……………………………

11. If you have more than one health problems/ symptoms at the same time, such as a headache and a sore throat, how likely are you to take/ use more than one OTCD? Please tick the answer which closely reflects your personal attitude

Always ☐ Often ☐ Rarely ☐ Never ☐

[1] By self-medication I mean treat yourself with OTCD before, or instead of consulting a doctor

12. Does the cost of an OTCD affect your decision to buy it?

Always ☐ Often ☐ Rarely ☐ Never ☐

13. Do you check the expiry date on drugs before taking them? Please tick the answer which closely reflects what you usually do.

Always ☐ Often ☐ Rarely ☐ Never ☐

14. When you buy an OTCD at the pharmacy, do you ask the pharmacist for an advice?

Always ☐ Often ☐ Rarely ☐ Never ☐

15. What is the most important factor that determines your choice when you buy/use an OTCD?

Product brand name	☐	Pharmacist's opinion and recommendation	☐
Had severe symptoms	☐	Families / friend's opinion and recommendation	☐
Package design	☐	Pharmaceutical company's country of origin	☐
Product advertisements	☐	Other (specify)................	

16. When you use OTCD for the **first time**, DO you read the OTCD leaflets? (IF THE ANSWERS ARE "Rarely" or "Never", SKIP TO QUESTION 22)

Always ☐ Often ☐ Rarely ☐ Never ☐

17. What information do you read in the OTCD leaflet? Please express your personal

The entire Drug Information Leaflet	☐	Indication	☐	Dosage	☐
Drug-drug interactions	☐	Cautions	☐	Adverse effects	☐
All of it / everything	☐	Contraindications	☐	Not sure/ do not know	☐

18. How would you describe the information in the OTCD leaflet?

Very easy to understand	☐	Very difficult to understand	☐
Easy to understand	☐	Difficult to understand	☐

19. How useful do you think the information in the in the OTCD information leaflet?

Useful ☐ Not sure ☐ Not useful ☐

20. Do you keep the OTCD information leaflet you receive for the first time?

Yes I keep it ☐ No I discard it ☐ Sometimes I keep it ☐

21. Have you ever changed the way you take your OTCD as a result of reading the OTCD information leaflet?

Yes ☐ NO ☐ Sometimes ☐

22. **If you do not always read** the OTCD information leaflet, then why? Please tick the box which closely reflects your personal views (you can tick more than one).

Too difficult to understand because the language is too technical	☐
Too long; it takes too long to read	☐
Too confusing	☐
Print is too small	☐
Feel that the information is not important	☐
Feel that the information is not useful	☐
I get information from my doctor	☐
I get information from my pharmacist	☐
The information provided worries me	☐
Common knowledge	☐
Other; specify	☐

23. Please read the following statements and tick the answer that best reflects your personal knowledge about OTCD.

Statement	Yes	No
OTCD may contain more than one active ingredients		
OTCD come in different concentrations		
OTCD can possibly cause toxic interactions with other prescription drugs		
OTCD can interact with food		
Using more than one OTCD can result in over dosage		
Some OTCD should be avoided in children, pregnant mothers, breast feeding mothers, geriatric and with some chronic diseases		

24. Please read the following statements and tick the answer that best reflects your personal opinion. Please tick only one answer for each statement.

Statement	**Yes**	**No**	**I do not know**
Antibiotics strengthen the immune system			
Nose may be blocked up if nasal spray is used for more than 10 days in a row			
Some medications can be absorbed into the blood through the skin			
If the given instructions were 1 tablet two times a day, it means that tablets ought to be taken at 8 hours intervals.			
Tylenol & Panadol both contain the same active ingredients			
You must check the instructions before using any medication			

25. Which of the following statements best expresses your personal views of medications? Tick only one answer

Medications are helpful (Positive)	☐	Medications are harmful (Negative)	☐	Medications are necessary but evil	☐

26. What is your belief about effectiveness of OTCD? Please tick only one answer which closely reflects your personal experience.

Effective ☐ Moderately effective ☐ Ineffective ☐ Moderately ineffective ☐

27. To what extent do you agree or disagree with the following statements? Please tick only one answer which closely reflects your personal view.

Statement	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
More expensive OTCD are more effective					
OTCD are safe regardless of how frequent they are used					

27. What is your first action when you experience one of the following minor health problems? Please tick the box for each symptom which closely reflects your personal experience.

Minor health illness	Ignore the symptoms/Rest	Self-treatment[a]	Consult a doctor
Allergic symptoms /Rash			
Backaches			
Constipation			
Cough & common cold			
Dyspepsia or upset stomach			
Earache			
Headache			
High temperature / fever			
muscle/joint/back pain			
Nausea and Vomiting			
Sore throat			
Teeth/gum problem			

[a] By self-treatment I mean treat yourself with OTCD before, or instead of consulting a doctor

28. Have you experienced any of the following minor illness in the past 30 days? Please tick the most recent illness*

Cough & cold	☐	Earache	☐	Constipation	☐
Fever	☐	Menopausal symptoms	☐	Nausea/Vomiting	☐
Headache	☐	Shortness of breath/asthma	☐	Diarrhea	☐
Sore throat	☐	Allergy/ Hay fever	☐	Body pain	☐
Sinusitis	☐	Dyspepsia/upset stomach	☐	Stress/anxiety	☐
Not sure	☐	Other (specify)..			

29. Did you take any OTCD to treat the illness you have experienced in the past 30 days?

Yes ☐ NO ☐

30. Please mention OTCD- name(s), dosage forms, doses, frequency and method of administration (before food/after food) for each symptom as the following examples:

Symptom	**Name of drug**	**Dosage form** (tablet, capsule, syrup)	**Dose** (Number of doses per time)	**Frequency** (Number of times per day)	**Drug administration**	
					Before food	After food
Headache	Panadol	Tablet	2 Tablet	3 times daily		√

Symptom	**Name of drug**	**Dosage form** (tablet, capsule, syrup)	**Dose** (Number of doses per time)	**Frequency** (Number of times per day)	**Drug administration**	
					Before food	After food

31. What was the likely outcome of self-treatment with OTCD for the illness you have

Cured the illness	☐	Has not cured or improved or prevented the illness	☐
Prevented the illness	☐	Suffered with a new problem on taking the drug	☐
Improved the illness	☐	other (specify).......................	

*If you have experienced more than one symptoms **at the same time** such as headache and fever, then tick both

32. Please rate the following statements below based on your own personal opinion. You can tick only one answer for each statement.

Statement	Always	Usually	Sometimes	Rarely	Never
The drug information provide by a pharmacist is trustworthy					
The drug information provide by a doctor is trustworthy					
The drug information provide by a nurse is trustworthy					
My pharmacist listen to me when I have a medication question(s)					
My doctor listen to me when I have a medication question(s)					
My pharmacist is easily approachable to discuss my medication(s)					
My doctor is easily approachable to discuss my medication(s)					
I am satisfied with my pharmacist					
I am satisfied with my doctor					
I am satisfied with my nurse					

33. Please read the questions below and indicated your answer by ticking the box that best describes your situation or write your response in the blank space.

Age (Years):..

Gender: Male ☐ Female ☐

Marital status:

Single ☐ Married ☐ Divorced ☐ other (specify) .....

Ethnic group:

UAE national ☐ Arabs ☐ Asian ☐ Iranian ☐ other (specify)..........

Employment:

Yes ☐ NO ☐

Faculty: ....

Year of study

First year ☐ 2nd year ☐ 3rd year ☐ 4th year ☐ 5th year ☐ 6th year ☐

Overall family average monthly income

<10000DH ☐ 10,000 - 20000DH ☐ 20, 0000 - 50,000DH ☐ >50,000DH ☐

Overall, how would you rate your current health?

Excellent ☐ Very good ☐ Good ☐ Fair ☐ Poor ☐

Thank you

Appendix 13: Gloucestershire university ethical approval

UNIVERSITY OF GLOUCESTERSHIRE
at Cheltenham and Gloucester

Academic Registry
The Park
Cheltenham
GL50 2RH
Tel: 01242 714700

Khalid Ayoob
Flat 704
Alfa Tower
Corniche
Sharjha
DUBAI 86621
United Arab Emirates

16 February 2015

Dear Khalid

Thank you for our earlier conversation regarding the approval of your project by the University's Research Ethics Sub-Committee.

I can confirm that we considered your project entitled *Use of oral over-the-counter drugs (OTCD) among undergraduate students in higher education institutions in United Arab Emirates: identifying risk factor(s) of irresponsible/inappropriate OTCD use* at our meeting of 25 November 2013 with final approval being confirmed at the RESC meeting of 13 January 2014.

The reference code for the ethics approval of the project is REC.41.13.

Please do not hesitate to contact me if I can be of any further assistance regarding ethics queries and issues in bringing your project to its conclusion.

Best wishes

Yours sincerely

[redacted]

Dr Malcolm MacLean
Chair, Research Ethics Sub-Committee (2006-14)/Research Ethics Committee (2015-)
Associate Dean, Quality & Standards

Appendix 14: Sharjaha University ethical approval

جامعــــــة الشـــــــارقة
UNIVERSITY OF SHARJAH

College of Medicine كليـــة الطـــب

Ref: DFCM /08/01/14/739
Monday ,January 08, 2014

Dear Mr. Khalid Ayoob

Principle Investigator

Re: Ethical approval

Project Title: **Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor(s) of Irresponsible/Inappropriate OTCD Use**

Researchers: Mr. Khalid Ayoob. University of Gloucestershire/UK

I am pleased to let you know that the Ethics and Research Committee of the University of Sharjah has approved the above mentioned research project to be conducted at Sharjah University.

It is the responsibility of the principle investigator to make sure that the study adheres to ethical standard and the study is conducted exactly as specified in the amended ethics application form.

Please provide us with final version of study protocol, questionnaire and consent form.

Any change to the design or methodology should be reported to the ERC for approval before implementing any change.

Please provide us with six monthly progress report starting from June 2014.

The ERC would like to wish you and the team all the best

[redacted]

Assoc Prof Nabil Sulaiman

Chairman, ERC
HOD, Family and Community Medicine and Behavioral Sciences

هاتف: ٥٠٥ ٧٢١٦ (٦ ٩٧١+) فاكس: ٥٥٨٥٨٧٩ (٦ ٩٧١+) ص.ب: ٢٧٢٧٢، الشارقة - الإمارات العربية المتحدة
Tel : (+971 6) 505 7216, Fax (+971 6) 5585879, P.O. Box : 27272, Sharjah - United Arab Emirates
E-mail: medicine@sharjah.ac.ae www.sharjah.ac.ae

Appendix 15: Emirates University ethical approval

UAEU

جامعة الإمارات العربية المتحدة
United Arab Emirates University

No: DVCRGS/ 113/2014
04/03/2014

To: Mr. Khalid Awad Ayoob
University of Gloucestershire

Subject: *Use of 'Oral Over-The-Counter Drugs (OTCD)' among Undergraduates Students in Higher Education Institutions in United Arab Emirates: Identifying risk factor (s) of Irresponsible/Inappropriate OTCD Use*

Dear Mr. Ayoob,

Please be advised that the UAEU Scientific Research Ethics Committee, in its meeting No. 43 on March 2, 2014, reviewed the ethical principles involved in your submission.

The decision reached is:

[√] Approved as is

On behalf of the Committee, I wish you every success with your study.

Sincerely,

[redacted]

Prof. Reyadh Al Mehaideb
Deputy Vice Chancellor for Research and Graduate Studies

UAEU

Deputy Vice Chancellor for
Research and Graduate Studies
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للدراسات العليا والبحث العلمي
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Appendix16: Ajman University ethical approval for the main survey study

5th of March, 2014

جامعة عجمان للعلوم والتكنولوجيا

AJMAN UNIVERSITY OF SCIENCE & TECHNOLOGY

To Whom It May Concern

Subject: Ethical Approval

Project Title: ***Use of "Oral Ober-The-Counter Drugs (OTCD)" among Undergraduate Students in Higher Education Institutions in the United Arab Emirates: Identifying risk factor(s) of Irresponsible/Inappropriate OTCD Us.***

Researcher: Mr. Khalid Ayoob of the University of Gloucestershire/UK.

I am pleased to inform you that the Colleges of Dentistry, Information Technology and Engineering have approved the above data collection pertaining to research project above to be conducted in this University.

The responsibility of adhering to the ethical standard of data collection as specified in the application form remains the responsibility of Mr. Ayoob.

This letter was issued to Mr. Khalid Ayoob on his request and Ajman University of Science and Technology is not responsible for any misuse.

[redacted]

Ahmed Ankit Ph.D.
Assistant to the President
External Relations & Cultural Affairs
Ajman University of Science and Technology

Tel: +9716-7055550
Fax: +9716-7483866
Mobile: +971050-6416882
P.O.Box: 346 Ajman, United Arab Emirates
http://www.ajman.ac.ae

Appendix 17: Invitation letter of the interview study

UNIVERSITY OF GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

Participant information sheet
Participation in a research study

Title: 1st October 2016

Title of the Study: Participation in an interview study about using antibiotics without doctor's prescription by university students

Dear participant,

My name is Khalid Ayoob. I am a resident of the Emirates and a registered PhD student with the University of Gloucestershire, Gloucester, United Kingdom. The purpose of this letter is to request your kind participation in my PhD research.

You are very kindly asked to participate in an interview to share your experience about using antibiotics without a doctor's prescription.

All participation will be completely voluntary, and data will only be obtained after getting your participation approval. Participant privacy and confidentiality will be assured because all data will be kept private and secret in a locked office so that only I will have access to the data. Data will be destroyed five years after the study has finished.

By taking part in this study, you will helps determining the reasons behind using antibiotics without prescriptions, the role of healthcare professionals on tackling the problem of antibiotic misuse and the potential role that your university might play in raising students' awareness about the risks attributed to use antibiotics without prescriptions. The data will be published as a doctoral dissertation.

Your participation in this study will be greatly appreciated.

Yours sincerely,

[redacted]

Khalid A. Ayoob
0509487037

Appendix 18: Informed consent of the interview study

UNIVERSITY OF
GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

Informed consent form

Title of the Study: Using antibiotics without doctor's prescriptions by Higher Education Institutions' students: a qualitative study.

I have read the participant information sheet for the above research project and understand the following statement:

1. I understand that I have been asked to participate in a panel of experts to identify the assessment criteria required categorize the to determine appropriate over the counter drugs' Users
2. I read and received a copy of the attached information letter
3. I understand the benefits involved in taking part in this study.
4. I understand that I am free to contact the researcher to ask questions and discuss this study
5. I understand that I am free to refuse to participate or to withdraw from the study at any my request
6. I understand that the researcher will keep my data confidential
7. I understand who will have access to my information

I agree to participate in this study:

Name:

Signature:

Date:

Preferred contact number:

E mail address:

Appendix 19: Interview Questionnaire

1) Can you tell me about your experience of self-medication with antibiotics without doctor's prescription please? (experience)

    a) Please tell me about the first time you ever did this.

2) Why do you self-medicate with antibiotics? (reasons of using antibiotics without prescriptions)

    a) Kinds of illness? (self-care orientations)

    b) Effectiveness (power)…(effectiveness belief)

    c) How often do you do this? (Frequency of use behaviour).

    d) Financial? Time? (Reasons)

    e) How do you know what types of antibiotic to take and the correct dose (Medication knowledge) ? Finishing course, using 'old' or leftover antibiotics (attitude of both using left over antibiotics and completing the full course of antibiotics).

    f) Generic or branded? Why? (Attitude regarding brand preference)

    g) Did the pharmacist give any advice? What was it? How useful was that advice? (medical advice seeking behaviour)

3) Do you self-medicate with other drugs such as Panadol or Brufen? (Polypharmacy behviour)

    a) What for

    b) Why

    c) How long

4) Would you recommend others to self-medicate with antibiotics? (Attitude)

    a) Explore reasons why/why not.

5) Have you ever heard about antibiotic resistance? What is your understanding of antibiotic resistance? (Awareness and knowledge of bacterial resistance)

    a) Do you think misuse of antibiotics causes resistance? (Knowledge)

    b) What role do Pharmacists and Doctors play in reducing antibiotic resistance? (Belief)

6) Do you think doctors over-prescribe antibiotics? (Trust in healthcare provider)

a) Why do you think this?

b) What do you think will be the outcome of over-prescribing? (Awareness)

7) Do you think other medical students misuse antibiotics when they self-prescribe? (Awareness about the problem of misusing antibiotics among healthcare students)

   a) In what ways?

8) Do you think your self-medication contributes/ leads to antibiotic resistance? (Awareness about negative consequences of misusing antibiotics).

   a) Why/ why not?

   b) How is your practice different from medical professionals or other medical students?

9) Overall, do you feel that the emphasis on tackling the problem of antibiotics misuse should be upon high level through policy change by ministry of health or local strategies within pharmacies, other approaches or combinations? (Suggestions for tackling the problem of using antibiotics without prescription at macro and micro levels).

10) Please have a look on these colored papers. Would you read them to enhance your knowledge about antibiotic use? If yes, why? If not, why not?

11) In your opinion, what is the best way to educate your class-mate about how to use antibiotic safely? e.g power points, video, text massages ….

12) As a student, in your opinion, how could the university play a significant role in providing the students with information about proper use of antibiotics?

13) Do you have any other suggestions to enhance safe use of antibiotics among students?

Appendix 20: Ajman University ethical approval for the interview and the intervention studies

جامعة عجمان للعلوم والتكنولوجيا

AJMAN UNIVERSITY OF SCIENCE & TECHNOLOGY

Date 15/2/2017

To whom It May Concern

Subject: Ethical Approval

Project-One: An interventional study to improve the practice, knowledge, awareness and attitude towards appropriate utilization of antibiotics among healthcare students in UAE

Project-Two: A qualitative study to investigate antibiotics use without a doctor's prescription among healthcare students in UAE

Resercher: Mr. Khalid Awad Al-Kubaisi

I am pleased to inform you that the college of Dentisry and the college of Pharmacy have approved the above reserch projects to conduct in Ajman Unveisity.

This letter was issued to the resercher on his request and Ajman Unversity is not responsible for any misuse

[redacted]

Dr, Abdulhaq B. Al-kattan Al-Nuaimi

Vice Chancellor for Advancement and Communication

[redacted]

Appendix 21: Invitation letter of the intervention study

UNIVERSITY OF GLOUCESTERSHIRE

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

23 September, 2016

Title of the Study: An interventional study to improve the knowledge and behaviour towards appropriate utilization of antibiotics among medical students in UAE

Dear participant,

I am Khalid Ayoob, a registered PhD student with the University of Gloucestershire, Faculty of Applied Sciences, United Kingdom. I am conducting the attached survey as the fieldwork for my doctoral thesis in collaboration with my local adviser Dr. Mohammed Shamssain- College of pharmacy /Ajman University. I would like to invite you fill out this survey. It will take approximately 15 minutes of your time. Your participation is voluntary and confidential. You are under no obligation to take part in this study. You are free to withdraw without giving any reason at any time of the study and your information will be withdrawn at your request.

Best wishes,

Khalid

Appendix 22: Informed Consent the intervention study

UNIVERSITY OF GLOUCESTERSHIRE
at Cheltenham and Gloucester

Faculty of Applied Sciences
Oxstalls Campus
Oxstalls Lane
Longlevens
Gloucester
GL2 9HW
Tel: 01242 715132

1ST October, 2016

Informed consent form

Title of the Study: interventional study to improve the knowledge and behaviour towards appropriate utilization of antibiotics among medical students in UAE

I have read the participant information sheet for the above research project and understand the following statement:

1. I understand that I have been asked to participate in An interventional study to improve the knowledge and behaviour towards appropriate utilization of antibiotics among medical students in UAE
2. I read and received a copy of the attached information letter
3. I understand the benefits involved in taking part in this study.
4. I understand that I am free to contact the researcher to ask questions and discuss this study
5. I understand that I am free to refuse to participate or to withdraw from the study at any my request
6. I understand that the researcher will keep my data confidential
7. I understand who will have access to my information

I agree to participate in this study:

Name:

Signature:

Date:

Preferred contact number:

E mail address:

Appendix 23: Table 6. 1Components of the intervention (Appendix 25)

Topics covered	Content
Introductions (Power Points)	Participants welcomed. Introduction about the differences between virus and bacteria. Next was the type of infections that are caused by viruses and should not be treated with antibiotics with a brief description of each infection (signs and symptoms). Finished with the definition of antibiotics and their mechanism of actions **Video:** Bacteria and Viruses – What is the difference between Bacteria and Viruses?
Bacteria: the good, the bad and the ugly (Power Points)	What are bacteria? Where are bacteria? Why we should love bacteria. Why bacteria love us. Uses for bacteria. Identification of bacteria. How do we defend ourselves? Life without bacteria. How can we stay healthy?
Activity	Discussion about mini poster: Viruses or Bacteria What's got you sick? *Antibiotics Aren't Always the Answer*
Antibiotics (Power Points	What are antibiotics? When do antibiotics work? When are antibiotics not needed? Benefits and risks of antibiotics. Why is there no point taking antibiotics for colds and flu? Three things to remember if you are self-prescribed an antibiotic. **Video:** What are antibiotics? How do antibiotics work?
Activity	Discussion about mini poster: Know When Antibiotics Work.

Table 6.1~Continued-Components of the intervention

Topics covered	Content
Diagnosis of infections: sore throat (Power Points)	What causes a sore throat? How do I know if I have a virus or bacteria? When should I see my doctor about my sore throat? Treatment options for viral and bacterial sore throats. How well do antibiotics work for strep throat?
Activity	Discussion about mini poster: So you have a sore throat ...now what do you do? How well do antibiotics work for strep throat?
Diagnosis of infections: common cold (Power Points)	Background about the most common causes of the common cold. Symptoms of common cold. Referral criteria of common cold. Treatment options. **Video:** How to catch a common cold.
Fever (Power Points)	Fever reducers and pain killers Paracetamol, aspirin, Ibuprofen. **Videos:** 1. What is a fever? 2. Fever home remedies – how to treat fever naturally – fever symptoms and treatment
Activity	Discussion about mini poster: Too much acetaminophen can destroy your liver.
Activity	Discussion about two mini posters: Important Notice To everyone DO YOU HAVE: Fever, cough, sore throat, and stuffy nose? Protect yourself Stop the spread of Germs

Table 6.1: Continued ~Components of the intervention

Topics covered	Content
Bacterial resistance (Power Points)	Mechanism of antimicrobial resistance. What is antibiotic resistance? How do bacteria become resistant to antibiotics? How should I use antibiotics to protect myself and my community from antibiotic resistance? **Videos:** 1. Antibiotic resistance 2. Using antibiotics correctly
Activity	Discussion about two mini posters: How Antibiotic Resistance Happens Examples of How Antibiotic Resistance Spreads Antibiotic Resistance: THE GLOBAL THREAT
Infection prevention and control: Does hand washing work? (Power Points)	Background. How to wash your hands. Use plain soap. Do not use antibacterial soap. Hand drying. Alcohol-based hand sanitisers. **Video** about how to wash hands
Activity	A nurse presentation and a practice of washing hands with all students.
Activity	Discussion about three mini posters: Hand hygiene and Antibiotic Resistance Hand washing With a Nail Brush Which Soap is Best?
How to Handle Leftover Medication (Power Points)	Why Remove Old Medications from Your Home? How Do I Safely Get Rid of Medications? Video: Tips on how to get rid of expired medications

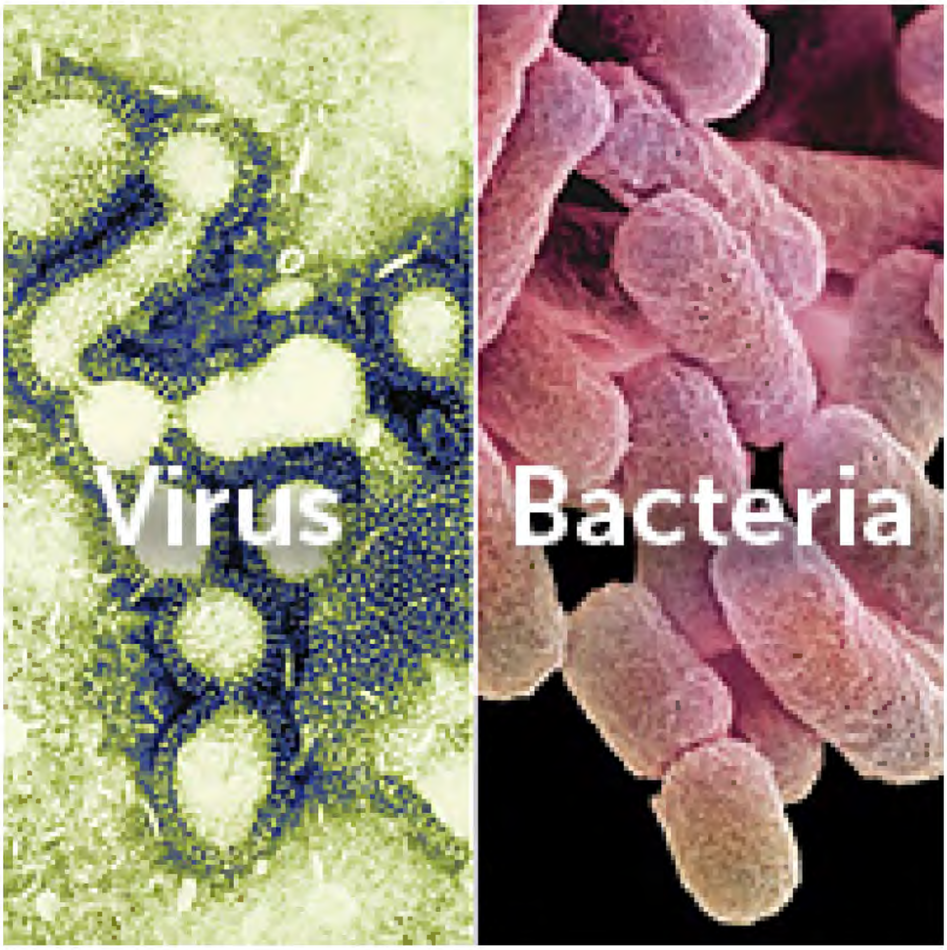
Appendix 24: Educational materials of the interventional study

Educational materials of the interventional study

What Everyone Should Know

About

Bacteria, Viruses, and Antibiotics

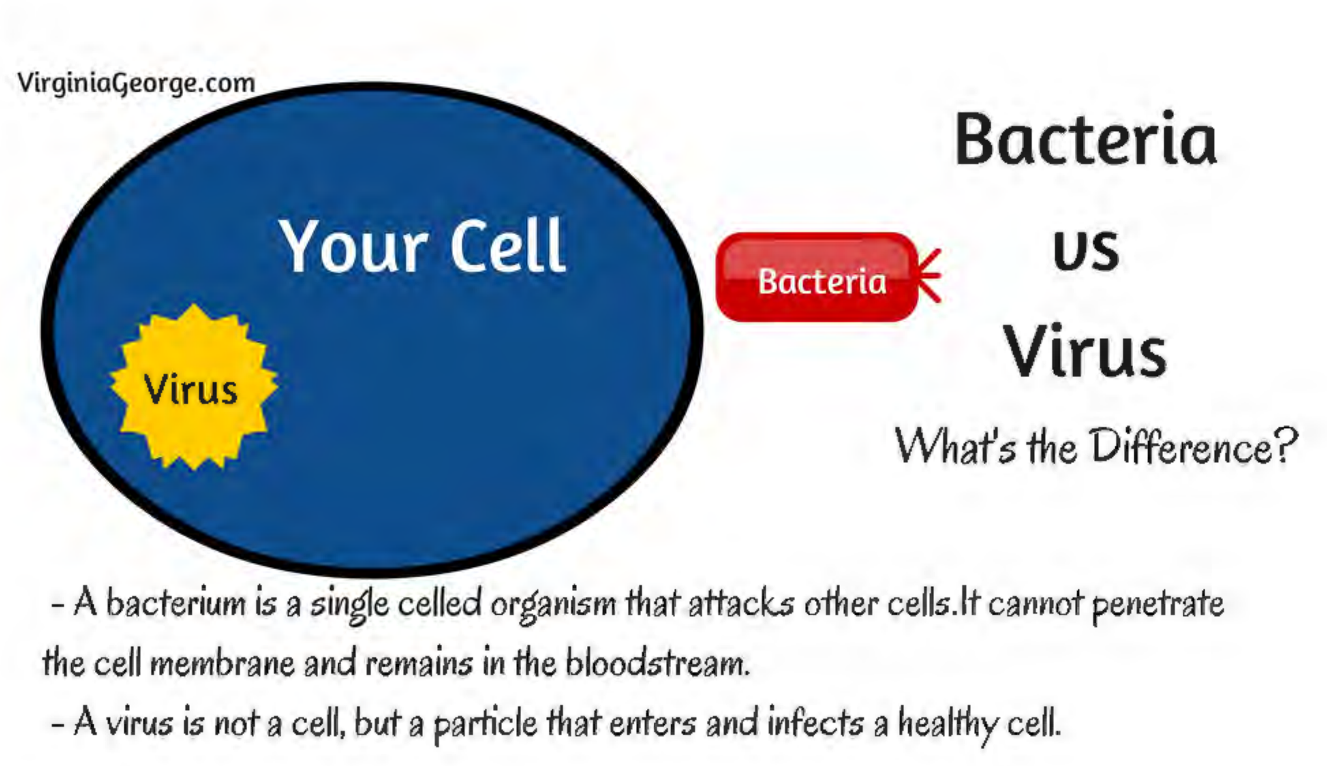


What are bacteria and viruses?

Bacteria are single-celled organisms found all over the inside and outside of our bodies [Centers for Disease Control and Prevention (CDCP), 2016}.

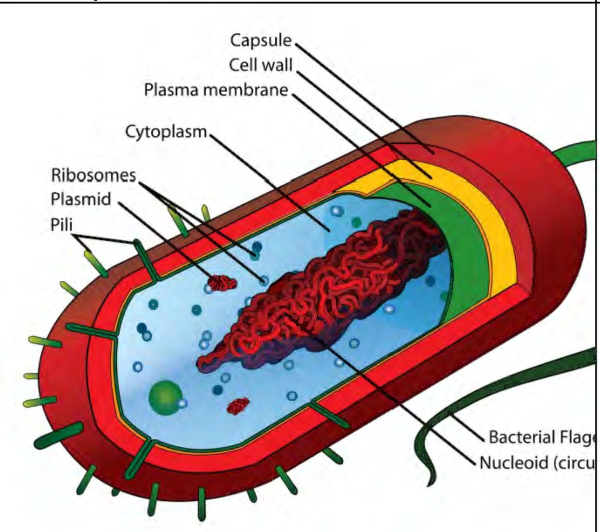
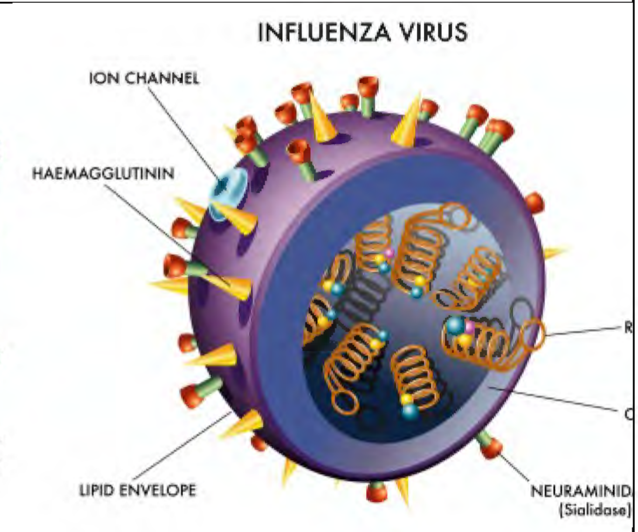
Many bacteria are not harmful. In fact, some are actually helpful, including the majority of bacteria that live in our intestines (guts). However, disease-causing bacteria can cause illnesses such as strep throat.

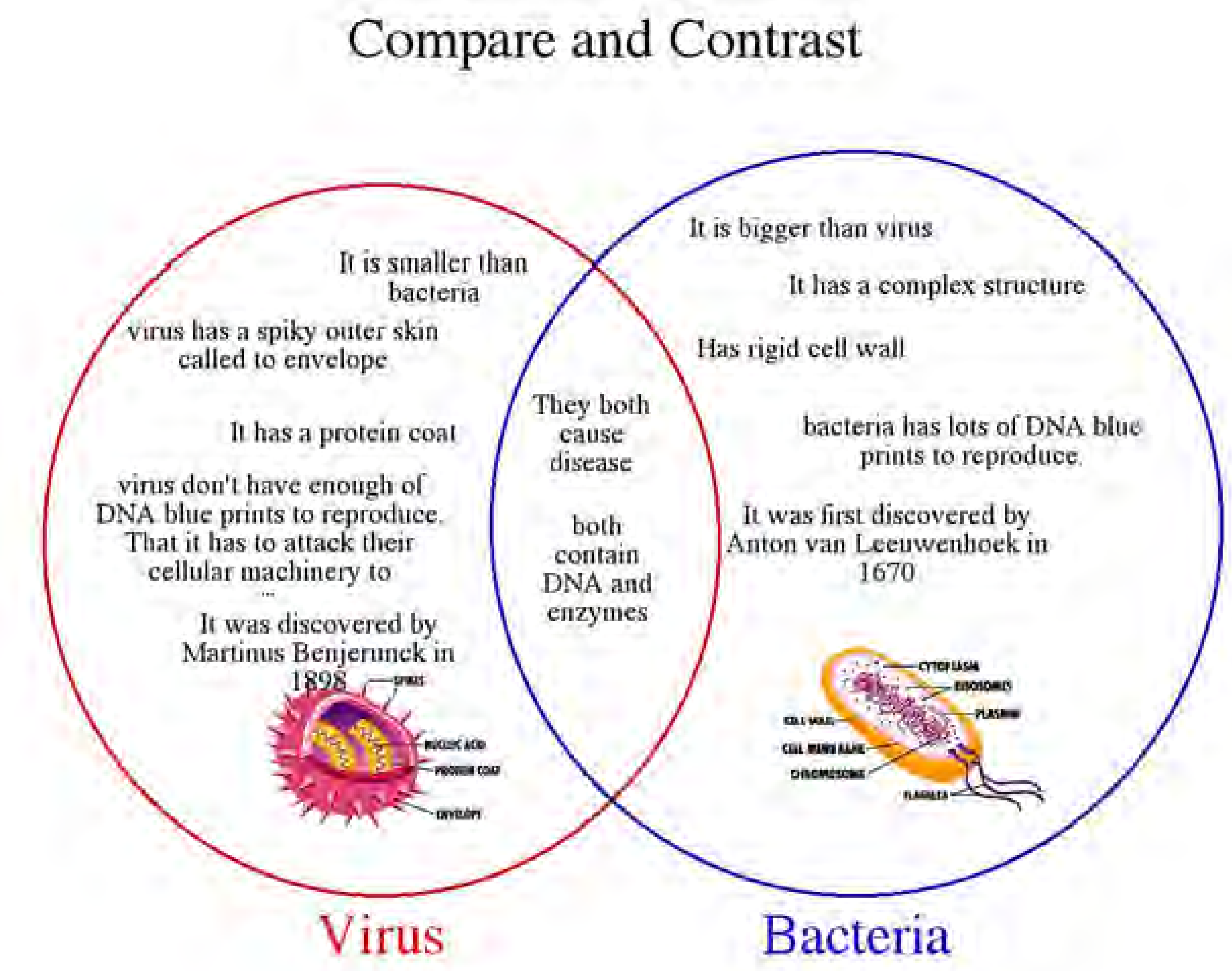
Viruses, on the other hand, are microbes that are even smaller than bacteria that cannot survive outside the body's cells (CDCP, 2016). They cause illness by invading healthy cells (table 1.1).



Sources: Yerzik, J. (2016)

Table1.1: Differences between bacteria and viruses

Bacteria	Viruses
Made of cells	Not made of cells
Bacteria are relatively complex, single-celled creatures with a rigid wall and a thin, rubbery membrane surrounding the fluid inside the cell.	All they have is a protein coat and a core of genetic material, either RNA or DNA.
Larger size. Usually about 100 times bigger	Much smaller than cells
Bacteria can survive in different environments, including extreme heat and cold, radioactive waste, and the human body.	Unlike bacteria, viruses can't survive without a host.
Less than 1% of bacteria cause diseases in people.	Unlike bacteria, most viruses do cause disease
Treatment of Bacterial Infections; Antibiotics are used for bacterial infections.	Treatment of Viral Infections; Viral infections have to run their course. Over the counter medicines can alleviate the symptoms and help you feel better.
Can be killed by antibiotics	Cannot be killed by antibiotics
Example of disease caused by Bacteria is Step throat	Example of disease caused by Virus is Influenza Virus
	



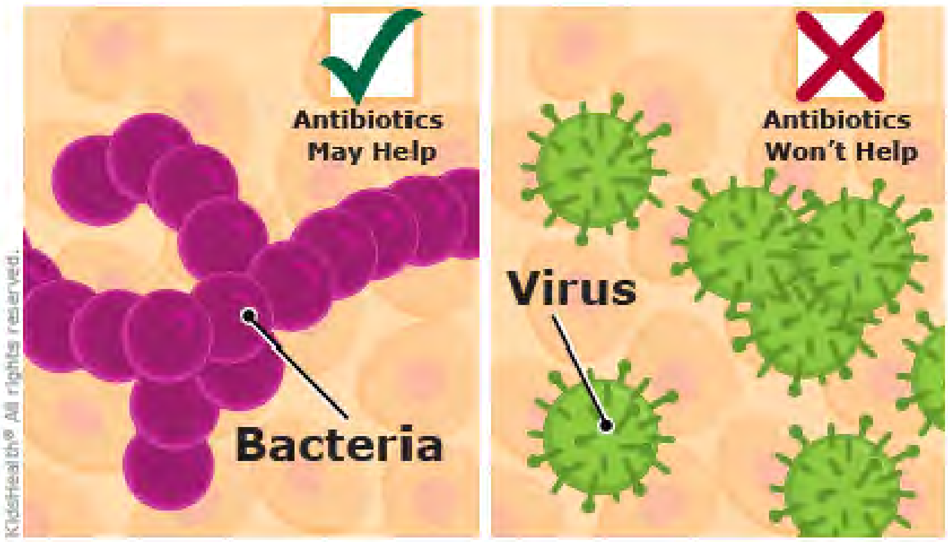
Source: Knowledge to kids, 2009

What is an antibiotic?

Antibiotics, also known as antimicrobial drugs, are drugs that fight infections caused by bacteria in both humans and animals (CDCP, 2016).

Antibiotics fight these infections either by killing the bacteria or making it difficult for the bacteria to grow and multiply. Antibiotics are not pain killers and can not be used to reduce any pain such as headache or back pain.

<u>Antibiotics do not have any effect on viruses.</u>



Which infections are caused by viruses and should not be treated with antibiotics?

Viral infections should not be treated with antibiotics (table2).

Common infections caused by viruses include:

- Colds
- Flu
- Most sore throats
- Most coughs and bronchitis ("chest colds")
- Many sinus infections
- Many ear infections

Table2: Illness and their usual cause

Illness	Usual Cause		Antibiotic Needed
	Viruses	Bacteria	
Cold/Runny Nose	✓		NO
Bronchitis/Chest Cold (in otherwise healthy children and adults)	✓		NO
Whooping Cough		✓	Yes
Flu	✓		NO
Strep Throat		✓	Yes
Sore Throat (except strep)	✓		NO
Fluid in the Middle Ear (otitis media with effusion)	✓		NO
Urinary Tract Infection		✓	Yes

Source: (CDCP, 2016).

Cough

By Khalid

Background

- Very often a cough *goes hand-in-hand with a cold*
- Coughing is a natural part of the body's defense system and serves an important purpose.
- A cough can be an indicator of infection, inflammation or irritation of the body's airways.

Types Of cough

- We all cough once or twice every hour to clear the airways of any mucus or debris.
- The coughing will become more frequent and more intense when there is an infection present
- There are two types of cough your customers may present you with: Dry (non-productive); Chesty (productive)

A chesty (productive) cough

- This is where the person feels that they are coughing something up – referred to as mucus, phlegm or sputum. This is usually clear or pale green, however if *it is yellow, brown or dark green it could indicate a bacterial infection and the patient should be referred.*

A dry (non productive) cough

- This is where the cells of the mucous membrane have become swollen and are raw, sore and inflamed. It is often *felt as a tickle in the back of the throat* which triggers the coughing and there is little mucus production. In this case, coughing is harmful because it removes the protective, soothing mucus that is present. This makes the cells even more uncomfortable, leading to more coughing in a vicious cycle that needs to be stopped.

Referral Criteria

- A cough lasting longer than two weeks
- A regularly recurring cough
- Shortness of breath/wheezing
- Chest pain or pain when breathing
- Coloured sputum (especially yellow or brown)
- Blood in the sputum

Symptoms of common cold

- Symptoms begin 2-3 days after infection with the cold virus and will include:
- Runny nose
- Sore throat
- Sneezing
- Cough
- Fever (high temperature)
- Blocked nose (congestion)
- Watery eyes
- Headache
- Tiredness/muscular aches and pains
- These symptoms can last from 2-14 days, but most people recover after a week.

Referral Criteria

- In general, anyone suffering from a cold and showing one or more of the following symptoms or complications should be referred to hospital :

Referral Criteria

- Wheezing
- Sore throat which doesn't improve after 3 days
- Pain on breathing or coughing
- Earache
- Blood stained or coloured mucus
- Shortness of breath
- A cough that is dry at night and productive in the morning
- If the symptoms have lasted longer than 14 days
- A cough that is worsened by exercise
- If there is a rash (Chickenpox)
- If neck stiffness is present (risk of meningitis)
- Headaches in children (risk of meningitis)

Treatment Options

- The principle aim of treatment for a cold is to relieve the symptoms so as to make the patient comfortable whilst the body's immune system deals with the infection.
- *Decongestants* to narrow the blood vessels; this reduces the inflammation in the nasal membrane and hence reduces the nasal congestion

Treatment Options

- ***Antihistamines***
- ***Analgesics: Pain-killers, such as paracetamol, ibuprofen and aspirin***

Treatment Options

- Aromatic Inhalations

Treatment of a Cough

- ***Expectorants***
- Expectorants are commonly recommended for (chesty) productive coughs.
- ***Suppressants***
- Suppressants (antitussives) are recommended for (dry) non-productive coughs. Suppressants are actually opioid drugs related to morphine, with one of their side effects being to suppress the cough reflex in the brain.

Treatment

- A cough suppressant must never be used for a chesty, productive cough as it will stop the cough reflex and prevent excess mucus being expelled.
- Diphenhydramine
- Diphenhydramine is an antihistamine which can reduce a cough in two ways. It causes drowsiness and the sedative effect may help to suppress a cough; this is often used in night-time cough remedies but may cause problems during the day. The second way it can help is when nasal secretions drip down the back of the throat causing an irritating cough (known as post-nasal drip); an antihistamine can dry up these secretions and thus improve the cough.

Sore Throats

Khalid Al-Kubaisi

Background

- Infection often causes inflammation in the respiratory tract and when it affects the throat (pharynx), this is known as pharyngitis
- If the inflammation affects the tonsils it is known as tonsillitis.
- Either case, we know it as **a sore throat.**

Cause

- The cause of the infection may either be viral, bacterial or fungal.
- 60-90% of all throat infections are caused by a virus and therefore will not respond to antibiotics such as penicillin.

Throat Infections

- Bacterial Infections:
- They can be distinguished from viral infections by the following signs and symptoms:
- Sudden onset of discomfort
- Worsens over a few days
- Lymphoid tissue (glands in the neck) often swells
- Sufferer feels generally unwell
- Pustules may be present on the tonsils

Pustules (White Spots on Throat)

Another causes

- Rarely, fungal infections can also occur, particularly in asthmatic patients who use corticosteroid inhalers and fail to rinse their mouth out after use.
- These customers should be referred to the
- pharmacist as should anyone whose sore throat has not improved after three days or is
- unresponsive to treatment.

Tonsillitis

Bacterial versus Viral

Bacterial

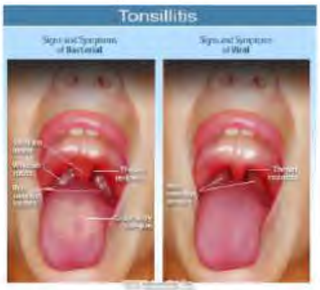
Viral

Viral !!

Viral

Tonsillitis

- Viral or Bacterial ?



When should I see my doctor about my sore throat?

When should I see my doctor about my sore throat?

- You should see your doctor when you have a sore throat and any 2 of these things:
- # A temperature more than 38°C/100.4°F
- # Tender glands around your throat
- # Swollen tonsils
- # Pus on your tonsils
- # 3 to 14 years old
- #DO NOT have a cough

Thank you

- Ahhhhh

Does hand washing work?

By Khalid

Back ground

- Margaret Ryan, Health Naval Research
- Centre, San Diego
- - Recruits ordered to wash hands at least
- 5 times / day
- - 45% reduction in respiratory illness
- Margaret Lee, Canadian Journal of
- Infection, Toronto
- - Nursing students washed hands at
- least 7 times / day
- - Reduced number of infections / colds

How to wash your hands

- Wet your hands
- Apply soap
- Rub hands together for 20 seconds
- Sing Twinkle, Twinkle song
- Rinse for 10 seconds
- Dry with a clean disposable towel
- Use towel to turn off taps and open the door

Use plain soap

- Does not have antibiotics
- Removes dirt and grease that attract bad germs
- Does not lead to antimicrobial resistance

Do not use antibacterial soap

- Antibacterial soap is not recommended
- Antibacterial soap leads to antimicrobial resistance
- Antibacterial soap has negative effects on the environment
- No more effective in preventing infections than plain soap

Hand drying

- Removes 42% more germs than washing alone
- Wet hands transmit germs more easily than dry hands
- Some hot air dryers encourage bacterial growth because
- hands are left warm and moist
- Use clean towels
- Avoid sharing towels

Alcohol-based hand sanitizers

- Must be at least 60% alcohol to be effective
- Do not cause antibiotic resistance
- Can kill bacteria and viruses
- Not effective against some germs that cause diarrhea
- Should not replace soap and water
- Not needed in the home

Antibiotic resistance

What is antibiotic resistance?

- Antibiotic resistance is the ability of bacteria to resist the effects of an antibiotic.
- Antibiotic resistance occurs when bacteria change in a way that reduces the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections.
- The bacteria survive and continue to multiply, causing more harm.

Why should I care about antibiotic resistance?

- Antibiotic resistance has been called one of the world's most pressing public health problems.
- Antibiotic resistance can cause illnesses that were once easily treatable with antibiotics to become dangerous infections, prolonging suffering for children and adults.

Antibiotic-resistant

- Antibiotic-resistant bacteria can spread to family members, schoolmates, and co-workers, and may threaten your community.
- Antibiotic-resistant bacteria are often more difficult to kill and more expensive to treat. In some cases, the antibiotic-resistant infections can lead to serious disability or even death.

Why are bacteria becoming resistant to antibiotics?

- Overuse and misuse of antibiotics can promote the development of antibiotic-resistant bacteria.
- Every time a person takes antibiotics, sensitive bacteria (bacteria that antibiotics can still attack) are killed, but resistant bacteria are left to grow and multiply.
- This is how repeated use of antibiotics can increase the number of drug-resistant bacteria.

- Antibiotics are not effective against viral infections like the common cold, flu, most sore throats, bronchitis, and many sinus and ear infections.
- Smart use of antibiotics is key to controlling the spread of resistance.

How do bacteria become resistant to antibiotics?

- Bacteria can become resistant to antibiotics through several ways. Some bacteria can "neutralize" an antibiotic by changing it in a way that makes it harmless.
- Others have learned how to pump an antibiotic back outside of the bacteria before it can do any harm.
- Some bacteria can change their outer structure so the antibiotic has no way to attach to the bacteria it is designed to kill.

- After being exposed to antibiotics, sometimes one of the bacteria can survive because it found a way to resist the antibiotic.
- If even one bacterium becomes resistant to antibiotics, it can then multiply and replace all the bacteria that were killed off.
- That means that exposure to antibiotics provides selective pressure making the surviving bacteria more likely to be resistant.
- Bacteria can also become resistant through mutation of their genetic material.

How should I use antibiotics to protect myself and my community from antibiotic resistance?

- Tell your healthcare professional you are concerned about antibiotic resistance.
- Ask your healthcare professional if there are steps you can take to feel better and get symptomatic relief without using antibiotics.
- Take the prescribed antibiotic exactly as your healthcare professional tells you.
- Discard any leftover medication.
- Ask your healthcare professional about vaccines recommended for you and your family to prevent infections that may require an antibiotic.
- Never skip doses or stop taking an antibiotic early unless your healthcare professional tells you to do so.
- Never take an antibiotic for a viral infection like a cold or the flu.
- Never pressure your healthcare professional to prescribe an antibiotic.
- Never save antibiotics for the next time you get sick.
- Never take antibiotics prescribed for someone else.

HOW TO HANDLE LEFTOVER MEDICATION

WHY REMOVE OLD MEDICATIONS FROM YOUR HOME?

Keeping old medications in your home can put you or your family at risk of:

Poisoning

Children and pets may get into the medicine and become sick or die. According to the Centers for Disease Control and Prevention, as of 2005, the number of emergency department visits by young children for medication poisonings exceeded visits by children for automobile accidents.

Having medicine stolen

People who have access to your house may go through medicine cabinets and take the drugs without your permission. Painkillers, in particular, can be illegally sold or given away so others can get high.

Taking medicine after its end date

All drugs have end dates, also known as expiration dates. Many medications don't work as well after this date. Some can degrade in quality and make you sick. Do not risk taking medicine after the end date.

Using medicine unwisely

Although it may be tempting to use old medicines when you feel sick instead of going to the doctor, this is very risky. Self-medicating with your own old medicine may lead to delayed treatment of a serious medical problem. The medicine may be past the end date or you may have unexpected reactions because of new medicines you're taking. Talk to your doctor, who can check your symptoms and your history, and, if necessary, write a new prescription that is right for your current illness.

HOW DO I SAFELY GET RID OF MEDICATIONS?

DO NOT throw drugs in the trash, flush them down the toilet, or pour them down the drain. This can pollute the water.

DO ask your pharmacist what to do with old medications. Many pharmacies, including those at grocery stores, will take unused medicines and dispose of them properly for you. They may or may not charge a small fee.

DO look online. Several web pages can point you to programs and stores that collect unused medicine, such as

the Drug Enforcement Administration: It organizes drug take-back programs a few times a year at certain locations. The dates and locations of upcoming events are posted at http://www.deadiversion.usdoj.gov/drug_disposal/takeback/

- the U.S. Food and Drug Administration website: It shows you how to properly throw away medicine, when it's appropriate. http://www.fda.gov/downloads/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/UnderstandingOver-theCounterMedicines/ucm107163.pdf
- Sharps Compliance, Inc.: It has a national directory of pharmacies that take back medicine: http://www.sharpsinc.com/locations/
- the American Medicine Chest Challenge: It has a national directory of permanent prescription drug collection boxes. http://www.americanmedicinechest.com

Antibiotic resistance

Adopted from ECDC, 2017

What is antibiotic resistance?

- Bacteria have antibiotic resistance when specific antibiotics have lost their ability to kill or stop the growth of the bacteria.
- Some bacteria are <u>**naturally resistant**</u> to certain antibiotics (intrinsic or inherent resistance).
- A more worrying problem is when some bacteria, that are normally susceptible to antibiotics, become resistant as a result of genetic changes (<u>acquired resistance</u>).

Antibiotic resistance

- Resistant bacteria survive in the presence of the antibiotic and continue to multiply causing longer illness or even death.
- Infections caused by resistant bacteria may require more care as well as alternative and more expensive antibiotics, which may have more severe side effects.

Causes of antibiotic resistance

- What is the most important cause of antibiotic resistance?
- Antibiotic resistance is a natural occurrence caused by <u>mutations in bacteria's genes</u>. However, excessive and inappropriate use of antibiotics accelerates the emergence and spread of antibiotic-resistant bacteria.
- When exposed to antibiotics, susceptible bacteria are killed and resistant bacteria can continue to grow and multiply.

- Resistant bacteria may spread and cause infections <u>in other people who have not taken any antibiotics</u>.
- **What is "inappropriate" use of antibiotics?**
- When you use antibiotics for the wrong reason: **most colds and flu** are caused by viruses against which antibiotics are NOT effective. In such cases, you won't improve your condition by taking antibiotics: antibiotics **don't lower fever** or **symptoms like sneezing.**

What is "inappropriate" use of antibiotics?

- When you use antibiotics incorrectly: if you **shorten the duration of treatment, lower the doses, don't comply with the right frequency** (taking the drug once a day instead of 2 or 3 times a day as directed), you won't have enough drug in your body and the bacteria will survive and may become resistant.
- **Always follow your doctor's advice on when and how to use antibiotics.**

Which diseases are caused by resistant bacteria?

- Multidrug-resistant bacteria can cause a wide range of infections: **urinary tract infection**, **pneumonia**, skin infection, **diarrhoea**, **bloodstream infection.**
- The location of the infection depends on the bacteria and the patient's condition.

- Patients in hospitals are at risk for infections **unrelated to the reason for admission,** including:
- Bloodstream and **surgical site infections** like MRSA (caused by Staphylococcus aureus resistant to methicillin, an antibiotic representative of those which are usually effective against Staphylococcus aureus.

Why is antibiotic resistance a problem?

- Treating infections due to resistant bacteria is a challenge: antibiotics commonly used are no longer effective and doctors have to choose other antibiotics.
- This may delay getting the right treatment to patients and may result in complications, including death. Also, a patient may need more care as well as alternative and more expensive antibiotics, which may have more severe side effects.

How serious is the problem?

- The situation is getting worse with the emergence of new bacterial strains resistant to several antibiotics at the same time (known as **multidrug-resistant bacteria**). Such bacteria may eventually become resistant to all existing antibiotics.
- Without antibiotics, we could return to the "pre-antibiotic era", when organ transplants, cancer chemotherapy, intensive care and other medical procedures would no longer be possible. Bacterial diseases would spread and could no longer be treated, causing death.

Is the problem worse than in the past?

- Before the discovery of antibiotics, thousands of people died from bacterial diseases, such as pneumonia or infection following surgery.
- Since antibiotics have been discovered and used, more and more bacteria, which were originally susceptible, have become resistant and developed numerous different means of fighting against antibiotics.

- Because resistance is increasing and few new antibiotics have been discovered and marketed in recent years, the problem of antibiotic resistance is now a major public health threat.

What can be done to solve the problem?

- Keeping antibiotics effectives is everyone's responsibility. Responsible use of antibiotics can help stop resistant bacteria from developing and help keep antibiotics effective for the use of future generations.
- On this basis, it is important to known when it is appropriate to take antibiotics and how to take antibiotics responsibly.
- Successful public awareness campaigns, which have already taken place in some countries, have resulted in a reduction of antibiotic consumption.

- Everyone can play an important role in decreasing antibiotic resistance:

1. **Follow your doctor's advice** when taking antibiotics.
2. When possible, prevent infection through appropriate **vaccination.**
3. **Wash your hands regularly,** for instance after sneezing or coughing before touching other things or people.
4. **Always use antibiotics under medical prescription, not using "leftovers" or antibiotics obtained without a prescription.**
5. Ask your pharmacist about how to dispose of the remaining medicines

Reference

- ECDC (European Centre for Disease Prevention and Control), 2017. Key messages for the general public. [online] Available at: http://ecdc.europa.eu/en/eaad/antibiotics-get-informed/key-messages/Pages/self-medication-general-public.aspx. [Accessed 17 January 2017].

Viruses or Bacteria
What's got you sick?

Antibiotics only treat bacterial infections. Viral illnesses cannot be treated with antibiotics. When an antibiotic is not prescribed, ask your healthcare professional for tips on how to relieve symptoms and feel better.

Illness	Usual Cause		Antibiotic Needed
	Viruses	Bacteria	
Cold/Runny Nose	✓		NO
Bronchitis/Chest Cold (in otherwise healthy children and adults)	✓		NO
Whooping Cough		✓	Yes
Flu	✓		NO
Strep Throat		✓	Yes
Sore Throat (except strep)	✓		NO
Fluid in the Middle Ear (otitis media with effusion)	✓		NO
Urinary Tract Infection		✓	Yes

Antibiotics Aren't Always the Answer

www.cdc.gov/getsmart

GET SMART

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Canada Drug Guide

So you have a Sore Throat ...now what do you do?

This information is to help you have an informed discussion with your doctor or pharmacist.

What causes a sore throat?

A virus or bacteria can cause a sore throat. Viruses cause **most** sore throats.

- When a virus causes a sore throat there is no antibiotic medication that will help. The sore throat will go away by itself.
- When bacteria causes a sore throat, it is often called strep throat. Antibiotic medications may help to relieve strep throat.

For 90% of adults and 70% of children, sore throats are caused by a virus.

No medication is needed to treat a virus.

How do I know if I have a virus or bacteria?

A throat swab by your doctor can show the difference. A special cotton swab is touched to the back of your throat. The swab is then put in a special tube and tested. Your doctor will tell you if you have a virus or bacteria. If you have strep throat your doctor may advise you to take antibiotic medication.

When should I see my doctor about my sore throat?

You should see your doctor when you have a sore throat and any 2 of these things:

- a temperature more than 38°C/100.4°F
- tender glands around your throat
- swollen tonsils
- pus on your tonsils
- 3 to 14 years old
- do **not** have a cough

Try these things to help a sore throat:

- sip water or juice
- suck cough candies, cough drops or lozenges
- gargle with a teaspoon of salt mixed in 1 cup of warm water
- take acetaminophen (Tylenol®) for pain and fever

over

The Canada Drug Guide Project, funded by Health Canada, aims to test the use of consumer-friendly information drawn from the best available studies.

How well do antibiotics work for strep throat?

Benefits of Antibiotics

- Penicillin is often the antibiotic used for Strep throat. For most people, a 10-day course is recommended. If you are allergic to penicillin, erythromycin is generally used.
- Strep throat lasts 5 to 7 days with or without antibiotics. People taking antibiotics have relief of their symptoms about 8 hours sooner than people who do not take antibiotics.
- About 2 out of 10 people taking antibiotics gain relief from symptoms such as fever and headache.
- Antibiotics prevent 2 to 4 people out of 100 from getting more serious problems such as an ear infection or abscessed tonsils.
- There is a very small chance that antibiotics lower chances of getting rheumatic fever: Antibiotics will benefit 1 person in 40,000.

Risks of Antibiotics

- For every 100 people who take penicillin, 5 to 10 will develop skin rash, nausea or diarrhea.
- For erythromycin, the chance of skin rash is less, but the chance of nausea and diarrhea is higher. For every 100 people, 20-40 will experience these problems.
- It is very rare to have an allergic reaction to an antibiotic that threatens your life: 1 in 40,000 people.
- Taking antibiotics when they are not needed may result in the development of resistance by the bacteria to the antibiotic. This means that the antibiotic will not kill the bacteria in the future.

Other Resources

Completed June, 1999

To learn more about the information on this sheet contact:

- Your Doctor
- Your Pharmacist
- **www.canadadrugguide.org** (this site has the references for the material on this sheet)

Production of this document has been made possible by a financial contribution from the Health Transition Fund, Health Canada. The views expressed herein do not necessarily represent the official policy of Health Canada.

GET THE FACTS- not the flu

PROTECT YOURSELF, YOUR FAMILY AND YOUR COMMUNITY

Seasonal influenza (flu) is a common infection of the airways and lungs that can spread easily among people. When someone with the flu sneezes or coughs, the virus can travel through the air and others can breathe it in.

The virus can also land on surfaces such as doorknobs, toys and phones. If a person touches something with the flu virus on it and then touches their eyes, nose or mouth, they can get the flu. In Canada, flu season usually runs from November to April.

Health Canada Santé Canada

Canada

RECOGNIZE THE SYMPTOMS

MOST COMMON

- Cough and fever that comes on quickly (not everyone will have a fever)

COMMON

- Being tired
- Body aches
- Sore throat
- Headache
- Not being hungry
- Runny nose

SOMETIMES

- Nausea
- Vomiting
- Diarrhea

The flu is not a cold. A cold is a mild infection of the nose and throat. A cold might linger but the symptoms will remain mild. Symptoms of the cold include runny nose, sneezing, cough and sore throat. With a cold you do not usually get a headache, fever, muscle aches or nausea.

CONTACT YOUR HEALTH CARE PROVIDER **RIGHT AWAY** IF YOU HAVE

- Shortness of breath, rapid breathing or difficulty breathing
- Chest pain
- Sudden dizziness or confusion
- Severe or continued vomiting
- High fever lasting more than 3 days

CONTACT YOUR HEALTH CARE PROVIDER IF YOU ARE CARING FOR A CHILD THAT HAS THE FLU **AND**

- Is not drinking or eating enough
- Is not waking up or interacting with others
- Is irritable; does not want to play or be held

Most people will recover from the flu within a week but others, such as pregnant women and those with chronic health conditions are more at risk for severe complications. If symptoms don't get better, see your healthcare provider.

STOPPING THE FLU VIRUS – YOU CAN MAKE A DIFFERENCE IN YOUR COMMUNITY.

HOW YOU CAN PREVENT THE SPREAD OF THE FLU

- Get a flu shot, if you can.
- Cough and sneeze into your arm, not your hand.
- Avoid touching your eyes, nose and mouth with your hands.
- Wash your hands often with soap and water for at least 20 seconds or, if hand washing is not possible, use hand sanitizer.
- Keep objects that many people touch clean, like doorknobs and TV remotes.
- If you are sick, stay at home and try to limit contact with others.
- To maintain a strong body, mind and spirit, eat well and be active every day.
- Be a role model for kids and teach them how they can stop the spread of the flu.

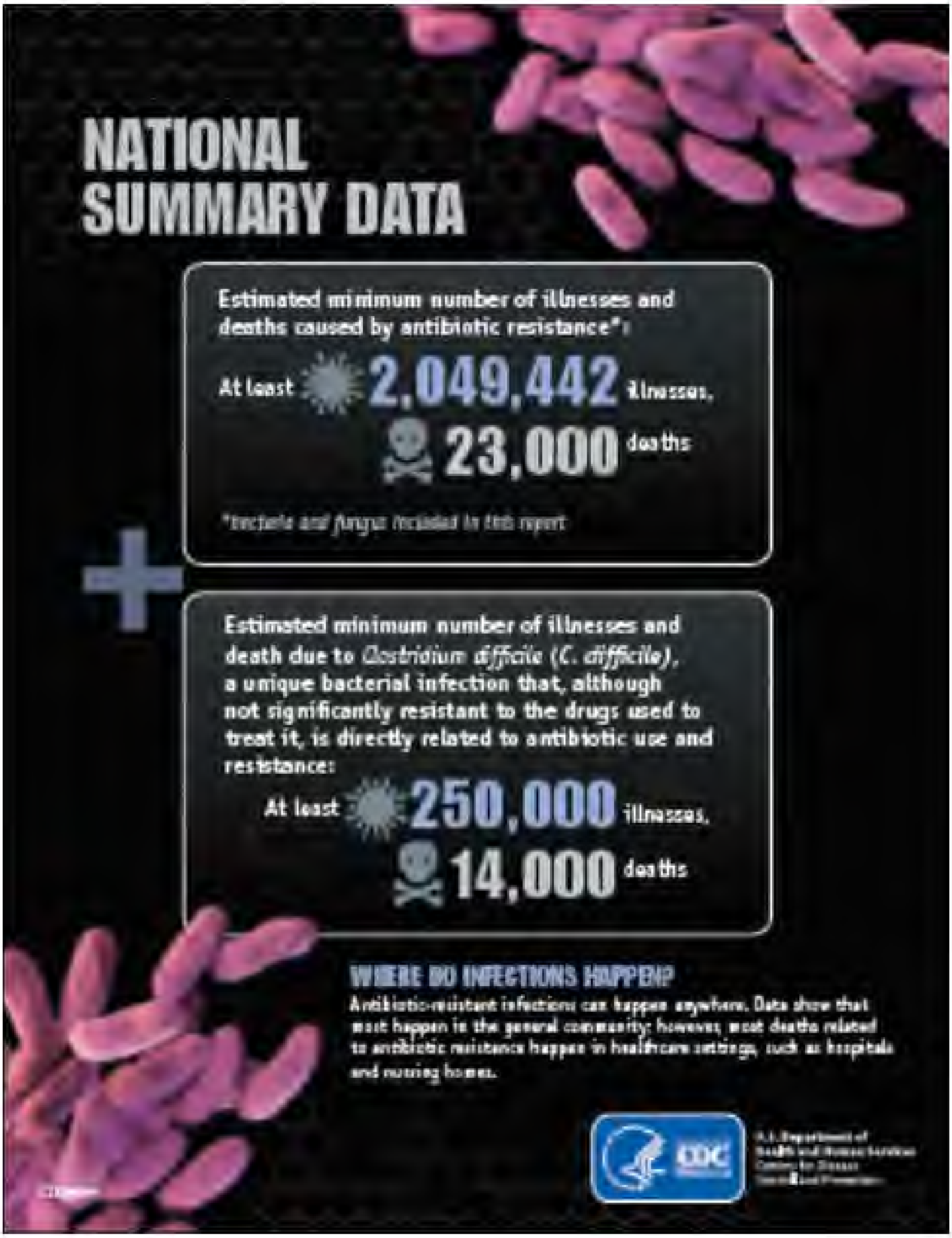
The flu virus usually changes from year-to-year, which is why there is a new vaccine each year to protect people. It is important to get the new flu shot every year.

TO LEARN MORE ABOUT THE FLU, TALK TO YOUR HEALTH CARE PROVIDER OR VISIT:

www.healthycanadians.gc.ca/flu

HC Pub.: 110291 Cat.: H34-241/1-2011E ISBN: 978-1-100-19615-2


Clean Your Hands!
1. WET
Soap
2. SOAP
3. WASH
20 seconds
4. RINSE
5. DRY
6. TURN OFF WATER WITH PAPER TOWEL
1. PLACE
2. RUB
until dry


NATIONAL SUMMARY DATA
Estimated minimum number of illnesses and deaths caused by antibiotic resistance*:
At least 2,049,442 illnesses,
23,000 deaths
Estimated minimum number of illnesses and death due to Clostridium difficile (C. difficile), a unique bacterial infection that, although not significantly resistant to the drugs used to treat it, is directly related to antibiotic use and resistance:
At least 250,000 illnesses,
14,000 deaths
WHERE DO INFECTIONS HAPPEN?
Antibiotic-resistant infections can happen anywhere. Data show that most happen in the general community; however, most deaths related to antibiotic resistance happen in healthcare settings, such as hospitals and nursing homes.
CDC

Appendix 25: Student Evaluation of the quality of teaching by the researcher

INDIVIDUAL RAPPORT

17) Instructor was friendly towards individual students	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
18) Instructor made students feel welcome in seeking help/advice in or outside of class.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
19) Instructor had a genuine interest in individual students	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
20) Instructor was adequately accessible to students during office hours or after class.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○

BREADTH

21) Instructor contrasted the implications of various theories.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
22) Instructor presented the background or origin of ideas/concepts developed in class.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
23) Instructor presented points of view other than his/her own when appropriate	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
24) Instructor adequately discussed current developments in the field.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○

Student Evaluation of Educational Quality (SEEQ) Standardized Instrument at the U of S

Instructions: For each of the following statements select the response that most closely expresses your opinion.

LEARNING

1) I have found the course intellectually challenging and stimulating	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
2) I have learned something which I consider valuable.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
3) My interest in the subject has increased as a consequence of this course.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
4) I have learned and understood the subject materials of this course	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○

ENTHUSIASM

5) Instructor was enthusiastic about teaching the course.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
6) Instructor was dynamic and energetic in conducting the course	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
7) Instructor enhanced presentations with the use of humour.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
8) Instructor's style of presentation held my interest during class.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○

ORGANIZATION

9) Instructor's explanations were clear.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
10) Course materials were well prepared and carefully explained.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
11) Proposed objectives agreed with those actually taught so I knew where the course was going	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
12) Instructor gave lectures that facilitated taking notes.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○

GROUP INTERACTION

13) Students were encouraged to participate in class discussions.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
14) Students were invited to share their ideas and knowledge.	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
15) Students were encouraged to ask questions and were given meaningful answers	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
16) Students were encouraged to express their own ideas and/or question the instructor	Not Applicable ○	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○

COMMENTS/FEEDBACK

34) Please provide any additional comments or feedback	4096 characters left

Appendix 26

Table 6. 2: Common threats to internal validity in experimental designs with actions that can mitigate their effects in the current research (adapted from Cohen et al., 2007; Robson, 2002; Mertens, 2010; Babbie, 2010)

Threat to internal validity	**Description**	**Actions taken to reduce impact**
Diffusion of educational intervention	This occurs when control and experimental groups have contact or communicate with one another, resulting in the sharing of information about the independent variable.	The control and experimental groups in the present study are based in different settings to minimise cross contamination
Experimental mortality	Withdrawal from the original sample can occur, which results in a biased group.	Because the intervention took place over a short period of time, with the university's full support, attrition was minimal. Furthermore, colleges that are participating have asserted that session attendance will be mandatory.
History	Events beyond the researcher's control may occur in the course of the research that may have a significant impact on the outcomes or results.	The researcher obtained information from the university about any additional feedback or input the participants may have received pertaining to social and behavioural changes (i.e., social activities or curriculum that might affect self-medication practice with antibiotics). Furthermore, a control group was employed for comparison
Instrumentation	Unreliable measures.	Instrumentation was valid and reliable.

Table 6.2 ~*continued*

Threat to internal validity	**Description**	**Actions taken to reduce impact**
Selection	This refers to the potential for selection bias, which could result in differences in the groups and might have a significant impact on respondents' performance.	Users of antibiotics without a doctor's prescription were identified in both intervention and control groups through the use of a screening measure. Because randomisation was not employed and each group was in a different setting, uncontrolled pre-existing differences are likely to exist. However, statistical tests were used to ascertain that the groups were equivalent at pre-test. But it should be noted that the research is not intended to generalise to other groups or settings.
Selection–maturation interaction	This refers to the tendency for groups to move towards each other on a dependent variable if the groups were initially different.	The selection criteria employed for both experimental and control groups was similar. Groups were relatively similar in age (all adolescents). Nevertheless, the gender ratio was different between the two groups.
Statistical regression	This describes the tendency of scores at the point of post-test to move in the direction of the mean.	Appropriate statistical analyses were employed. Checks were used to ascertain if the groups were equivalent at the point of pre-test. A control group was also used; consequently, effects would also be seen in their results.

Table 6.2 ~*continued*

Threat to internal validity	**Description**	**Actions taken to reduce impact**
Maturation	Participants experience changes in the course of the study that are not related to the intervention.	The time between the two points of data collection was relatively short (18 weeks). Additionally, a control group was used and all the participants were about the same age
Testing/Instrument Reactivity	Subjecting participants to initial testing can affect their behaviour on subsequent tests.	Participants were fully informed of the purpose of the study in line with ethical guidelines of the university. To maintain consistency all measures were completed in the same environment, using valid and reliable measures. Self-reported survey of both groups only took place on two occasions and these were separated by a 3-months interval.

Appendix 27: Antibiotic assessment tool of the intervention study

First Part: Demographic Data

Age:

Gender: M ☐ F ☐

Nationality:

College:

Year of study:

Living in: inside Campus ☐ outside Campus ☐

At least one member of your family (parents, sister, and brother) works in a health related field?

- ☐ yes
- ☐ no

Second Part: Frequency of antibiotic use

1. Have you used antibiotics without doctor's prescription in the previous year?

- ☐ yes
- ☐ no

2. If yes, how many times?

- ☐ 1-2
- ☐ 3-5
- ☐ > 5

Third part: Knowledge about Antibiotics

3. Penicillin or Amoxicillin are antibiotics.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

4. Aspirin is an antibiotic.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

5. Paracetamol is an antibiotic.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

6. Antibiotics are useful for bacterial infections (e.g. Tuberculosis).

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

7. Antibiotics are useful for viral infections (e.g. flu).

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

8. Antibiotics are indicated to reduce any kind of pain and inflammation.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

9. Antibiotics can kill "good bacteria" present in our organism.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

10. Antibiotics can cause secondary infections after killing good bacteria present in our organism

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

11. Antibiotics can cause allergic reactions.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

Fourth Part: Awareness about antibiotic resistance

12. Have you ever heard about antibiotic resistance?
   - ☐ yes
   - ☐ no

13. In particular, have you discussed the problem of antibiotic resistance during degree courses?
   - ☐ yes
   - ☐ no

14. Have you ever heard of it outside degree courses?
   - ☐ yes
   - ☐ no

If yes, where have you heard it from? (more than one answer is possible)

- ☐ I have never heard about it outside degree course
- ☐ General Practitioner
- ☐ Television
- ☐ Newspaper
- ☐ Web
- ☐ Other ______________________

15. Antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

16. Misuse of antibiotics can lead to a loss of sensitivity of an antibiotic to a specific pathogen.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

17. If symptoms improve before it is completed the full course of antibiotic, you can stop taking it.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

Fifth Part: Attitudes regarding consumption of antibiotics

18. Do you usually take antibiotic for cold or sore throat?
    - ☐ yes
    - ☐ no
19. Do you usually take antibiotic for fever?
    - ☐ yes
    - ☐ no

20. Do you usually stop taking antibiotic when you start feeling better?
    - ☐ yes
    - ☐ no

21. Do you take antibiotic only when prescribed by the doctor?
    - ☐ yes
    - ☐ no

22. Do you keep leftovers antibiotics at home because they might be useful in the future?
    - ☐ yes
    - ☐ no

23. Do you use leftovers antibiotics when you have cold, sore throat or flu without consulting your doctor?
    - ☐ yes
    - ☐ no

24. Do you buy antibiotics without a medical receipt?
    - ☐ yes
    - ☐ no

25. Have you ever started an antibiotic therapy after a simple doctor call, without a proper medical examination?
    - ☐ yes
    - ☐ no

Thank you so much