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WAITING TIME AND PATIENTS’ SATISFACTION

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Declaration of Original Work

I, Haleema Mohamed Hasan Mahmood Al Hammadi, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this dissertation entitled "*Waiting Time and Patients' Satisfaction*", hereby, solemnly declare that this dissertation is my own original research work that has been done and prepared by me under the supervision of Dr. Youssef Boulaksil, in the College of Business and Economics at UAEU. This work has not previously been presented or published, or formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my dissertation have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this dissertation.

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Abstract

In line with Vision 2021, the UAE's National Agenda has six pillars: providing world-class healthcare is one of them. It is hence not surprising that the UAE healthcare industry is allocating substantial weight to the element of quality. Patient-centred care is internationally becoming part of the quality domain. Patient-centred quality may be defined as "providing the care that the patient needs in the manner the patient desires at the time the patient desires". This requires substantially more attention to learning about patients' preferences. One of the main dimensions of patient-centred quality is the timely access to care, which includes shorter waiting time and an efficient use of physicians' time. Long waiting time is a globally challenging phenomenon that most healthcare systems face; it is the main topic of this thesis.

The thesis consists of two main studies. The first empirical study was conducted by interviewing a sample of 552 patients with the objective of assessing their satisfaction with their waiting experience in UAE's hospitals. The collected data allowed us to test several hypotheses that were formulated on the basis of an extensive literature study to better understand the relationship between waiting time and certain variables.

In the second study, a simulation model for a typical clinic was built from real data obtained from a public hospital in Abu Dhabi emirate, considering two types of patients' arrival; by appointment and walk-in, to test the effect of delayed arrivals and number of resources on the waiting time. The objective of the simulation study was to determine effective strategies for reducing the patients' waiting time. The results of both studies are presented and discussed, with some recommendations, managerial implications and conclusions.

Keywords: Waiting time, Waiting experience, Patients satisfaction, Patients perception, Patients expectation, Simulation model, delayed arrival, number of resources, Outpatient clinic, Walk-in patients.

Title and Abstract (in Arabic)

أوقات الإنتظار ورضا المرضى

الملخّص

تماشيا مع رؤية 2021، يتضمن جدول الأعمال الوطني لدولة الإمارات العربية المتحدة ستة ركائز، وأحد هذه الركائز هو توفير الرعاية الصحية بمعايير عالميةالمستوى. ليس من المستغرب إذن أن يولي قطاع الرعاية الصحية في دولة الإمارات العربية المتحدة أهمية كبيرة لمعيار الجودة في تقديم الرعاية والخدمات الصحية للمرضى عالمياُ، أصبحت الرعاية التي تركز على المريض تشكل جزءًا أساسيا من معيار الجودة. ويمكن تعريف الجودة التي تركز على المريض على أنها "توفير الرعاية التي يحتاجها المريض بالطريقة التي يفضلها المريض في الوقت الذي يرغب فيه المريض". وهذا يتطلب مزيدًا من الاهتمام بمعرفة ما يفضله المرضى. أحد اهم العناصر الرئيسية للجودة التي تركز على المريض في الوصول إلى الرعاية في الوقت المناسب، هو جعل وقت الانتظار أقصر والاستخدام الأمثل لوقت الأطباء. إن أوقات الانتظار الطويلة هي ظاهرة عالمية تعاني منها معظم أنظمة الرعاية الصحية؛ هذا هو الموضوع الرئيسي لهذه الأطروحة.

تتكون هذه الأطروحة من دراستين رئيسيتين. أجريت أول دراسة تجريبية عن طريق إجراء مقابلات مع عدد 552 مريض بهدف تقييم رضاهم عن تجربة الانتظار في مستشفيات دولة الإمارات العربية المتحدة. سمحت لنا البيانات التي تم جمعها باختبار العديد من الفرضيات التي تمت صياغتها على أساس دراسة تقصي شاملة لفهم العلاقة بين وقت الانتظار وعناصر معينة بشكل أفضل.

في الدراسة الثانية، تم بناء نموذج محاكاة لعيادة نموذجية من بيانات حقيقية تم الحصول عليها من مستشفى عام في إمارة أبوظبي، مع الأخذ بعين الاعتبار نوعين من المرضى وهم: مرضى لديهم مواعيد مسبقة، ومرضى بدون مواعيد مسبقة، وذلك لاختبار تأثير الوصول المتأخر وعدد الموارد المتاحة على وقت الانتظار. ان الهدف من دراسة المحاكاة هو تحديد استراتيجيات فعالة لتقليل وقت انتظار المرضى، وقد تم عرض نتائج كلتا الدراستين ومناقشتهما مع بعض التوصيات والآثار الإدارية والاستنتاجات في نهاية هذه الأطروحة.

مفاهيم البحث الرئيسة: وقت الانتظار، تجربة الانتظار، رضا المرضى، تجربة المرضى، توقعات المرضى، نموذج المحاكاة، تأخر وصول المرضى، عدد الموارد، عيادة العيادات الخارجية، مرضى بدون موعد مسبق.

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Dedication

To my beloved parents, who taught me to work hard for the things that I aspire to achieve. To my husband who always believed in me, sometimes more than I personally do. To my brothers, sisters, extended family and friends whom I am truly grateful for having you in my life thank you for your support and understanding throughout my doctorate journey. Thank you all for supporting and encouraging me to bring my big dream to reality.

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List of Abbreviations

ENT	Ear, Nose and Throat
KPIs	Key Performance Indicators
OPD	Outpatient Department
UAE	United Arab Emirates
UK	United Kingdom
USA	United States of America
WT1	Waiting time from arrival to registration
WT2	Waiting time from registration to consultation
WT3	Waiting time at the pharmacy for receiving medicine

Chapter 1: Introduction

In the past two decades, the relationship between the growth of services and overall economic growth has become closer as the average service contribution to GDP and value added has increased. In high-income countries (Deloitte, 2018), the value added by services had increased constituted nearly 56 percent of the national GDP represented by the real market sector (Mckinsey, 1992). Among the high-income nations, the contribution of services' value added to GDP was highest in the United States. In low- and middle-income countries, the increase in the services' share of GDP was more prominent; it jumped from 48% in 1997 to 57% in 2015 (Bank, 2016) accounted for about 82% of the GDP, and about 87% of employment (Statistics, 2014). In this context, Service Management is becoming increasingly important for companies and governmental institutions when they seek productivity growth and cost advantage over their local and international competitors. They find it typically by optimizing the service operations within and across organizations to satisfy customer needs (Voudouris, Lesaint, & Owusu, 2008).

Healthcare is one of the most rapidly growing service sectors of the global economy, with a global expenditure total of $7,682 million in 2015 (Economist, 2016). According to estimates by the Economist Intelligence Unit, the healthcare sector's spending will increase worldwide, rising to an average of 5.2% a year in 2014-2018, equal to $9.3 trillion (Economist, 2014). One of the most important service industries in the United Arab Emirates (UAE) is the healthcare sector. In this country, the healthcare sector has witnessed a long period of high growth, which is forecast to continue, judging by the gap between supply and demand (INSEAD, 2017).

The demand to improve the quality of healthcare and its related services is increasing (Cheng-Hua, Yuan-Duen, Wei-I, & Pang-Mau, 2006). However, the resources to do so are becoming more and more limited, while the cost of healthcare is constantly increasing. This increase is driven by the needs of aging and growing populations, the prevalence of chronic diseases, emerging market expansion, infrastructure improvements, and advances in treatment and technology (Deloitte, 2015). This may explain the increased interest in optimizing healthcare operations, where the trade-off is usually between improving patients' satisfaction and reducing cost. This is usually a challenge for administrators and policy makers.

The UAE is trying aggressively to meet the growing needs of its nationals and residents and diversify its economy, partly by expanding its national healthcare system. In line with the vision of the UAE President, His Highness Sheikh Khalifa Bin Zayed Al Nahyan, to provide security, prosperity and a good life for Emiratis, the priority of the UAE Federal Government budget for 2019 has been allocated to the social services, education and health sectors which account for 43.5% of the total budget for the year (KhaleejTimes, 2018; UAE-Cabinet, 2018). The prediction of the Ministry of Health was that by 2015 the government spending on healthcare sector would reach AED40 billion (National, 2013) but in fact it reached AED56.25 billion, and in 2016 this sum increased by 5%. It is expected to grow at an annual rate of 5.5% to reach AED73.52 billion in 2020 (U.S & U.A.E BusinessCouncil, 2018). According to the World Health Organization, the total expenditure on health as of 2014 as a percentage of the country's GDP was 3.6% (WHO, 2018) whereas it has been announced that the healthcare sector budget for 2019 will be 7.4% of GDP (UAE-Cabinet, 2018).

Healthcare is increasingly taking center stage for the government, which deeply desires to improve healthcare quality and safety and yet to control cost. The public policies and market influence the way in which the direction of change in hospital practices and performance is driven and raises challenges among healthcare providers. In an attempt to resolve the issues facing the healthcare sector, many governments are seeking administrators' views on their current resources, waiting time, quality of care, shortage of staff/resources, medical errors, disclosure of performance data to the public, and efforts to improve quality.

The UAE the Federal Government has developed strategic plans to both respond to the growing demand for healthcare and meet the associated challenges. One of the urgent tasks of the UAE 2021 vision is to achieve "world-class healthcare" through, among other measures, accrediting all public and private hospitals according to clear national and international standards. In keeping with the federal government vision, the emirate of Abu Dhabi has developed its own strategic healthcare plan. In December 2014, the Crown Prince of Abu Dhabi approved the emirate's strategy, one of the pillars of which is to improve the nation's healthcare. This strategy included 85 initiatives which aimed to elevate the quality of healthcare services, improve safety standards and patient experience, attract and retain medical professionals, integrate IT systems and build on electronic data (HAAD, 2014)

There are several reasons for the growth of the UAE healthcare market, including moves to introduce universal health insurance. Another factor is increasing prosperity, which is leading to a higher demand for better healthcare (U.S & U.A.E BusinessCouncil, 2018). In this regard, various statistics have shown that the quality of UAE healthcare has improved. In 2017, the Legatum Institute's Legatum Prosperity

Index report ranked the healthcare of the UAE 25th in the world, up from 34th in 2015 and 28th in 2016 (Vision2021, 2018). On the sub-index level of satisfaction with healthcare, the UAE also ranked 9th in the world, thus among the top 10 countries in terms of residents' satisfaction with their health services (Gulfnews, 2017). The UAE has also ranked on the top 10 economies in healthcare efficiency (Bloomberg, 2018), and, in the World Health Organization's ranking of the world's health systems, the UAE is ranked 27th (WHO, 2019).

In this thesis, we focus on one of the key activities of a hospital: its outpatient department (OPD) and its operations. Outpatient service departments provide diagnostic, curative, preventive and rehabilitative services to patients and are becoming a crucial component of healthcare services (Broyles & Roche, 2008). Outpatient department services are also very important for hospital administration because this is the first interface that patients experience with the hospital. Outpatient service departments typically face a number of challenges. First, they treat a high volume of patients. They arrive according to an appointments schedule or at random (we refer to these as walk-in patients). What even further complicates the arrivals is that the patients who have an appointment rarely arrive on time; they may be delayed by all sorts of reasons outside their control as well as lack of respect; or they arrive earlier than their appointment. Second, the service-mix of procedures in medical and surgical specialties changes over time (Barlow, 2002). The combination of these two challenges often results in over-crowded OPDs with long waiting times for patients. A study by Su and Shih (2003) in Taiwan found that on average 72% of the daily visitors to healthcare centers are walk-ins. In a study conducted by Wang, Liu, and Wan (2017), however, a healthcare center in New York city was found to have 15% of its patients as walk-ins, though the clinic administration team believed that the walk-ins were the main reason for the long patient waits. Some research effort has gone into accommodating all types of design and produced an appointments system with three decision levels, namely; the appointment rule, patient classification and adjustment for no-shows and walk-ins. For further detail, please refer to Cayirli and Veral (2009). A review of the literature shows that patient queues are common and considered one of the major challenges in healthcare services (Afrane & Appah, 2014; Ameh, Sabo, & Oyefabi, 2013; Cheng-Hua et al., 2006; Ir et al., 2011; Mital, 2010).

The literature on service quality indicates that waiting experiences are typically negative and have been shown to affect the overall satisfaction of the patients with the service provided (Ir et al., 2011). The long waiting time leads to a lose-lose situation, because patients lose valuable time, the hospital loses patients and reputation, and the staff experience tension and stress (Barlow, 2002). Hospital administrators and policy makers are becoming more and more concerned about outpatient waiting time, since it measures the organization's efficiency.

1.1 Study objectives and research questions

The above discussion leads us to the key research question: How can we reduce the waiting time and increase patients' satisfaction in the UAE healthcare facilities?

To raise the level of understanding what factors are contributing to reducing the waiting time and increasing patients' satisfaction, this research question is further divided into four sub-questions in two sections.

1.1.1 Research question 1

There is a demand to improve the quality of healthcare and its related services (Cheng-Hua et al., 2006). The public policies and the demanding markets are forcing changes in the practice of healthcare facilities which is increasing the competition between them. In the UAE, the driver for demanding better healthcare is the move towards universal health insurance and increasing prosperity. At the same time, while the demand is increasing, the challenges that outpatient clinics are facing are also increasing, including long waiting times. Two major domains of healthcare quality are patient-centered and timely treatment, which reduce the waits and harmful delays for healthcare receivers and providers (IoMCoQoHCi, 2001). There is consensus that the waiting time affects patients' satisfaction, but there are few studies which could be found to link the satisfaction with the quality of service and with that of the waiting time (Bielen & Demoulin, 2007; Mejabi & Olujide, 2008; Pakdil & Harwood, 2005). Due to the need to understand the relationship between waiting time satisfaction and t service quality satisfaction, the present study attempts to answer the following research question:

Q1: What is the relationship between patients' waiting time satisfaction and their satisfaction about the services provided in the healthcare sector?

During the literature review different factors were found to affect waiting time satisfaction, and both agreement and disagreement were found on some of the factors that affect waiting time satisfaction. This led to research question 2.

1.1.2 Research question 2

"The psychology of waiting line" is a conceptual framework developed by Maister (1984), identifying the factors affecting customer satisfaction with waiting time. Various attempts have been made to test and validate Maister's proposition in such sectors as healthcare which have produced a range of findings. The differences in results sometimes come from the area of investigation and led us to explore them in research question number 2, which is stated as follows:

Q2: What are the factors that affect waiting time satisfaction?

After answering the research question 2, it seemed of interest to understand what caused the long waiting time. This led to research question 3.

1.1.3 Research question 3

The phenomena of long waiting time are common in public healthcare facilities worldwide. The literature review summarizes many reasons, which have been investigated on the basis of observation, modelling, but few are based on surveys of patients (in our review only one was found (Ir et al., 2011)). This led to research question 3:

Q3: From the patients' perspective, what are the factors that influence excessive waiting time?

Sixteen causes of long waiting time were listed in the present study as part of the survey of patients' opinions on what caused the waiting times in UAE healthcare facilities. The findings of this question were used to formulate the design of the discrete event simulation method that contributes to answering research question 4.

1.1.4 Research question 4

Society's resources are becoming more and more limited, while the cost of healthcare is constantly increasing. Despite the advances in medical technologies, human resources constraints have imposed a critical challenge on healthcare providers. The World Health Organization (WHO) announced that there is a critical lack of healthcare resources globally in all specialties, i.e. doctors, physicians, nurses, etc. This shortage is expected to grow worse in the future for several reasons, such as an aging population. This may explain why several strategies have been proposed to tackle the situation, including the increased interest in and the need to apply operations management techniques, such as simulation, queuing theory, scheduling of health care systems, and lean philosophy (Lim & Tang, 2000), which would allow better use of the existing human resources. Studies showed that patients' unpunctuality (arriving earlier or later than their appointment) is a contributing factor of long waiting time. Coming earlier than their appointment does not pay off; the studies showed that it had in fact an opposite effect, making the queue longer and increasing the waiting time. What makes this experience worse is the walk-in patients who arrive at random intervals (Fetter & Thompson, 1966). This trade-off between, better use of the existing resources, improving patients' satisfaction and cost creates a challenge for administrators and policy makers. The led to the fourth research question:

Q4: What is the effect of the factors that have been identified by patients as leading to excessive waiting time on the waiting time?

1.2 Scope of the study

This study was conducted to assess patients' satisfaction with their waiting time experience in UAE healthcare facilities and to determine effective strategies for reducing this waiting time. The study reviews the literature on the areas of service quality as a key to the success of the organizations and demonstrates its relationship to an organization's financial outcomes, and its customers' satisfaction, retention and loyalty. The study will also review what have been written about service quality in the healthcare sector, its relationship to patient satisfaction and what constitutes patient satisfaction, including their expectations and perceptions of received care. The study also reviews the area of customers' waiting time in marketing studies and in relation to healthcare services, in addition to the four aspects of waiting time and the expected and perceived waiting time. The latter was reviewed to understand what variables are identified as relating to patient satisfaction and waiting time and the service quality provided, which allows the gap in the literature to be identified in relation to differences in the reported findings. Moreover, a review of the identified causes of prolonged waiting time reported in different studies is added. The literature review allows survey to be designed which is intended to collect the primary data for meeting the research objectives. The findings of what causes long waiting time for patients are used to design a simulation model from which to draw guidance in designing operating strategies in the healthcare sector to reduce patients' waiting time. For the simulation model study, an input from the survey will be used, in addition to secondary data from one of the hospitals in the UAE, and, on the basis of the data, the parameters will be identified, designed and estimated.

1.3 Relevance/significance/contribution of this research

Although many studies have emerged about the quality of healthcare and patient satisfaction in the UAE, and the Gulf Council Countries (GCC), there seem to be no studies from the UAE and the GCC about waiting time satisfaction in outpatient clinics. This research project is generally intended to contribute to the existing literature on waiting time in the healthcare sector in general, and in the UAE in specific, to improve the services offered. The empirical study shows the importance of the survey-based method for understanding the phenomena of waiting and what contributes to them, in addition to assessing patients' satisfaction with their waiting time. It also demonstrates that patients' opinion is valid and they can identify a needless problem. The hypotheses testing results confirmed that the waiting time satisfaction affects the satisfaction about the services provided to the patients. It also confirmed that the waiting time perceptions and expectations, the perceived attractiveness of the waiting environment, receiving information in case of delay and about the expected waiting time, the effect of patients coming alone or accompanied, visiting the hospital for the first time, the time spent in consultation with doctors, patient perception about the technical and interpersonal skills of doctors, and the socio-demographics are all affecting the waiting time satisfaction in the healthcare facilities in the UAE. The empirical study also demonstrated that the top five factors causing the prolonged waiting time from patients' point of view are; Patients' unpunctuality, understaffing, using computer systems, inadequate facility (number of consultation rooms), and crowded waiting rooms. The simulation study contributes to reducing global concerns about the lack of resources and their use, and also about patients' access to healthcare facilities. A better and more efficient use of the available resources allows more patients to access the healthcare facilities and to be seen by doctors. In addition, the study highlighted the effect of patients' delayed arrivals on the waiting time. In addition, the simulation allowed allowing the inefficiencies in patient-related processes to be identified.

The study considers the agreement on the reported results about patients' satisfaction with waiting time as applicable to the UAE healthcare sector. In this research, the inconsistences in the previous findings are considered as a gap in the literature (detailed in Chapter 2, Section 2.3 below), namely, the relationship of patients' satisfaction with the length of waiting time,; their perceptions and expectations of waiting time, their experience of waiting time (attractiveness of the waiting environment and uncertainty of waiting time), patients' coming to their appointment alone or accompanied with another person, the frequency of visits, time spent in consultation with doctors, and the socio-demographics of the patients. Most previous studies tested one or two of the above variables, while in the present research they are all under study. This will, it is hoped, give this study an advantage over other studies. It is a cross-sectional survey in exploratory form to describe patients' satisfaction with their experience of waiting time and it provides a snapshot of their satisfaction at a particular time. In addition to the above, by observing what is going on patients can usefully comment on the service process – they are too rarely asked their opinion on the causes of their long wait. In this research we ask them and build on their answers to produce some strategic solutions for reducing the waiting time. This approach, to the best of our knowledge, has never been used to formulate simulation based strategies.

In order to answer the research questions and meet the objective of this study, we will:

1. Assess the relationship between the waiting time satisfaction and satisfaction with the service quality
2. Assess what contributes to the understanding of patients' satisfaction regarding waiting times
3. Highlight the causes from the patients' perspective for their prolonged waiting time
4. Formulate resource-related options that seem likely to improve the healthcare services by applying a simulation study.

1.4 Structure of the thesis

There are two approaches in the literature that deals with the waiting time with a view to reducing it and increase the patients' satisfaction. They are studied in the next two chapters, in our case, either psychologically enhancing the patients' experience of waiting time or reducing the waiting time through simulation modelling. In Chapter Two we report an empirical study, in which the basis of satisfaction is the difference between perception and expectation. It was carried out by collecting data from patients to assess the relationship between waiting time and patients' satisfaction. The research hypotheses were developed on the basis of the contradictory findings in the literature; these were tested, and the results discussed. In the third chapter, a reported finding from the empirical study about patients' opinion on what contributes to their long waiting time is used along with real data which were generated from the system of a public hospital to build a simulation model for assessing the effect of the available number of different resources on patients' waiting time and to study the effect of delayed arrivals of patients on the waiting time. The simulation results were reported and discussed. The last chapter lists the practical implications and offers our recommendations to the decision makers and we summarize in it the results of Chapters Two and Three. Figure 1.1 shows the chapters' interconnection diagram.

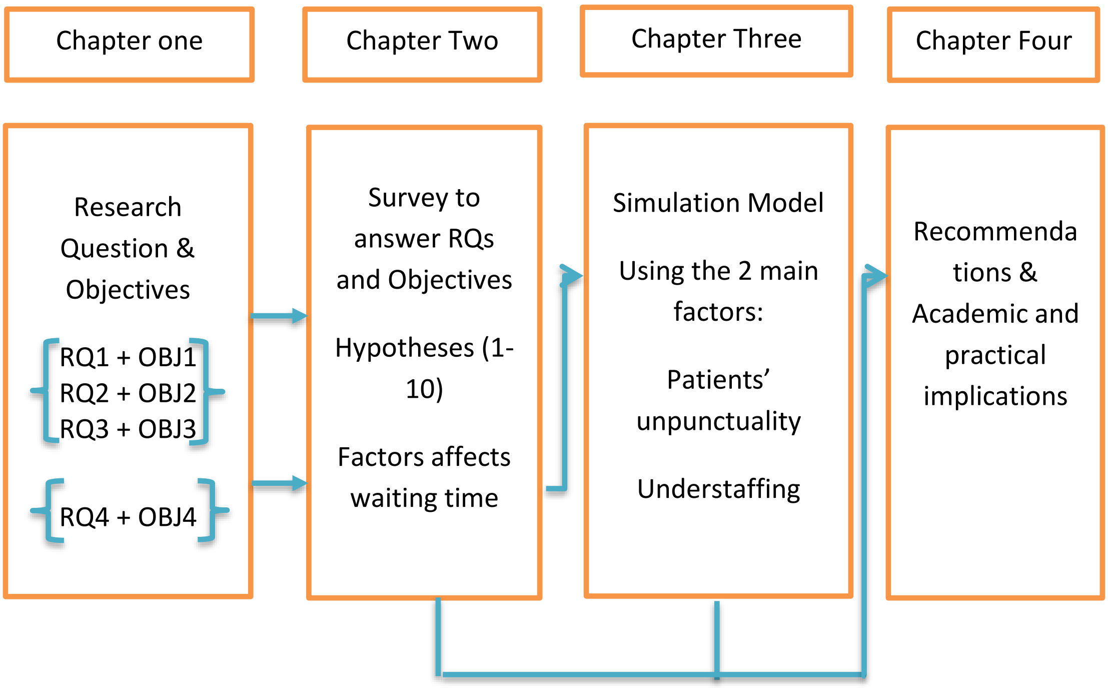

Figure 1.1: Chapters' interconnection diagram

Chapter 2: Waiting Time and Patients' Satisfaction

2.1 Introduction and objectives

Research on quality of care and patients' satisfaction can be traced back to the early 1960s, (Fetter & Thompson, 1966). Many studies have been conducted on the structure, process and outcome of services (Cleary & McNeil, 1988) and the objectives of patient care (Davies & Ware Jr, 1988; Ware, Snyder, Wright, & Davies, 1983). Hence, patient satisfaction is considered a key factor to the survival of the healthcare providers; i.e. in terms of patients' loyalty (Bielen & Demoulin, 2007). Some researchers consider patients' satisfaction as one of the final indicators for evaluating the quality of healthcare services (Donabedian, 1988; Sitzia & Wood, 1997), while others argue that patients' satisfaction is in fact the most important performance metric for healthcare delivery (Manaf, Mohd, & Abdullah, 2012; Zabada, Singh, & Munchus, 2001).

Healthcare institutions are becoming more concerned about healthcare quality. One of the most influential frameworks provided for the quality assessment in the public and private sectors is that proposed by the Institution of Medicine (IOM). One of its six domains of healthcare quality is patient-centered provision, which is defined as "providing care that is respectful of an individual patient's preferences, needs, and values and ensuring that patient values guide all clinical decisions". Other domains are that treatment should be safe (avoiding harm to patients), effective (providing services on the basis of scientific knowledge, avoiding both underuse and misuse), timely (reducing waits and sometimes harmful delays for both those who receive and those who give care), efficient (avoiding waste) and equitable (providing care that does not vary in quality because of personal characteristics) (IoMCoQoHCi, 2001).

The quality of healthcare services is assessed using instruments that were developed to measure inpatients' and outpatients' satisfaction. One of the validated and reliable instruments is the patient satisfaction survey (Fitzpatrick, 1991; Jeon, Fethney, & Ludford, 2012; Tsianakas et al., 2012). The disconfirmation method is one of most popular survey tools which capture the disconfirmation between the expectation and perception of services provided (Parasuraman, Berry, & Zeithaml, 1985; Thompson & Yarnold, 1995).

A major source of dissatisfaction with the healthcare provided to patients is the amount of time they have to wait during their visits to clinics. This source of dissatisfaction has been observed in various service sectors, but the present focus is on the healthcare sector. Several studies have found a reverse relationship between waiting time and the customer satisfaction (Katz & Blaire, 1989; Katz, Larson, & Larson, 2003). Most studies conducted in primary care outpatient settings find the same negative relationship between waiting times and patient satisfaction (Huang, 1994; Leiba et al., 2002). The Institute of Medicine has identified timely access as one of the key elements of healthcare quality (IoMCoQoHCi, 2001), and reducing delays became the focus of healthcare institutions (Green, 2006).

To alleviate waiting time dissatisfaction, it is important to have a channel of communication or a communication mechanism where patients can feel their opinion is heard and valued if they express it to the management of the healthcare provider. Management needs to assess the effectiveness of the services provided, and understand, address and control the relevant quantitative and qualitative aspects of patients' behavior and their reactions to the delays. Davis and Heineke (1993) propose some control actions to influence the perception of waiting time: for example, introducing a queuing system and opening long enough to address unfairly long waits; designing waiting areas to relieve discomfort; acknowledging patients'/customers' concerns and providing explanations, or providing enough staff in the system to prevent waiting and unexplained waits; and updating information about the delay to overcome the uncertainty of waiting. Healthcare providers would thus manage the patients' perception of the length of their waiting time and limit its negative effects on their satisfaction. They would also improve the expectation of the waiting time and the service, in addition to two aspects of waiting time, the cognitive (connected to the experience) and the affective (connected to the resulting emotions). It is believed that incorporating the opinion of the patients in assessing the waiting time and the quality of the service provided is one way of improving the service and being responsive to the patients' needs.

Hospitals have a range of reasons for patients' delays; apart from staff trying to find a parking spot, they are specifically related to the service process itself. They result from delays in the pre-process (the arrival at the hospital waiting to be registered); delays in the in-process (from waiting to be seen by the doctor and waiting for the results of tests; and delays in the post-process (waiting to pay for the service and receive medication).

In this study, the scientific method has been used to acquire the knowledge about the researched subject. This knowledge is reliably obtained based on the evidences from an empirical research approach which emphasis on direct and systematic approach. From there, the key research question has been established which is "What factors are contributing to reducing the waiting time and increasing the patient's satisfaction in the UAE healthcare facilities?" where it has been divided into four sub-research questions. The research questions are exploratory in its nature. Then the research hypotheses have been established in an attempt to explain the research phenomenon under study. The hypotheses involve an exploration about the relationship between the variables being studied which are then empirically tested by gathering and analyzing the collected data in which the hypotheses can be supported or refuted. The research is descriptive and the approach used here is considered as correlational, were we are looking to explore the relationship between two or more variables. After articulating the research hypotheses, the next step is conducting the research study after identifying the sample size and selection, which is the data collection. Then we start the data collection, the collected data will be then analyzed using statistical analysis technique which is in this case using the Statistical Package for the Social Sciences (SPSS).

The choice of which research approaches to use depends on the type of questions being asked in the research study, as the research is a descriptive and exploratory in its nature, the suitable research method is the survey, and as this is a quantitative research approach it relies on statistical analyses to obtain the findings and the used statistical analysis is the descriptive statistics and the multiple linear regression analysis method that is being used to describe data and to explain the relationship between one dependent variable and two or more independent variables. After conducting the data analysis, then the conclusions are being presented.

The research paradigm is simply a belief system (or theory) that guides the way we do things, or more formally establishes a set of practices (Lincoln et al., 2000). This research paradigm is the positivist. According to Guba (1990), paradigms can be characterized through their: ontology, epistemology and methodology. The research

Ontology (refers to the philosophy of the existence and nature of Phenomena (What is reality?)) is that we are relativist as it is believed that knowledge is a social reality and it only can be explored through individual interpretation. The research epistemology (is the branch of philosophy that deals with how knowledge of such phenomena is acquired (How do we know something?)). The epistemological position regarding the study undertook is subjective, as it is believed that the knowledge is something interpreted by individuals, and can be formulated as follows: a) data are contained within the perspectives of people that are involved in the healthcare system as patients; and b) because of this the data are being collected. The research methodology (How do we go about finding out?) is the quantitative method using a survey technique, except for the last research question where the case study was used; therefor the approach used is deductive.

A sample of convenience is the source of research participants which is easily accessible to the researcher. The sample was randomly approached in different public areas such as universities and colleges, clinics, parks, shopping centers, government facilities, etc. As it is understood, that if we want to select a random sample in its most general form it is almost impossible to accomplish considering the resources and logistical network that would be necessary to randomly select from an entire population of interest. For this reason, as the general approached by the researchers, we tend to randomly select from samples of convenience. The advantage of this approach is that it allows conducting the research and gaining valuable representable information within the limitation of the time and resources.

The following research objectives were formulated in an attempt to understand the process and provide some recommendations to the healthcare management. They are as follows:

- To assess the relationship between patients' satisfaction with aspects of waiting time and satisfaction with the service quality.
- To assess the relationship between patients' waiting time satisfaction and the expected and perceived waiting time.
- To assess the relationship between the waiting time satisfaction and some of the identified variables which have thrown up contradictory findings in research.

To achieve these objectives, a survey is planned as an empirical study collecting data from patients to assess the above relationships and to measure the patients' satisfaction with waiting times.

The rest of this chapter is organized in the following order; in the second section is a literature review of the service quality in healthcare, the waiting time, causes of long waiting time, relevant studies in the Gulf Region, a description of the questionnaire instrument, and the development of hypotheses. Then in the third section the research methodology is presented and discussed along with tests of the instrument for its reliability and validity. In the fourth section of the chapter the results, data analysis and hypothesis testing are presented, and the fifth is a discussion of the results and the conclusions from them. Recommendations and managerial implications are left to the last chapter (Chapter 4) of the present study.

2.2 Literature review

2.2.1 Service quality

Service quality is considered an essential strategy for the successful surviving of service organizations in today's competitive environment (Dawkins & Reichheld, 1990; Parasuraman et al., 1985; Zeithaml, Parasuraman, & Berry, 1990). Service quality is gaining increased attention in research in view of the significant relationship it bears to profit and financial outcomes (Anderson, Fornell, & Lehmann, 1994; Rust & Zahorik, 1993), customer satisfaction (Bolton & Drew, 1991; Boulding, Kalra, Staelin, & Zeithaml, 1993), customer retention (Ennew & Binks, 1996; Reichheld & Sasser, 1990; Rust & Zahorik, 1993), customer behaviour (Zeithaml, Berry, & Parasuraman, 1996); it is also a driver of corporate marketing and financial performance (Nosek & Wilson, 2001).

The evolving theory of quality in Krishnan (1999) refers to the importance of quality to businesses and services of being able to adjust in real time to customers' expectations, as the service quality evolves towards customer satisfaction. Berry, Parasuraman, and Zeithaml (1988) define service quality as "conformance to customer specifications".

Service quality is generally difficult to define quantitatively, because quality is a subjective term (Sower et al., 2001). There is no general consensus in the literature on the nature or content of service quality dimensions (Brady & Cronin Jr, 2001). Earlier works advanced our understanding of service quality measurement and the general perspective of the service quality is that it is multidimensional (Eckerlund, Jönsson, Tambour, & Westlund, 1997; Parasuraman et al., 1985; Parasuraman, Zeithaml, & Berry, 1988; Sower et al., 2001; Ware, 1977).

2.2.2 Service quality in healthcare

Quality in healthcare services, as in other business sectors, being difficult to define, is hard to set standards for and to control the level of performance (Ramirez & Crowe, 1997; Ware, 1977) and difficult to measure due to the intangibility, heterogeneity and inseparability of its components (Naidu, 2009; Parasuraman et al., 1985). Therefore, evaluating healthcare quality raises a problem due to service size, complexity, the specialization of the organization and its expertise (Eiriz & Figueiredo, 2005). Customer-based determinants and perception of the quality of services are the most important aspects in choosing a hospital (Lim & Tang, 2000). Therefore, a hospital’s service quality measures should be determined by customers’ expectations. Patients with service providers collectively set the hospitals’ service delivery specifications, because the perceived service quality is the result of the service that the customers receive and how they perceive what they are receiving (Parasuraman et al., 1985). Patients are experts on their own personal circumstances and needs (Morgan & Murgatroyd, 1994). In patient-oriented healthcare organizations, it is expected that patients' satisfaction will be considered at every point of the planning, implementation and evaluation stages of the service delivery; from a clinic’s working hours and counseling techniques to the decision about the longest acceptable waiting time. Unquestionably, patients should be at the center of the healthcare quality agenda. Meeting patients' needs and creating healthcare standards are crucial to achieving high quality service (Ramachandran & Cram, 2005).

There is a growing consensus that an important indicator of healthcare quality is patients’ satisfaction (Ramirez & Crowe, 1997). Patients’ satisfaction is a concept which has been receiving increased attention, reflecting the service-oriented healthcare market (Thompson, Yarnold, Williams, & Adams, 1996). Ware (1977) refers to the increased emphasis on patient satisfaction as part of a broader trend to consider the accountability of service providers to their customers. Although there was no consensus in the medical profession on the role that patient satisfaction should play in the assessment of the quality of care, many researchers and policy makers believe it has a pivotal role (Cleary & McNeil, 1988). Some arguments about quality are documented, in which it is argued that healthcare providers alone can recognize the characteristics of quality care; others, however, believe that only patients' perceptions about quality matter (Sower et al., 2001).

Patient satisfaction is defined by Brennan (1995) as the appraisal of the extent to which the care provided has met the individual's expectations and preferences. According to psychological theories by Alford (1998); Klein (1997), patients' evaluations of different situations are moderated by personal feelings of equity in the exchange, disconfirmation between desires and outcomes, individual preferences, and social comparisons. Satisfaction is an emotional response to the difference between what patients expect and what they ultimately receive. The most frequently used dimensions of patient satisfaction are the personal aspect of care, the technical quality, accessibility and availability, continuity of care, patient convenience, the physical setting, financial considerations and efficacy (Cleary & McNeil, 1988; Ware, 1977).

A widely used construct in healthcare management research is the patient's perspective of quality, which has been linked to several performance metrics, including patient satisfaction and recommendations for improvement (Andaleeb, 1998, 2001). Patients' satisfaction results from meeting or exceeding patient expectations (Thompson et al., 1996). Patient satisfaction is a multidimensional construct affected by several variables (Farid, 2008; Hyde, 2014; Naidu, 2009; Sower et al., 2001). Other factors that have been thought to be related to patient satisfaction include patient socio-demographic characteristics, psychological and physical status, attitudes and expectations regarding medical care, in addition to the structure, process and outcome of care (Cleary & McNeil, 1988).

Various attempts have been made to measure service quality and patients' satisfaction in healthcare using different measures. For further details, refer to Appendix 2.1.

2.2.3 Waiting time

Over decades, several marketing studies have focused on the management of customers' waiting time (Durrande-Moreau & Usunier, 1999; Katz, Larson, & Larson, 1991). Maister (1984) developed a conceptual framework which identified the factors affecting customer satisfaction with waiting time, which was widely accepted because of its strong face validity. His eight propositions were called "the psychology of waiting lines". There were several attempts to test and validate Maister's propositions by Davis and Heineke (1998); Jones and Peppiatt (1996); Katz and Blaire (1989), for example.

Different methods were used to measure the satisfaction with waiting time in the service sector in addition to testing Maister's proposition, such as changes in customers' perception of waiting time and overall satisfaction by Katz and Blaire (1989), testing the different aspects of Maister's propositions, as in the study by Jones and Peppiatt (1996), and testing the disconfirmation between expectation and perception and between perceived and actual waiting time (Davis and Heineke (1998).

The importance of time was studied in hospitals, where it was considered a predictor of customer satisfaction (Davis & Heineke, 1998). There is consensus among researchers that waiting time is an important factor affecting patients' satisfaction (Anderson., Camacho, & Balkrishnan, 2007; McMullen & Netland, 2013; Patwardhan, Davis, Murphy, & Ryan, 2013; Pitrou et al., 2009).

The literature in the service sector suggests that waiting time has four aspects: objective, subjective, cognitive and affective (Antonides, Verhoef, & van Aalst, 2002; Bielen & Demoulin, 2007; Thompson et al., 1996). The objective aspect of waiting time is measured by the actual waiting time before a customer is served (Davis & Vollmann, 1990; Katz et al., 1991). The subjective aspect of waiting time is the estimation of waiting time by the customer and this is based on perceptions and influenced by psychological factors (Durrande-Moreau & Usunier, 1999). This is endorsed in several studies measuring the perception of waiting time (Smidts & Pruyn, 1998). The cognitive aspect of waiting time is the evaluation of the waiting time by the customer as being acceptable, reasonable, or tolerable (or not), as well as short or long (Bielen & Demoulin, 2007; Smidts & Pruyn, 1998). The affective aspect consists of emotional responses to the waiting, such as boredom, stress, irritation, happiness (Ir et al., 2011; Smidts & Pruyn, 1998).

Different aspects of the waiting time have been measured in studying the satisfaction of patients in this regard using different ways of measuring. For example; (Barlow, 2002; Pakdil & Harwood, 2005) studied subjective measures of waiting time. In addition, Barlow (2002) studied disconfirmation as a measure of satisfaction, and compared it to actual waiting time. Bielen and Demoulin (2007) sought to measure subjective, cognitive and affective aspects. Smidts and Pruyn (1998) studied the subjective and objective aspects in addition to the cognitive and affective measures. All studies concur on the importance and significance of the relationship between waiting time and patients' satisfaction.

The perception of waiting time had been investigated by a number of researchers as a way of calculating how waiting time and its perception affected customers' satisfaction. However, some studies compared the actual waiting time with the perceived waiting time and found that the estimated time depends on time as objectively measured time (Barlow, 2002; Bielen & Demoulin, 2007; Davis & Heineke, 1998; Katz & Blaire, 1989; Smidts & Pruyn, 1998; Thompson et al., 1996). For studies of different waiting times, refer to Appendix 2.2.

The importance of understanding the difference between patients' perception and expectation is demonstrated by the research conducted by Pakdil and Harwood (2005), who found that the greatest gap between patient expectation and perception was the clinic waiting time. Pakdil and Harwood (2005) studied patient satisfaction using the SERVQUAL scale. They concluded that the widest gap was between overall quality and waiting for an appointment and next, the gap in the clinic between overall quality and waiting time to be seen once. Anderson. et al. (2007) and Patwardhan et al. (2013) disagree, finding that the most powerful determinant is the time spent with the physician.

2.2.4 Causes of long waiting time

Long queues and delay in receiving medical care not only impact negatively on patients' satisfaction (Anderson. et al., 2007), but also increase the possibility of patients leaving the hospital without being seen by a physician (Monzon, Friedman, Clarke, & Arenovich, 2005). This can increase the dissatisfaction, pain and suffering of the patients and may even threaten their lives (Grumbach, Keane, & Bindman, 1993). Long waiting times in public healthcare facilities are found all over the world, and have been the subject of studies in the UK (Barlow, 2002; Hart, 1996), Belgium (Bielen & Demoulin, 2007), Malaysia (Ir et al., 2011), USA (Thompson et al., 1996), China (Xu, 2014) and others.

From summarizing the causes in the literature of the long waiting time in healthcare facilities, we can conclude the reasons to be as follows: unpunctuality among physicians or medical staff (Fetter & Thompson, 1966; Rohleder et al., 2011), patient unpunctuality (Fetter & Thompson, 1966; Reid, 1976), physicians' age (Wolinsky & Marder, 1983), patient health status (Wolinsky & Marder, 1983), poor work attitude of employees (Ir et al., 2011), irregular sequencing of patients (Zhu, Heng, & Teow, 2012), understaffing (Clague et al., 1997; Potisek et al., 2007; Rohleder et al., 2011), insufficient management and supervision (Ir et al., 2011), clinic composition (Clague et al., 1997), scheduling practices; block appointments systems (Harper & Gamlin, 2003; Johnson & Rosenfeld, 1968; Rohleder et al., 2011), inappropriate design of appointment schedule (Clague et al., 1997), double booking (Santibáñez et al., 2009), appointment intervals (Clague et al., 1997; Hill-Smith, 1989; Santibáñez et al., 2009), distribution of appointment slots (Harper & Gamlin, 2003), full attendance of patients (Clague et al., 1997), patients' place in the queue (Heaney, Howie, & Porter, 1991), inefficient work processes (Ir et al., 2011), inappropriate design of clinic workflow and patient flow (Fetter & Thompson, 1966; Heaney et al., 1991; Zhu et al., 2012), physician workload (Ir et al., 2011), clinic load/number of patients in clinic session (Racine & Davidson, 2002), inappropriate use of nurse time (Zhu et al., 2012), long consultation times (Clague et al., 1997), late start of clinic (Harper & Gamlin, 2003; Johnson & Rosenfeld, 1968; Santibáñez et al., 2009; Zhu et al., 2012), session physicians' work schedules (Racine & Davidson, 2002), and the involvement of students/residents in the clinics (Santibáñez et al., 2009). in addition to inadequate facilities (Ir et al., 2011), and inappropriate facility design (Potisek et al., 2007).

Different studying methods were used to deal with the causes of long waiting time such as mathematical modeling (Hill-Smith, 1989), survey study (Ir et al., 2011), patient flow analysis (Potisek et al., 2007; Reid, 1976; Xu, 2014), computer simulation modeling (Clague et al., 1997; Fetter & Thompson, 1966; Harper & Gamlin, 2003; Rohleder et al., 2011; Santibáñez et al., 2009; Zhu et al., 2012), and time study (Johnson & Rosenfeld, 1968; Racine & Davidson, 2002).

2.2.5 Relevant studies in the gulf region

Few studies addressing patients' satisfaction could be found in the Gulf Region but Qatari and Haran (1999) noted in their study of the determinants of users' satisfaction in primary healthcare in Saudi Arabia that satisfaction was most closely associated with the type of primary center building and that regular visitors to the center were more satisfied than irregular users/visitors. They also found that the longer the waiting time spent in the health center, the lower the satisfaction. Al-Mandhari, Hassan, and Haran (2004) studied the association in Oman between perceived health status and satisfaction with the quality of care. Ramez (2012) used the SERVQUAL instrument, studying the relationship between the service quality dimensions and overall patient satisfaction with the service quality of the healthcare providers in Bahrain. Chaker and Al-Azzab (2011), who found that patients in the Qatar Orthopedic and Sports Medicine Hospital were generally satisfied with the quality, access (including waiting time) and interpersonal skills of the medical staff.

In the UAE, few studies have been found related to patients' satisfaction with the services provided; one of the earliest of these is by Harrison (1996), describing patients' evaluations of their consultations with their primary health clinic doctors in the UAE.

Jabnoun and Chaker (2003) compared the service quality provided by public and private hospitals using a developed and tested SERVQUAL questionnaire. Margolis, Al-Marzouqi, Revel, and Reed (2003) studied patients' satisfaction with two types of clinic, resource-intensive and resource-thrifty, with the aim of evaluating the suitability of the questionnaire used, which was translated into Arabic from the Western research literature. Jabnoun and Juma AL Rasasi (2005) studied the relationship between transformational leadership and service quality in UAE hospitals. Badri, Taher Attia, and Ustadi (2008) tested several models of service quality and satisfaction in healthcare on a sample of discharged patients from UAE public hospitals. Badri, Attia, and Ustadi (2009) studied healthcare quality and the moderators of patient satisfaction, aiming to present a comprehensive structural equation model that took into account the patient's condition before and after discharge from a public hospital in the UAE. Al-Neyadi, Abdallah, and Malik (2018) evaluated the quality of healthcare services in public and private hospitals in the UAE, using the SERVQUAL instrument.

2.2.6 The questionnaire instrument for surveying patients

Satisfaction is a key element in the relationship between firms and their customers. Assessing patients' satisfaction is currently a standard part of the evaluation activities of many health service organizations (Sorensen, Kantor, Margolis, and Galano (1979). Different definitions have been used for customer satisfaction. On the basis of the study conducted by Giese and Cote (2000), the different definitions of satisfaction share three general components; customer satisfaction is a response (emotional or cognitive), the response is related to a specific subject (expectations, product, consumption experience, etc.), and the response happens at a specific time (after consumption, after choice, on the basis of accumulated experience, etc.). Therefore, it can be looked at as a psychological process involving stored knowledge, beliefs, expectations; perceived performance of a service or product; and the evaluation of this information, or an affective response to it. On the basis of (Oliver, 1993) satisfaction is defined as "an experiential judgment of outcomes compared to a set of goals or standards resulting in a sense of fulfillment, including over- or under-fulfillment". Similarly, (Tse & Wilton, 1988) defined satisfaction as an "evaluation of the perceived discrepancy between prior expectations and the actual performance of the product". Satisfaction may be summed up as the patient's judgement of the quality of care (Donabedian, 1988).

Unlike physical quantities and tangible items, the level of a customer's satisfaction must be interpreted. It is assessed by what Torgerson (1958) in a "theory in methods of scaling" called "measurement by fiat". Since we cannot measure it directly, we instead try to measure other variables that are observable on the basis of a priori grounds, or other more sophisticated procedures; we assign meaning to what we observe on the basis of the acknowledged relationship between satisfaction and the indicator variables. Therefore, and because satisfaction is tied up with an individual's experience, one of the most often used methods of obtaining the relevant data about this subject is the survey/questionnaire. Surveys are commonly used in psychology related research, where self-report data are collected from the participants. A survey allows factual information about individuals to be collected, and/or allows the opinions of the participants to be elicited (Mathers, Fox, & Hunn, 2007).

Some methodical issues are raised with patient satisfaction questionnaire by Chow, Mayer, Darzi, and Athanasiou (2009). While open-ended questionnaires could document direct patient input as a qualitative measure, closed-ended questionnaires require a direct response from patients that can be quantified. Most of the scales in marketing studies are sourced from consumer surveys of goods and services which are based on a seven- or five- or three- point Likert-type scale that categorizes responses from "very satisfied" to "very dissatisfied" (Chow et al., 2009; Copay et al., 2010; Zanoli, 2005). Mathers et al. (2007) summarizes the advantages of using the survey method to collect the data: surveys have internal and external validity, being based on some form of random sampling technique which could be considered to represent a specific population and its findings can be generalized. It is also an efficient tool which can reach many participants in various geographic locations cost-effectively. Surveys may also be considered ethical since they do not expose the participants to invasive techniques. Of the three methods used in collecting survey data one is the telephone interview, a second is the face-to-face interview and the last is a questionnaire, which was used in the present study.

Various models of quality have been developed and used to measure the satisfaction of patients, possibly because no universal, practical or all-encompassing definition or model of quality exists (Mugo, 2011; Sower et al., 2001). The difficulty in defining hospital quality, equally, stems from the lack of a valid and reliable instrument (Sower et al., 2001). Because service quality is a multidimensional concept (Eiriz & Figueiredo, 2005; Larsson & Larsson, 2002; Parasuraman et al., 1985; Sower et al., 2001), many attempts have been made to measure it, using different models such as the SERVQUAL model which was developed by Parasuraman et al. (1985) and is a widely used measure of the dimensions of service quality in service industries such as banks, fast food, healthcare, tourism and others. The model is based on the concept that quality is shown by comparing expectations with performance; hence, determining the set of gaps affects the service quality evaluation. The gaps are related to the lack of understanding among the service providers of the customers' expectations and needs. The initial model was developed on the basis of the ten dimensions of service quality, which are Reliability, Responsiveness, Competence, Courtesy, Communication, Credibility, Security, Understanding, and Tangibles. Later the ten dimensions were captured under five dimensions by Parasuraman et al. (1988) in an instrument called the SERVQUAL, which had 22 items. The five dimensions of Parasuraman et al. were as follows:

Tangibles: the physical facilities, equipment, and appearance of personnel.

Reliability: the ability to perform the promised services dependably and accurately.

Responsiveness: the willingness to help customers and provide prompt services.

Assurance: the knowledge and courtesy of employees and their ability to inspire trust and confidence.

Empathy: caring for the customers and individualizing the attention paid to them.

Many researchers use the resulting model (SERVQUAL) which accommodates the above five dimensions.

Although this model drew some criticism, it was related to the industries it was tested in and not to the healthcare industry (Brown, Churchill Jr, & Peter, 1993); later it was criticised by other researchers (Brennan, 1995; Klein, 1997; Murray & Berwick, 2003; Santibáñez et al., 2009). In response to a critique raised against SERVQUAL, (Parasuraman, Berry, & Zeithaml, 1993) clarified that their guidelines state that the SERVQUAL items are considered a basic "skeleton" for service quality in a range of sectors, and could be supplemented by context-specific items when necessary. The SERVQUAL was widely used in the healthcare services to measure patients' perceptions and satisfaction, for instance, by Babakus and Mangold (1992) and Reidenbach and Sandifer-Smallwood (1990) in the USA, Lim and Tang (2000) in Singapore, Brahmbhatt, Baser, and Joshi (2011) in India, by Pakdil & Harwood (2005) in Turkey, and Purcărea, Gheorghe, and Petrescu (2013) in Romania. It was also used in such countries of the Gulf Region as Saudi Arabia (Qatari & Haran, 1999) and (Al-Borie & Sheikh Damanhouri, 2013), Qatar (Chaker & Al-Azzab, 2011), and the UAE (Margolis et al., 2003) and (Jabnoun & Chaker, 2003). It has been used to study acute care hospitals (Carman, 1990), patient satisfaction (Bowers, Swan, & Koehler, 1994), medical and healthcare (Dean, 1999), inpatient, outpatient and emergency care (Reidenbach & Sandifer-Smallwood, 1990), and other things. So we may conclude that, as Asubonteng, McCleary, & Swan (1996) noted, "until a better but equally simple model emerges, SERVQUAL will predominate as a service quality measure".

2.3 Hypotheses development

The literature review below documents interesting and sometimes contradictory findings. In this section, we develop our hypotheses on the basis of these.

2.3.1 Waiting time and level of satisfaction

Ir et al. (2011) studied the objective and subjective aspects of waiting time in Malaysia and Pitrou et al. (2009) studied its affective aspects in France. Pitrou et al. (2009) concluded that the satisfaction with the amount of time spent waiting was the strongest driver of the overall score of patients' satisfaction. Meanwhile, Ir et al. (2011) reported that 50% of respondents felted bored while waiting for a consultation, but surprisingly that, however long the wait (average 85 minutes), most patients reported being satisfied with the waiting time. This was interpreted as perhaps being related to the type of patient who attended public hospitals in Malaysia: laborers who could not afford to visit a private hospital and were receiving healthcare for almost nothing.

H1: Waiting time satisfaction affects patients' satisfaction

2.3.2 Perceived and expected waiting time

Of the four aspects of waiting time, its two distinct dimensions, actual and perceived waiting time, were studied by Bielen and Demoulin (2007); Thompson et al. (1996). They concluded that a more effective strategy to improve patient satisfaction is to manage the perceptions and expectations of waiting time rather than to reduce the waiting time itself. Arshad (2014) reported in his study from Pakistan that although patients' actual waiting time was longer than expected, 70% of the patients were totally satisfied with it and with the time given for consultation.

Jones and Peppiatt (1996) concluded that reducing the difference between actual and perceived waiting time may or may not lead to improved customer satisfaction, whereas satisfaction was mainly identified as being derived from matching perceptions to expectations. Parasuraman et al. (1985), however, found that reducing the "gap" between actual delivery and perceived delivery improved patient satisfaction.

H2: Patient's perception of waiting time affects patients' waiting time satisfaction

H3: Expected waiting time affects patient's waiting time satisfaction

2.3.3 Unoccupied waiting time, and uncertain waiting time

In the work of (Smidts & Pruyn, 1998), it was found that the actual waiting time influences satisfaction, though it recommended improving the attractiveness of the waiting environment rather than shortening the objective waiting time. The findings of Smidts and Pruyn (1998) and Katz and Blaire (1989) about TV distractions, which contradict Maister's proposition that unoccupied time feels longer than occupied time, may be explained by recalling that different cultural groups have different tolerance to queuing (Jones & Peppiatt, 1996). In this research the effect of occupied time at the waiting environment was studied.

H4: the perceived attractiveness of the waiting environment affects patients' waiting time satisfaction (occupied waiting time).

One of Maister (1984) in his conceptual framework of the psychology of waiting lines is "uncertain waits seem longer than certain waits". Uncertainty about how long the wait will be is the most profound source of anxiety. According to Hui and Tse (1996) information provided about the expected length of a delay influences the customers' evaluation of the service through affecting the acceptability of the waiting time and the affective response to the delay. Thompson et al. (1996) found that the perception that more information had been provided increased the level of satisfaction. Bielen and Demoulin (2007) identified the determinant of waiting time satisfaction as the perceived waiting time, the satisfaction with the information provided in cases of delay, and the satisfaction with the waiting environment.

In the study by Katz and Blaire (1989), it was found that introducing an electronic clock to tell the estimated waiting time for the queue improved the accuracy of the customers' perception of waiting time, but did not influence the customers' satisfaction. Bielen and Demoulin (2007), however, did find that one of the determinants of waiting time satisfaction was the information provided in cases of delay. They also confirmed that the information provided about estimated waiting time in cases of delay and the satisfaction with the environment had a direct impact on the satisfaction with the service. Pakdil and Harwood (2005) recommended supplying the waiting room with TV sets, outside telephones, and games for children, because their study found that most dissatisfaction was related to waiting time.

Davis and Heineke (1993) identified that service managers are able to influence the proposition that waits of unknown length can be eased by providing a status update, and unexplained waits can be addressed by providing customers with an explanation and an acknowledgement of their concerns.

H5: Uncertain waiting time affects patients' waiting time satisfaction

2.3.4 Waiting experience and accompanied patients

An unexpected outcome was found in Barlow (2002) measuring the level of patients' satisfaction with their waiting time: that accompanied patients were more dissatisfied than solo patients. The same results were reconfirmed in Barlow (2004). This contradicts Maister's proposition that waiting alone feels longer than waiting in a group, and the findings of some other studies in the service sector (Jones & Peppiatt, 1996) and healthcare (Lin, Xirasagar, & Laditka, 2004).

H6: Patients coming accompanied or alone affects their satisfaction with waiting time

2.3.5 Waiting experience and frequency of visit

Hasin, Seeluangsawat, and Shareef (2001) observed in three Japanese hospitals that there is a relationship between the patients' experience (affective aspect of the waiting time) and the frequency of visits. The patients who visit infrequently are irritated by long waiting times, whereas those who visit extremely often are bored by them. This topic was also studied by Barlow (2002) in a UK hospital; he found that repeating patients are less satisfied with their waiting experience than first-time patients, although both groups were dissatisfied with the waiting time. This contradicts what Jones and Peppiatt (1996) propose: that new or infrequent users feel that they wait longer than frequent users.

H7: Patients' frequency of visit to the clinic affects their satisfaction with waiting times

2.3.6 Time and consultation with doctors

Generally, the outpatients' studies looked at the total actual waiting time from the time of a patient's arrival at the clinic, to the time the patient was called for the consultation with the doctor, while some other studies looked at the time spent in consultation with doctors.

Anderson. et al. (2007) found that the time spent with physicians was the strongest predictor of patient satisfaction. In addition they found that the combination of a short time with the physician and a long waiting time was associated with very low overall satisfaction. The findings of Anderson. et al. (2007), cited above, may be similar to the findings of Oche and Adamu (2014) from a general outpatients' clinic in Nigeria who found the overall satisfaction was generally low and patients expressed their dissatisfaction with the time it took to register, to wait, and to see the doctor, and with the condition of consultation room. They found that the determinants of satisfaction were total waiting time, clinic waiting time, and the respondent's age.

One of the most consistent findings in the literature is that good communication skills, empathy and caring have been found to be among the strongest predictors of the way that patients evaluate the care received (Cleary & McNeil, 1988). Thompson et al. (1996) found that in an emergency department the information delivery about the procedures of the tests and treatment was positively associated with overall satisfaction.

McMullen and Netland (2013) concluded that the three variables most closely correlated with patient satisfaction were waiting time (lowest satisfaction), knowledge of the doctor, and time spent with the doctor. Pitrou et al. (2009) found that one of the highest satisfaction levels was found with the medical information provided by physicians. Adamu and Oche (2014) also found that one of the satisfaction variables was the clinical environment, registration time, waiting time in the clinic, communication with doctors, explanations provided by the doctors and satisfaction with the physicians. Mehra (2016) studying the healthcare in three major cities in India found that waiting time had no relationship with the communication style, and overall satisfaction at the outpatient clinic.

H8: Time spent with doctors affects patients' satisfaction with waiting time

H9: The perceived technical and interpersonal skills of the doctors and healthcare provider affect patients' satisfaction with waiting time

2.3.7 Patients' satisfaction and socio-demographic characteristics

It can be seen from the study by Adamu and Oche (2014), and that by Barlow (2002), that age is one of the determinants of patients' satisfaction or dissatisfaction. Al-Borie and Sheikh Damanhouri (2013) report in their study that demographic factors (gender, education, income and occupation) significantly influenced inpatient satisfaction, while age did not, whereas Thompson et al. (1996) found that the overall satisfaction of ED patients bore no relationship to age or sex. Figure 2.1 shows the hypotheses framework.

H10: The socio-demographical characteristics of the outpatients influence their waiting time satisfaction

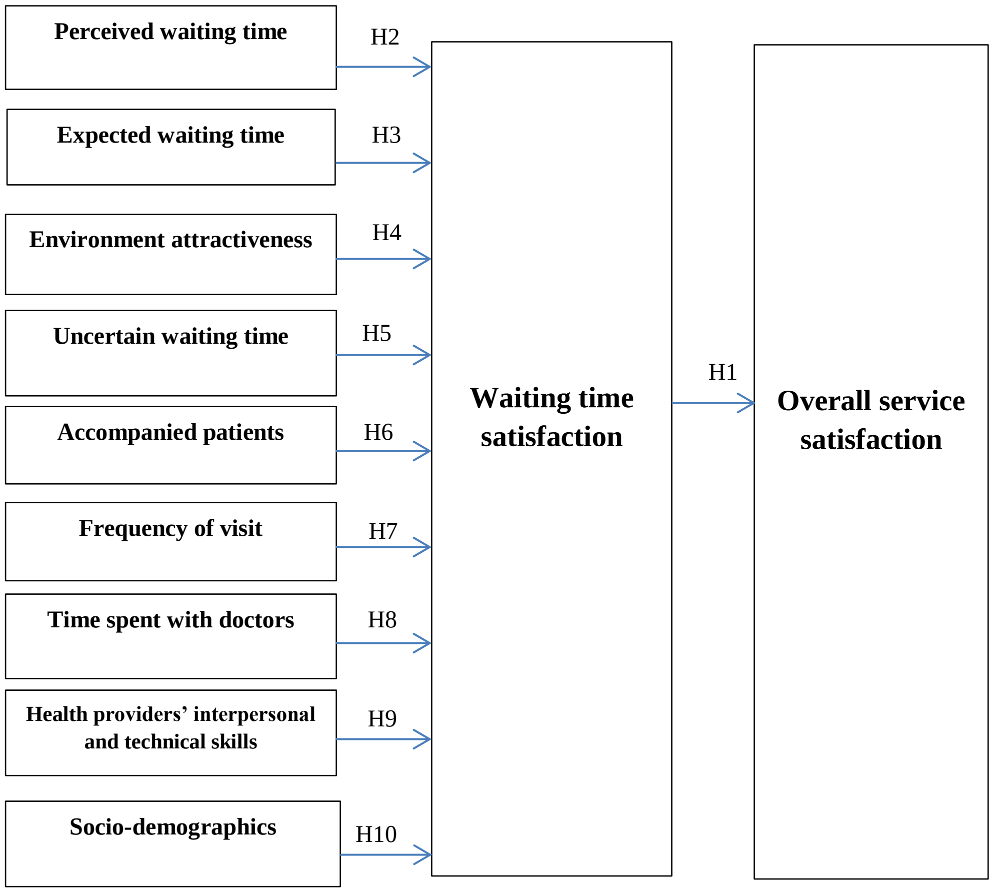

Figure 2.1: Hypotheses framework

2.4 Methodology

Long waiting time for patients affects the efficiency and effectiveness of the medical care provided to patients, in addition to its influence on the overall quality perceived. To examine the relationship between the waiting time of patients in the outpatient department/clinic, and the patients' satisfaction with the quality of the services provided and the waiting time, a questionnaire survey was undertaken. The questionnaire was developed from the comments in the literature about waiting time and patients' satisfaction, The skeleton of SERVQUAL (Parasuraman et al., 1988) was used to measure the level of satisfaction.

2.4.1 Questionnaire development

The principles of the SERVQUAL questionnaire were used in the present study to measure patients' satisfaction. The five dimensions of SERVQUAL were used, with some modifications to the questions to adapt them to the healthcare services and the specific subject under study, in addition to some questions added to cover the research purpose and the seven dimensions of the quality of service delivery in the hospitals cited above. The original SERVQUAL instrument has twenty-two questions. We asked each question twice, because we wanted to measure the expected and perceived values.

2.4.2 Developing and testing the questionnaire

The development of the questionnaire went through several stages before its final revision (refer to Figure 2.2: Sequence of questionnaire development).The first step was considering the purpose of the research, objectives, research questions, literature review, the hypotheses to be examined and the target population to be identified. The second step was generating question statements for the questionnaire on the basis of the literature review, identifying the link between the objectives of the study and the established questions. At this stage, major variables were identified and defined. In the third step the focus was on writing the questions, establishing the selection of the scale measurement on the basis of the literature review, the questionnaire layout and format, and ordering. The fourth step was establishing the validity of the questionnaire and reviewing the questionnaire and field test. The purpose of this step was to understand if the questionnaire measured what it was intended to measure, if it represented the content, and if it was appropriate to the target population/sample. In addition, it was aimed to test whether the questions were readable and understandable by the population/sample. The fifth step was to pilot the questionnaire on forty-seven subjects. Feedback was received in addition to the responses to the questionnaire; it suggested that some of the questions were redundant. Then the coefficient of reliability was measured.

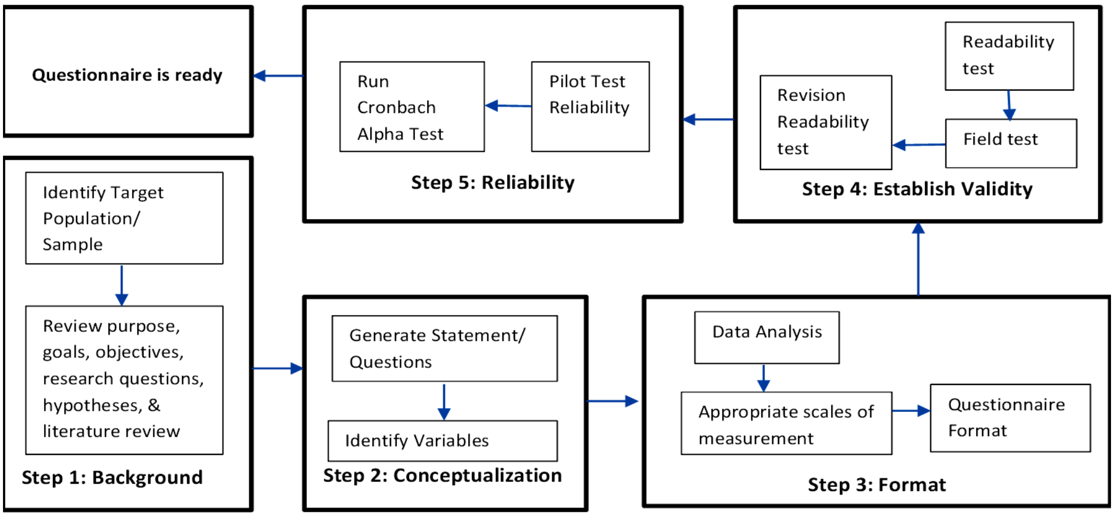

Figure 2.2: Sequence of questionnaire development

2.4.2.1 Structure of the questionnaire

In this study, the survey was divided into three sections. The first section asked five questions about socio-demographic variables. Since income was considered a sensitive question, the last question on it was left to the end of the questionnaire, to minimize the number of respondents who might give up prematurely. The factors included in the questionnaire are presented in Appendix 2.3.

Section two of the survey deals with the hospital visit and appointments, in addition to various aspects of waiting time, such as the subjective (waiting time estimated by the patient), the cognitive (evaluation by the patient of waiting time as being acceptable, short, or long), and the affective aspect of the waiting time (the emotional response of the patient – boredom, stress, or satisfaction). This section consisted of twenty questions including the causes of waiting time as the patients perceived them. The questions were developed in this section on the basis of the literature review – refer to Appendix 2.4.

The last section in the survey was about service quality and organized in eleven sub-sections. with twenty-seven questions altogether measuring the satisfaction with the skill of care, technical aspects, care and attention, accessibility/convenience, the physical environment, availability, continuity of care, efficacy/outcome of care, interpersonal components, amenities, and overall service satisfaction. The first ten sub-sections were defined from the literature on the best ways of providing service in healthcare and measuring the patients' satisfaction with them. In addition, section headings were used to break the questionnaire into smaller sections which might look more meaningful to the participants, and to break the visual continuity of the questions. Questions about overall satisfaction were also included, to self-measure the levels of satisfaction admitted by the patients. (See Appendix 2.5 for Section Three questions and the dimensions of the questionnaire; for the questionnaire, please refer to Appendix 2.6).

2.4.2.2 Reliability Coefficient of the questionnaire

The internal consistency of the modified SERVQUAL items was assessed by computing the total reliability of the scale, which has multiple items. The reliability of the scale was tested by using the reliability coefficient "Cronbach's alpha" for the three sections of the questionnaire; the waiting time, causes of waiting time and satisfaction with the service quality. The achieved alpha values which represent internal consistency were generally high, except for the waiting time (Table 2.1)

Table 2.1: Reliability statsitics

Components/items	Cronbach's Alpha	Cronbach's Alpha on the basis of Standardized Items	Number of Items
Waiting Time	.657	.625	10
Causes of waiting time	.867	.878	16
Service quality	.948	.958	52

2.4.3 Sampling

Since we assume that the whole UAE population has some experience of the healthcare system, the survey was distributed, with the help of research assistants, over a period of three weeks to 552 participants at a selection of public places. To determine the sample size in this exploratory research, we followed the concept of five subjects for each variable, as suggested by Alquraini (2003). In this study we identified 42 attributes, so the ideal sample size should be 210 (42 X 5 = 210). The sample of this study was n = 552, which exceeded the required number by a margin of 342 samples. At the same time, if the SERVQUAL attributes, which total 25, has a required sample size of 125 (=25 X 5), the sample size of this study exceeds this also. The sample of the present study exceeded that in the study by Siciliani and Hurst (2003), who used a sample size of 200; that by Santibáñez et al. (2009), who used a sample size of 227 for scale construction and scale validation; and that by Jabnoun and Chaker (2003) who used a sample of 205.

2.5 Results and analysis

This section presents an analysis of the primary data collected and the findings using the SERVQUAL scale, statistical tests and graphs, for data that were collected from the 552 participants who had visited 114 hospitals in the UAE.

This section then presents the results of the questionnaire analysis, testing in three steps the hypotheses and their relevance to the research questions and aims. First, we present some descriptive statistics of the collected data. Then the collected data from the survey were analyzed to test the hypotheses. In the third step, the collected service quality details of the selected hospitals were analyzed to determine the service gaps between the patients' perceptions and expectations by using the SERVQUAL scale proposed by Parasuraman et al. (1985) and statistical tools using SPSS 21.

SERVQUAL: According to Parasuraman et al. (1988), Service quality = Perception – Expectation. The higher the positive service quality score, the better the service quality. One of the main benefits of the SERVQUAL scale is its capacity to identify the shortfalls in service quality.

2.5.1 Data collection and assessment of data quality

In data collection the validity and triangulation of data were carefully taken into consideration. Johnson (1997) lists ten strategies identified by different researchers to maximize the validity of a research study; for the nature of the present research the following are the strategies which were applied: Triangulation, which means "cross-checking" information and conclusions through the use of multiple sources; data triangulation means using multiple data sources to help understand a phenomenon; Methods triangulation, which means using multiple research methods; and Investigator triangulation, which means using many investigators to collect the data.

Data were collected with the help of five research assistants who worked with us for three weeks at different public places such as shopping centres, clinics, educational institutions, government offices, private companies, parks, etc. The questionnaire was distributed according to convenience sampling, and was meant to be self-completed by the participants in the presence of the research administrators, except for participants with a low literacy level who had difficulties in complete the questionnaire by themselves. In such cases, face-to-face interviews were used. The research assistants were asked to enter the results of the closed-ended questions (which do not need researchers' interpretations at the data entry stage) into a designed form, the form was explained and an example of data was entered for clarification. The assistants wrote their own names on these completed questionnaire forms. After collecting the weekly questionnaire, the data entries were reviewed and cross-checked by us. In addition, the participants were asked to add their names and phone numbers for reconfirming purposes. Using Microsoft Excel, five randomly numbered questionnaires were generated for each researcher and we telephoned each of the twenty-five participants thus chosen to confirm their participation.

The quality and the nature of the collected data were first assessed by "data cleaning". A two-step process was used; Detection followed by Correction. Some of the errors found to be related; not applicable or blank, were coded as "0", typing errors on data entry, for example, entered "11" instead of "1", "44" instead of "4" and "6" instead of 5. Others, such as coding errors which related to errors in coding the responses to the questions, might be found at a later stage when possible outliers and bivariate associations were examined.

To detect these types of error, data were first assessed by applying the univariate analyses approach: identifying the distribution, response rate and percentage of missing values. In this way the outliers or variables that were far different from the expected values could be investigated.

2.5.2 Demographic characteristics

The analysis was conducted to convey a general understanding of the respondents' gender, age group, education level, city and income.

From the collected data it was found that the respondents' gender was 51% male and 49% female. 33.5% of the respondents were in the age category '25 to 34 years'; 33.5% of the whole fell into the age groups above 35 years old. (Refer to Figure 2.3).

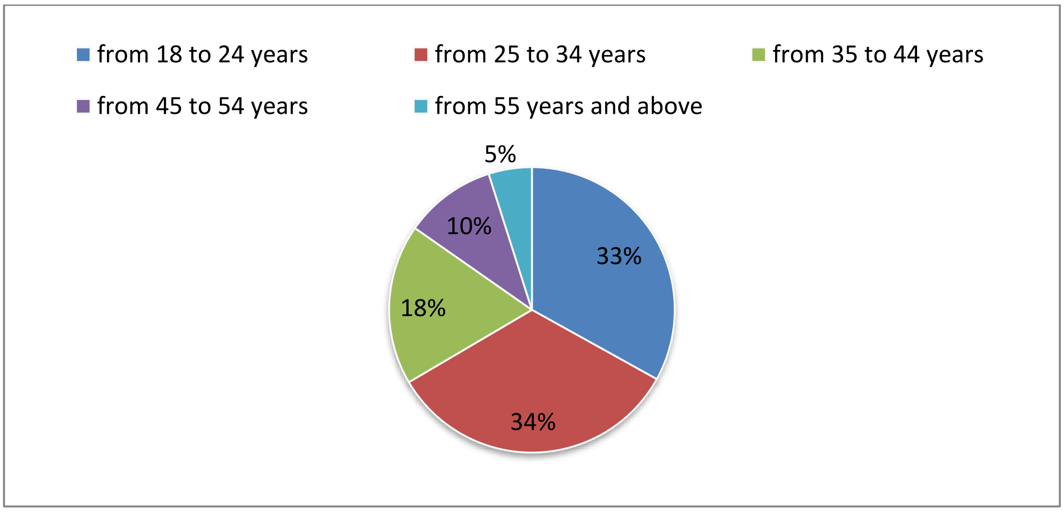

Figure 2.3: Sample by age group

We had participants from 28 nationalities which we grouped as Emirati, Arabs, and Non-Arabs. The maximum number of responses came from Emiratis, representing 46.8% of the total, followed by 41.4% of Arabs, and the Non-Arabs occupied 11.8% of the whole. After excluding responses from one non-UAE city (Al Buraimi-Oman), it was found that most of the respondents came from Abu Dhabi (44.04%), followed by Al Ain (32.77%), then from Dubai (11.49%). The remaining responses from other UAE cities amounted to 11.7%.

From Figure 2.4, the graduate respondents with a bachelor's degree composed 65.5% of our sample, followed by the respondents who held a secondary (high-school) certificate (20.1%), then post-graduates (11.3%), and others who held a primary certificate (1.6%), or were literate (1.5%).

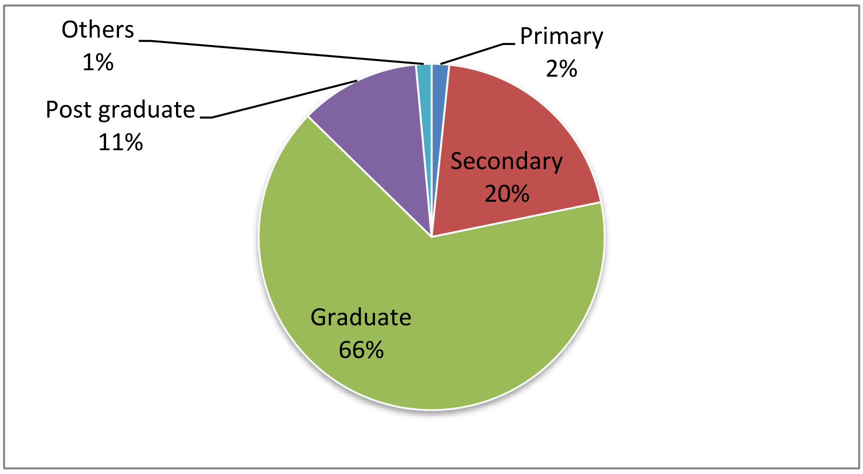

Figure 2.4: Educational level

From Table 2.2, it was found that 42.3% of the respondents' monthly incomes fell between AED 5,000 and AED 25,000. 34.2% of the respondents' monthly salaries were below AED 5,000, 17.7% earned anything from AED 25,000 to AED 50,000, 4.4% earned more than AED 50,000 and 1.4% had no monthly salary.

Table 2.2: Respondents' income level

Income level	Percent
Less than 5,000	34.2%
from 5,000 to 25,000	42.3%
from 25,000 to 50,000	17.7%
more than 50,000	4.4%
Not Applicable	1.4%
Total	100.0%

2.5.3 Characteristics of the visits

2.5.3.1 Type of hospital

Almost two thirds (62.3%) of the respondents visited and were treated in a private hospital, versus 37.7% who visited a public hospital. 32% of the respondents had visited this hospital for the first time, while 68% were repeat visitors. 69% of the respondents visited the hospital alone and 31% were accompanied. Of those who were accompanied, 43% went with both of their parents, 29% went with a family member, 16% with their partner or spouse, 11% were accompanied by one or more friends, and 1% went with someone else. (See Figure 2.5).

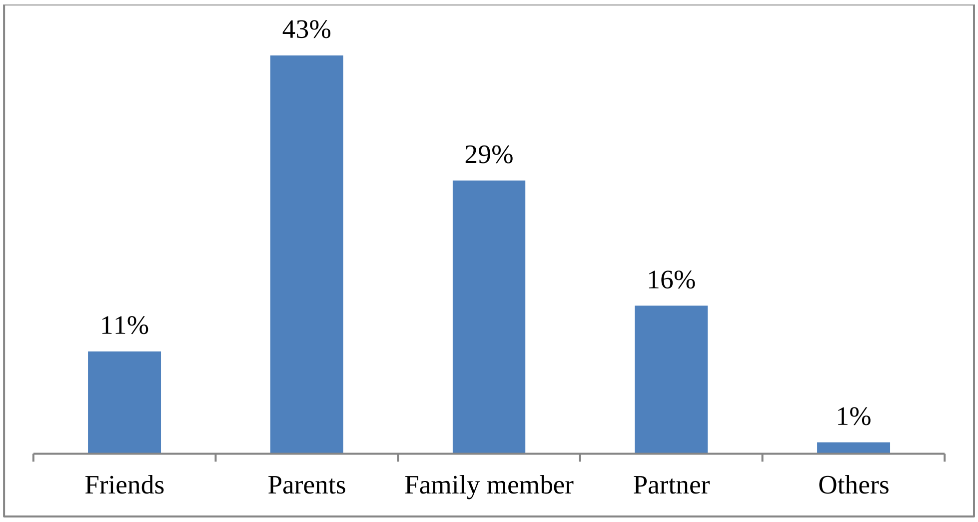

Figure 2.5: Patients visiting the hospital accompanied

Slightly more than one third (34%) of the participants had visited the hospital less than a month before, 27% had visited the hospital less than three months before (refer to Table 2.3). 20% of the respondents mentioned that they visited the hospital at least once a month, 31% visited once every three months (refer to Table 2.4).

Table 2.3: Last visit to the hospital

Last visit to the hospital	%
Less than one month ago	34%
From one month to less than 3 months ago	27%
From 3 months to less than 6 months ago	19%
More than 6 months ago	19%
Total	100%

Table 2.4: Frequency of visits

Frequency of visits	%
At least once a month	20%
Once every three months	31%
Once every 6 months	27%
Once every year	11%
Less often than is listed above	10%
Total	100%

2.5.3.2 Waiting time experience

2.5.3.2.1 Arrival to registration (WT1)

The participants' perception of waiting time from arrival to registration (WT1) was equal to or less than the expected waiting time, except in two cases: when the length of waiting time was between 5 and 10 minutes and when the waiting time was more than 30 minutes (Figure 2.6).

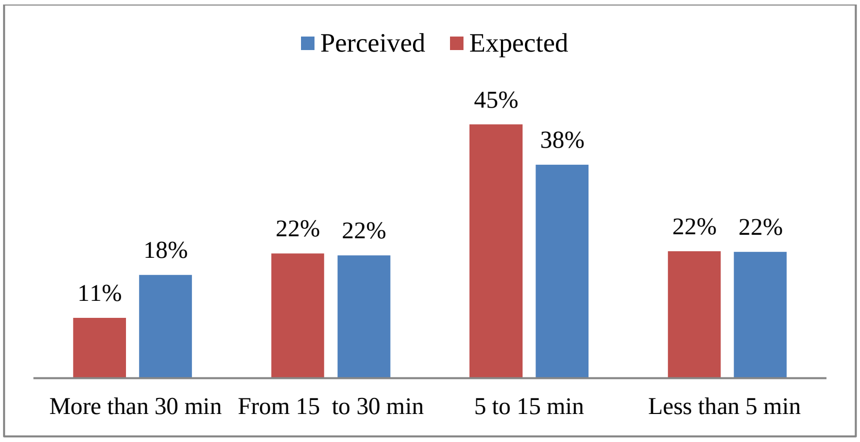

Figure 2.6: Expected and perceived waiting times – WT1

2.5.3.2.2 Registration to consultation (WT2)

Participants' expectations of the waiting time from registration to consultation or seeing the doctors (WT2) were different from their perceptions. 72% of the participants perceived the waiting time to have been longer than they expected (refer to Table 2.5 and Figure 2.7). 48% of the patients expected to spend more than 10 minutes with the doctors in consultation, but they perceived that less time was spent (Figure 2.8).

Table 2.5: Expected and perceived waiting time - WT2

Length of waiting time	Expected	Perceived
Less than 5 min	44%	28%
5 to 15 min	41%	45%
From 15 to 30 min	11%	18%
More than 30 min	4%	8%
Total	100%	100%

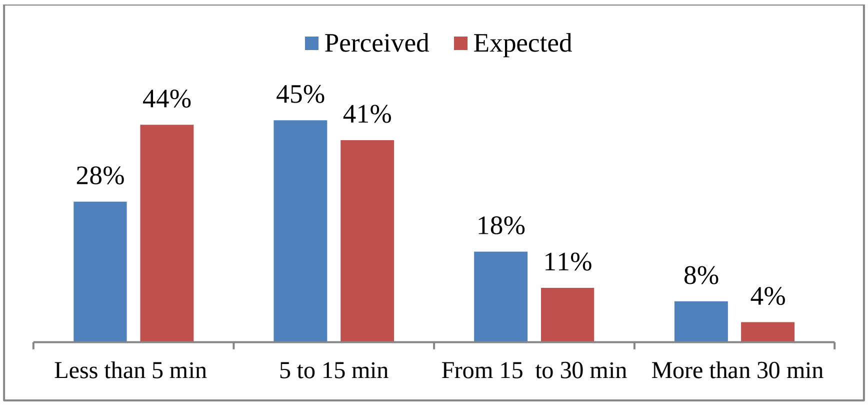

Figure 2.7: Expected and perceived waiting time - WT2

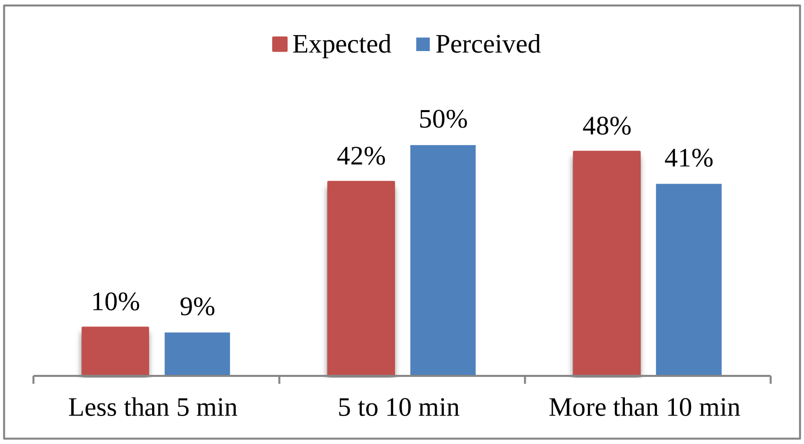

Figure 2.8: Expected and perceived time spent in consultation with doctors

2.5.3.2.3 Waiting time at pharmacy (WT3)

79% of the patients perceived that they waited at the pharmacy longer than they expected for all waiting times up to 20 minutes. However, 21% of the patients perceived that they had waited less time than they had expected (see Figure 2.9).

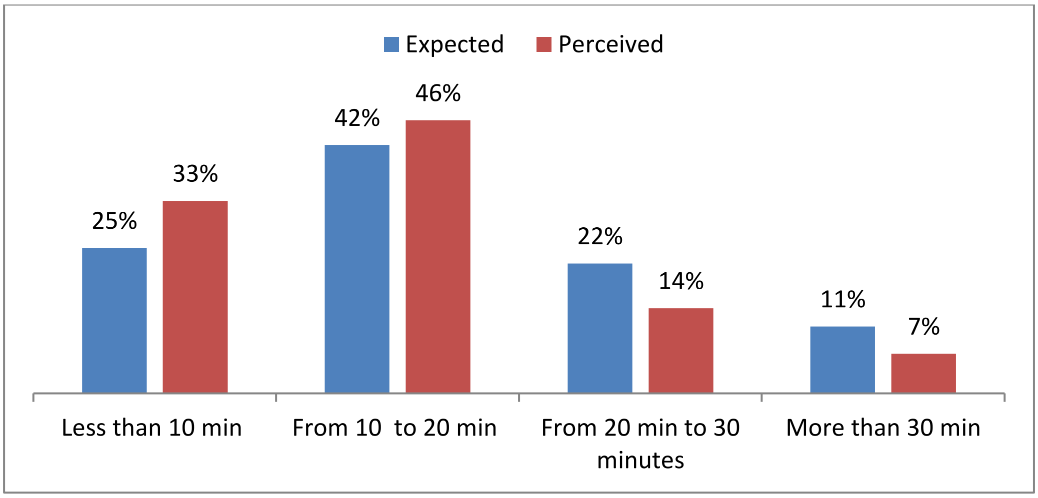

Figure 2.9: Expected and perceived waiting times - WT3

2.5.3.2.4 Waiting time experience

When patients were asked to tell us about their waiting time experience, 54% said that it had been acceptable, while 31% said that they had experienced a long waiting time (refer to Table 2.6). While 38% of the patients had felt satisfied about the waiting time, 31% of them had been bored and 30% stressed (refer to Table 2.7)

Table 2.6: Waiting time experience

Experience	%
Short	15%
Acceptable	54%
Long	31%
Total	100%

Table 2.7: Feelings about waiting time

Feelings	**%**
Bored	31%
Stressed	30%
Satisfied	38%
Total	100%

2.5.3.2.5 Causes of long waiting time

From the participants' point of view, one of the main causes of the long waiting time in hospitals is patients' unpunctuality. In Table 2.8, there are some other reasons, showing also the percentage of agreement from patients.

Table 2.8: Causes of long waiting time from patients' perspective

1.	Patient unpunctuality	47%
2.	Understaffing, including doctors	41%
3.	Using computer systems.	38%
4.	Inadequate facilities (number of consultation rooms)	38%
5.	Crowded waiting lounge/room	36%
6.	Long consultation time	36%
7.	Lack of supervision	35%
8.	Full attendance of patients	34%
9.	Physicians are slow	34%
10.	Inefficient work process	30%
11.	Double booking	28%
12.	Too many forms to fill	27%
13.	Too many staff having rest hour at the same time	26%
14.	Doctors starting clinic late	26%
15.	Clinic sessions starting late	25%
16.	Inappropriate design of clinical work and patient flow	23%

2.5.4 Patients' satisfaction

In this study the patients' satisfaction is assessed, questions 26-50 examining the gap between the perception of the quality of services and the expectation of it. In addition, Qs 51 and 52 of the survey ask about the willingness to recommend the hospital to family and friends and overall satisfaction with the services provided. Bearing in mind that Satisfaction = Perception – Expectation, to assess the gap between the perception and expectation a gap score was calculated for each of the statements in each dimension. Then we obtained an average gap score for each dimension. The results are presented below.

2.5.4.1 Healthcare Dimensions

The healthcare quality of services is assessed here in nine dimensions, as appears in the section headings of the questionnaire (Appendix 2.6). The calculation results indicate a gap between the patients' perceptions of care and their expectations (refer to Appendix 2.7 for more details). The gaps found are listed below in Table 2.9, with the order showing the biggest average gap first; availability (-1.08), accessibility/convenience (-0.94), the art of care (-0.83), interpersonal components (-0.80), efficacy/outcome of care (-0.76), continuity of care (-0.67), technical aspects (-0.59), physical environment (-0.24). Last came the appeal and comfort of the amenities/facilities (-0.02), indicating the smallest gap.

Table 2.9: Average gap score of healthcare dimensions

Healthcare dimensions	**Average gap score**
Art of Care	-0.83
Technical Aspect	-0.59
Accessibility/convenience	-0.94
Physical Environment	-0.24
Availability	-1.08
Continuity of care	-0.67
Efficacy/outcome of care	-0.76
Interpersonal Components	-0.80
Amenities/facilities appeal and comfort	-0.02

2.5.4.2 SERVQUAL dimensions

The SERVQUAL items are assessed on the basis of 5 dimensions; tangibility, assurance, responsiveness, empathy and reliability. The calculations indicate that there were gaps between all the patients' expectations and their perceptions. Since satisfaction = Perception – Expectation, the results indicate dissatisfaction in all five dimensions.

Comparing the average score for each of the dimensions, the average gap scores can be arranged in the following order, with the largest first: responsiveness (-0.98), empathy (-0.91), reliability (-0.84), assurance (-0.78), and with lowest average gap score comes tangibililty (-0.12), (see Table 2.10). For details please refer to Appendix 2.8.

Table 2.10: Average gap score of SERVQUAL dimensions

SERVQUAL dimensions	Average gap score
Tangibility	-0.12
Assurance	-0.78
Responsiveness	-0.98
Empathy	-0.91
Reliability	-0.84

2.5.4.3 Willingness to recommend the hospital to family and friends

When the patients were asked in question (51) if they were willing to recommend the healthcare facility they had visited to their family and friends, 27.12% strongly agreed that they would do so, while 2.07% said that they would unquestionably not recommend it (refer to Figure 2.10).

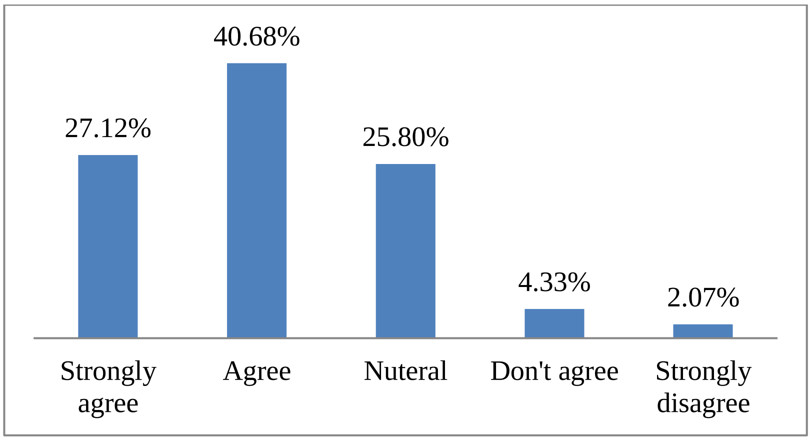

Figure 2.10: Willingness to recommend the healthcare facility to family and friends

2.5.4.4 The overall satisfaction with the services provided.

Patients were also asked in question (52) to tell us about their level of satisfaction. 22.41% were totally satisfied with the services provided, while 1.69% were at the opposite extreme (refer to Figure 2.11).

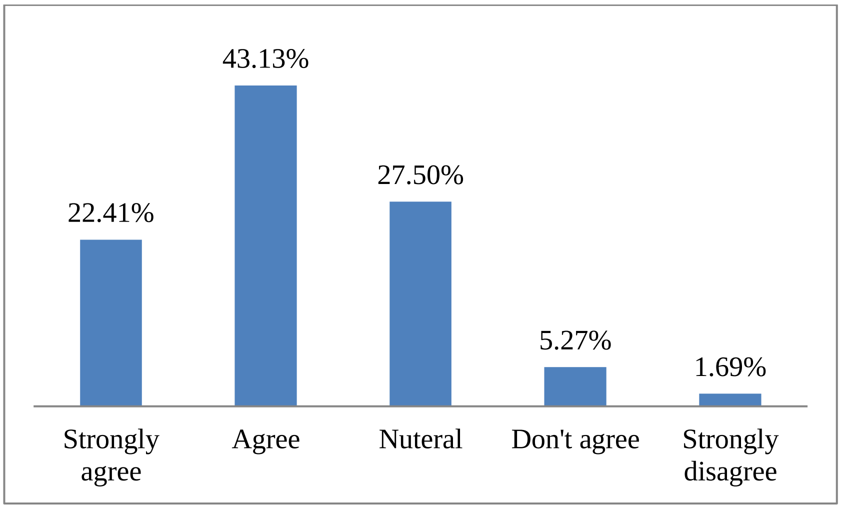

Figure 2.11: Overall satisfaction with level of service quality

2.5.5 Hypotheses testing

The Statistical Package for the Social Sciences (SPSS) software version 21 was used to analyse the responses in this study. Multiple Linear Regression analysis was conducted to test the hypotheses and to identify the most influential variables. For a detailed analysis, refer to Appendices 2.9.1 and 2.9.2.

The patients' satisfaction was measured in our study as the difference between expectation and perception. Patient satisfaction was measured in different questions; with average SERVQUAL (questions from 26 to 50), and recommending the hospital to family members and friends (question 51). All of the questions were measured on a 5-level Likert scale (from 5=strongly agree to 1=strongly disagree).

Waiting time satisfaction was measured through five questions: satisfaction with waiting time from arrival to registration (WT1) (question 16); with waiting time from registration to consultation (WT2) (question 18); with waiting time at the pharmacy (WT3) (question 22), with the cognitive aspect of the waiting experience (waiting time classified as long, acceptable, or short (question 23)), and the affective aspect of waiting time – feelings about the waiting time (bored or stressed, which reflect not satisfied, or dissatisfied (question 24)).

We used the concept of satisfaction as Satisfaction = Perception – Expectation to measure the patients' satisfaction in Q16, Q18, Q22 and for Qs 26 to 50 for satisfaction with the service quality (SERVQUAL).

2.5.5.1 Waiting time satisfaction and patients' satisfaction

Here we test the following hypothesis:

H1: Waiting time satisfaction affects patients' satisfaction

The waiting time satisfaction is measured here by five questions: Q16 satisfaction with the waiting time from arrival to registration (WT1), Q18 satisfaction with the waiting time from registration to consultation (WT2), Q22 satisfaction with the waiting time at the pharmacy (WT3), Q23 the waiting time experience, and Q24 the feelings induced by the waiting time. The satisfaction with the service quality is, however, measured by two methods, namely, satisfaction with the quality of services–SERVQUAL (Qs 26-50) and willingness to recommend the hospital to others (Q51).

2.5.5.1.1 Waiting time satisfaction and service satisfaction

Using the first measure of satisfaction, which is satisfaction with the quality of services (SERVQUAL) to check if there was a relationship between satisfaction with the waiting time and with the service quality, it was found that there was a statistically significant ($P=.009$) positive relationship ($\beta=.099$) between the satisfaction with the quality of services provided, satisfaction with the waiting time from arrival to registration (WT1) and a statistically significant ($P=.002$) statistical positive relationship ($\beta=.169$) between the satisfaction with the quality of services provided and the waiting time experience (cognitive aspect of waiting time satisfaction).

After removing the non-significant variables (waiting time feelings, satisfaction with waiting time from registration to consultation (WT2), and satisfaction with waiting time at the pharmacy (WT3) and rerunning the analysis, we found that both variables – the waiting time experience and the waiting time satisfaction from arrival to registration (WT1) – were statistically significant, with ($P=.001$) for both and with a coefficient value of $\beta=.179$ and $\beta=.124$ respectively (refer to Table 2.11).

Table 2.11: Regression analysis with significant variables: H1 – Satisfaction with waiting time and with service quality

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.081	.102		-10.591	.000					
	Q23	.179	.051	.146	3.478	.001	.163	.147	.145	.986	1.014
	WT1	.124	.035	.146	3.493	.001	.164	.147	.145	.986	1.014
a. Dependent Variable: SERVQUAL											

2.5.5.1.2 Waiting time satisfaction and hospital recommendation

Using the recommendation of the hospital to family and friends as a measure of satisfaction with the quality of service overall, we found a statistically significant (P=.010) positive relationship (β=.123) between satisfaction with the waiting time from arrival to registration (WT1) and patients' being prepared to recommend the hospital to others. The results also indicated a statistically significant (P=.000) positive relationship (β=.211) between the feelings about the waiting time and patients' willingness to recommend the hospital to family and friends.

After removing the non-significant variables and re-running the model, we found the results to indicate a statistically significant (P=.031) positive (β=.094) relationship with satisfaction with the waiting time from arrival to registration (WT1) and a statistically significant (P=.000) positive (β=.210) relationship with feelings about waiting time. (refer to Table 2.12).

Table 2.12: Regression analysis: H1 – Relationship between satisfaction with waiting time and willingness to recommend the hospital

Coefficients[a]												
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.473	.111		31.206	.000					
	WT1	.094	.043	.095	2.167	.031	.117	.096	.094	.987	1.014
	Q24	.210	.049	.188	4.285	.000	.199	.188	.187	.987	1.014
a. Dependent Variable: Q51											

Therefore, we cannot reject H1, that satisfaction with the waiting time affects patients' satisfaction.

2.5.5.2 Perceived waiting time and patients' satisfaction

Here we test the following hypothesis:

H2: Patients' waiting time perception affects patients' waiting time satisfaction

The satisfaction with waiting time was measured using the same concept of satisfaction as was used in the difference between the perception and expectation of waiting time for the three stages of waiting time in the clinic; from arrival to registration (WT1), from registration to consultation (WT2) and at the pharmacy (WT3) (Q16, Q18 and Q22). A regression analysis was used to find a relationship between the perceived waiting time at the following stages: waiting time from arrival to registration (WT1.b) (Q16.b), the perceived waiting time from registration to consultation (WT2.b) (Q18.b), and the perceived waiting time at the pharmacy (WT3.b) (Q22.b) In addition we used the cognitive (Q23) and affective aspects of waiting time (Q24) as measures of waiting time satisfaction. This means that the analysis was run three times here: using the dependent variables as satisfaction with the waiting time in the first case, with the waiting time experience in the second case, and the patients' feelings during the waiting time in the third case. The dependent variables in all cases were the answers to the three questions about the perceived waiting time.

2.5.5.2.1 Perceived waiting time and satisfaction with average waiting time

Using the data on waiting time satisfaction, we found a significant (P=.000) statistically positive relationship (β=.172) between the perceived waiting time from arrival to registration (WT1.b) and satisfaction with waiting time as a whole. We also found a significant (P=.000) statistically positive relationship (β=.159) between perceived waiting time from registration to consultation (WT2.b) and satisfaction with the waiting time, and a significant (P=.000) statistically positive relationship (β=.148) between the perceived waiting time at the pharmacy (WT3.b) and satisfaction with the waiting time as a whole (refer to Table 2.13).

Table 2.13: Regression analysis: H2 – Perceived waiting time and satisfaction with waiting time

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.596	.082		-19.520	.000					
	WT1.b	.172	.026	.269	6.593	.000	.458	.271	.233	.747	1.340
	WT2.b	.159	.028	.232	5.731	.000	.434	.238	.202	.756	1.322
	WT3.b	.148	.025	.232	6.019	.000	.407	.249	.212	.835	1.198
a. Dependent Variable: WTS											

2.5.5.2.2 Perceived waiting time and average waiting time experience

Using the waiting time experience (the cognitive aspect of waiting time) as an indicator of waiting time satisfaction, we found in the results a significant (P=.004) statistically positive correlation between perceived waiting time from arrival to registration (WT1.b) and waiting time experience (cognitive waiting time) (β=.080), a significant (P=.013) statistically positive correlation between perceived waiting time from registration to consultation (WT2.b) and waiting time experience (cognitive waiting time) (β=.073), and a significant (P=.000) statistically positive correlation between perceived waiting time at the pharmacy (WT3.b) with waiting time experience (cognitive waiting time) (β=.140). (refer to Table 2.14).

Table 2.14: Regression analysis: H2 – Perceived waiting time and waiting time experience

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.093	.087		12.626	.000					
	WT1.b	.080	.028	.134	2.909	.004	.268	.123	.115	.747	1.340
	WT2.b	.073	.029	.113	2.486	.013	.253	.106	.099	.756	1.322
	WT3.b	.140	.026	.232	5.356	.000	.318	.223	.212	.835	1.198
a. Dependent Variable: Q23											

2.5.5.2.3 Perceived waiting time and average feelings about waiting time

Using the feelings about waiting time (the affective aspect of waiting time) as an indicator of waiting time satisfaction, we found in the results a statistically significant (P=.015) positive relationship (β=.099) between perceived waiting time from arrival to registration (WT1.b) and the feelings about waiting time. The results also indicate a statistically significant (P=.008) positive relationship (β=.096) between perceived waiting time from registration to consultation (WT2.b) and the feelings about waiting time. However, the results indicate no statistically significant (P=.124) relationship between perceived waiting time at the pharmacy (WT3.b) and feelings about waiting time.

After rerunning the analysis and removing the non-significant variables (Q22b), we found that the other two variables of statistical significance were the positive relationship (β=.121) between the feelings about waiting time and the perceived waiting time from arrival to registration (WT1.b) and the positive relationship (β=.109) between the feelings about waiting time and the perceived waiting time from registration to consultation (WT2.b). (refer to Table 2.15).

Table 2.15: Regression analysis: H2 – Perceived waiting time and feelings about waiting time

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.451	.123		11.844	.000					
	WT2.b	.121	.038	.142	3.171	.002	.183	.138	.136	.911	1.097
	WT3.b	.109	.035	.139	3.112	.002	.182	.135	.133	.911	1.097
a. Dependent Variable: Q24											

Therefore, we cannot reject H2, that patients' waiting time perception affects patients' satisfaction.

2.5.5.3 Expected waiting time and waiting time satisfaction

Here we test the third hypothesis, which is:

H3: Expected waiting time affects patients' waiting time satisfaction

As discussed earlier, the waiting time satisfaction was measured using the same concept of satisfaction, as the difference between the perception and expectation of waiting time. As in the previous analysis, the hypothesis is now measured in three steps, the dependent variables being different in each step. The dependent variables are satisfaction with waiting time, the waiting time experience and the feelings about waiting time. The dependent variables remain the same in all three steps of testing the hypothesis, namely, the expected waiting time from arrival to registration (WT1.a)

(Q16.a), the expected waiting time from registration to consultation (WT2.a) (Q18.a), and the expected waiting time at the pharmacy (WT3.a) (Q22.a).

2.5.5.3.1 Expected waiting time and waiting time satisfaction

Using the waiting time satisfaction as a dependent variable, we found in the results a statistically significant (P=.010) negative relationship (β= -.091), between the expected waiting time from arrival to registration (WT1.a) and the satisfaction with waiting time. It was also indicated that there was a statistically significant (P=.002) negative relationship (β= -.117) between the expected waiting time from registration to consultation (WT2.a) and the satisfaction with waiting time, and a statistically significant (P=.000) negative relationship (β= -.110) between the expected waiting time at the pharmacy (WT3.a) and the satisfaction with the waiting time as a whole (refer to Table 2.16).

Table 2.16: Regression analysis: H3 - Expected waiting time and waiting time satisfaction

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.574	.119		4.804	.000					
	WT1.a	-.091	.035	-.122	-2.596	.010	-.241	-.110	-.105	.740	1.351
	WT2.a	-.117	.038	-.150	-3.121	.002	-.265	-.132	-.126	.707	1.414
	WT3.a	-.110	.030	-.158	-3.642	.000	-.246	-.154	-.147	.861	1.162
a. Dependent Variable: WTS											

2.5.5.3.2 Expected waiting time and waiting time experience

Using the waiting time experience (cognitive aspect of waiting time) as an indicator of waiting time satisfaction and as a dependent variable, we found a statistically significant (P=.029) positive (β=.074) relationship between it and the expected waiting time from arrival to registration (WT1.a); a statistically significant

(P=.036) positive relationship between it and the expected waiting time from registration to consultation (WT2a) (β=.076), and a statistically significant (P=.003) positive relationship (β=.088) between it and the expected waiting time at the pharmacy (WT3.a). (refer to Table 2.17).

Table 2.17: Regression analysis: H3 – Expected waiting time and waiting time experience

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.142	.115		9.938	.000					
	WT1.a	.074	.034	.105	2.183	.029	.194	.093	.090	.740	1.351
	WT2.a	.076	.036	.103	2.102	.036	.202	.089	.087	.707	1.414
	WT3.a	.088	.029	.134	3.010	.003	.200	.128	.124	.861	1.162
a. Dependent Variable: Q23											

2.5.5.3.3 Expected waiting time and feelings about waiting time

Using the feelings about waiting time (the affective aspect of waiting time) as an indicator of waiting time satisfaction and as a dependent variable, it was found that there is no significant relationship (P=.177) between the expected waiting time and the feelings about waiting time. (refer to Table 2.18).

Table 2.18: Analysis of variance: H3 – Expected waiting time and feelings about waiting time

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.507	3	1.169	1.649	.177[b]
	Residual	367.146	518	.709		
	Total	370.653	521			
a. Dependent Variable: Q24						
b. Predictors: (Constant), WT1.a, WT2.a, WT3.a						

Therefore, we cannot reject H3, that patients' waiting time expectation affects patients' satisfaction.

2.5.5.4 Perceived waiting environment and waiting time satisfaction

Here we test the following hypothesis:

H4: the perceived attractiveness of the waiting environment affects patients' waiting time satisfaction (occupied waiting time).

As suggested by Smidts and Pruyn (1998), we measured the waiting time experience as the perceived satisfaction with the waiting environment. This was measured by answers on the visual appearance of the materials and their availability in the waiting room (Q32.b); whether the perceived physical environment of the hospital was one of the best in its industry (Q39.b); whether the hospital had a clean and comfortable environment and clear directional signs (Q41.b); and whether the waiting rooms were clean, comfortable, accessible and attractive (Q42.b). The hypothesis, like the previous hypotheses, was tested in three stages/steps, using three dependent variables as measures of waiting time satisfaction.

2.5.5.4.1 Perceived waiting environment and waiting time satisfaction

Using the waiting time satisfaction as a dependent variable, we found in the results a statistically significant ($P=.031$) positive relationship ($\beta=.089$) between a perceived clean, comfortable, accessible and attractive waiting room and satisfaction with the waiting time.

After rerunning the analysis with the significant variable, the results indicated a statistically significant ($P=.007$) positive relationship ($\beta=.091$) between the perceived clean, comfortable, accessible and attractive waiting room and the waiting time satisfaction. (refer to Table 2.19).

Table 2.19: Regression analysis: H4 – Perceived waiting environment and waiting time satsifaction

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.710	.131		-5.439	.000					
	Q42b	.091	.034	.116	2.702	.007	.116	.116	.116	1.000	1.000
a. Dependent Variable: WTS											

2.5.5.4.2 Perceived waiting environment and waiting time experience

Using the waiting time experience (cognitive waiting time aspect) (Q23) as a dependent variable, we found in the results the non-statistical significance (P=.102) of the model. (refer to Table 2.20).

Table 2.20: Analysis of variance: H4 – Perceived waiting environment and waiting time experience

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.280	4	.820	1.942	.102[b]
	Residual	219.997	521	.422		
	Total	223.278	525			
a. Dependent Variable: Q23						
b. Predictors: (Constant), Q42b, Q32b, Q39b, Q41b						

2.5.5.4.3 Perceived waiting environment and feelings about waiting time

Using the feelings about waiting time (affective waiting time aspect) (Q24) as an indicator of waiting time satisfaction, it was found that the only statistically significant (P=.001) positive relationship (β=.178) was with the perceived best physical environment.

After re-running the analysis with the significant variable, it was found that the variable had a statistical significance (P=.000) with a positive relationship (β=.183). (refer to Table 2.21).

Table 2.21: Regression analysis: H4 – Perceived waiting environment and feelings about waiting time

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.383	.162		8.519	.000					
	Q39b	.183	.042	.189	4.338	.000	.189	.189	.189	1.000	1.000
a. Dependent Variable: Q24											

Therefore, we cannot reject H4: the attractiveness of the environment positively affects the patients' satisfaction with the waiting time.

2.5.5.5 Perceived information provided about waiting time and waiting time satisfaction

Here we test the following hypothesis:

H5: Uncertain waiting time affects patients' waiting time satisfaction

Using the three stages of analysis to measure the waiting time satisfaction as a dependent variable, which is the same in the three analyses, we investigated the effect of perceived information provided to the patients about the expected waiting time as measured through answers to Q38.b.

2.5.5.5.1 Perceived information provided about waiting time and waiting time satisfaction

Using the average difference of satisfaction with the waiting time, we found in the results a statistically significant (P=.000) positive relationship (β=.107) between satisfaction with the waiting time and the perceived information provided about the expected waiting time. (refer to Table 2.22).

Table 2.22: Regression analysis: H5 – Perceived information provided about waiting time and waiting time satisfaction

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.721	.088		-8.180	.000					
	Q38b	.107	.026	.178	4.173	.000	.178	.178	.178	1.000	1.000
a. Dependent Variable: WTS											

2.5.5.5.2 Perceived information provided about waiting time and waiting time experience

Using the waiting time experience (cognitive waiting time aspect) (Q23) as an indicator of waiting time satisfaction and as a dependent variable, we found in the results that there was a statistically significant (P=.000) positive relationship (β=.091) between the perceived information provided about the expected waiting time (certainty over waiting time) and the waiting time experience. (refer to Table 2.23).

Table 2.23: Regression analysis – H5 – Perceived information provided about waiting time and waiting time experience

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.532	.085		18.079	.000					
	Q38b	.091	.025	.158	3.702	.000	.158	.158	.158	1.000	1.000
a. Dependent Variable: Q23											

2.5.5.5.3 Perceived information provided about waiting time and feelings about waiting time

Using the affective waiting time aspect (Q24) as an indicator of waiting time satisfaction and as a dependent variable, we found in the results a statistically significant (P=.002) positive relationship (β=.101) between the information provided about the expected waiting time and the feelings about waiting time. (refer to Table 2.24).

Table 2.24: Regression analysis: H5 – Perceived information provided about waiting time and feelings about waiting time

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.737	.112		15.545	.000					
	Q38b	.101	.033	.137	3.110	.002	.137	.137	.137	1.000	1.000
a. Dependent Variable: Q24											

Therefore, we cannot reject H5, that satisfaction with the information provided affects the waiting time satisfaction.

2.5.5.6 Accompanied or solo patients and waiting time satisfaction

Here we test the following hypothesis

H6: Patients coming accompanied or alone affects their satisfaction with waiting time

One of the questions was whether the patients had come alone or accompanied (Q15). Below we reveal the results of using the same three methods as used earlier to measure patients' satisfaction with the waiting time,

2.5.5.6.1 Accompanied or solo patients and waiting time satisfaction

Using the waiting time satisfaction as a dependent variable, we found in the results a statistically significant (P=.046) positive relationship (β=.104) between patients coming accompanied and waiting time satisfaction. (refer to Table 2.25).

Table 2.25: Regression analysis: H6 – Accompanied or solo patients and waiting time satisfaction

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.503	.075		-6.684	.000					
	Q15	.104	.052	.086	1.997	.046	.086	.086	.086	1.000	1.000
a. Dependent Variable: WTS											

2.5.5.6.2 Accompanied or solo patients and waiting time experience

Using the waiting time experience (cognitive waiting time aspect) (Q23) as an indicator of waiting time satisfaction and as a dependent variable, we found non-statistical significance in the model (P=.229). (refer to Table 2.26).

Table 2.26: Analysis of variance: H6 – Accompanied or solo patients and waiting time experience

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.630	1	.630	1.450	.229[b]
	Residual	234.406	540	.434		
	Total	235.035	541			
a. Dependent Variable: Q23						
b. Predictors: (Constant), Q15						

2.5.5.6.3 Accompanied or solo patients and feelings about waiting time

Using the feelings about waiting time (affective waiting time aspect) (Q24) as an indicator of waiting time satisfaction, we found the non-significance of the model (P=.734). (refer to Table 2.27).

Table 2.27: Analysis of variance: H6 – Accompanied or solo patients and feelings about waiting time

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.077	1	.077	.108	.743[b]
	Residual	366.281	516	.710		
	Total	366.357	517			
a. Dependent Variable: Q24						
b. Predictors: (Constant), Q15						

Therefore, we cannot reject H6: Patients coming accompanied or alone affects their satisfaction with waiting time

2.5.5.7 Patients' visits and waiting time satisfaction

Here we tested the following hypothesis:

H7: Patients' frequency of visit to the clinic affects their satisfaction with waiting times

The satisfaction with the waiting time, as above, was measured in three ways. The dependent variables were related to the frequency of visits. In this study, it was captured in three questions: when their last visit was (Q6), whether this was their first or a repeat visit to this clinic (Q11), and how frequently they visited the hospital (Q12).

2.5.5.7.1 Patients' visit and waiting time satisfaction

Using the waiting time satisfaction as a dependent variable, it was found that the model is not statistically significant (P=.744) (refer to Table 2.28).

Table 2.28: Analysis of variance: H7 – Patients' visits and waiting time satisfaction

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.588	3	.196	.413	.744[b]
	Residual	219.330	462	.475		
	Total	219.918	465			
a. Dependent Variable: WTS						
b. Predictors: (Constant), Q12, Q11, Q6						

2.5.5.7.2 Patients' visits and waiting time experience

Using the waiting time experience (cognitive waiting time aspect) (see Q23) as an indicator of waiting time satisfaction and as a dependent variable, the non-significance of the model was found (refer to Table 2.29).

Table 2.29: Analysis of variance: H7 – Patients' visits and waiting time experience

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.692	3	.564	1.283	.280[b]
	Residual	203.183	462	.440		
	Total	204.876	465			
a. Dependent Variable: Q23						
b. Predictors: (Constant), Q12, Q11, Q6						

2.5.5.7.3 Patients' visits and feelings about waiting time

Using the feelings about waiting time (affective waiting time aspect) (see Q24) as an indicator of waiting time satisfaction and as a dependent variable, we found in the results a statistically significant (=.017) negative relationship (β=-.094) between the last time a patient had visited the hospital/clinic and their satisfaction with the affective aspect of the waiting time.

After re-running the regression analysis with the significant variable, we found that the last visit to the hospital was statistically significant (P=.011), showing a negative relationship (β=-.087) with the waiting time experience; that is, the more recent the visit to the hospital, the more they were satisfied (refer to Table 2.30).

Table 2.30: Regression analysis: H7 – Patients' visit to the hospital and waiting time feelings

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.257	.083		27.087	.000					
	last_visited	-.087	.034	-.113	-2.550	.011	-.113	-.113	-.113	1.000	1.000
a. Dependent Variable: Q24											

Therefore, we cannot reject H7: Patients' frequency of visit to the clinic affects their satisfaction with waiting times.

2.5.5.8 Time spent with doctors and waiting time satisfaction

Here we test the following hypothesis:

H8: Time spent with doctors affects patients' satisfaction with waiting time

We used the same three methods mentioned earlier to measure the satisfaction with waiting time against the time spent with doctors. We asked two questions about the time spent with the doctor: how long did you spend with the doctor? (Q20. expected and perceived), and how far do you agree that patients should always spend enough time with the doctor? (Q47. expected and perceived).

2.5.5.8.1 Time spent with doctors and waiting time satisfaction

Using the average difference of satisfaction with the waiting time, we found a statistically significant (P=.001) negative relationship (β=-.139) between patients' waiting time satisfaction and patients' expectation of spending enough consultation time with the doctors. We found also a statistically significant (P=.000) positive relationship (β=.119) between patients' waiting time satisfaction and patients' perception that they had spent enough consultation time with the doctors.

After re-running the regression analysis and removing the non-significant variables, we found that both variables were statistically significant, and the patients' expectation that patients should always spend enough time with the doctor was statistically significant (P=.035), showing a negative relationship (β=-.089) with waiting time satisfaction. We found also that the patients' perception that they always spent enough time with the doctor was statistically significant (P=.000), showing a positive relationship (β=.122) with waiting time satisfaction. (refer to Table 2.31).

Table 2.31: Regression analysis: H8 – time spent with doctors and waiting time satisfaction

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.429	.206		-2.080	.038					
	Q47a	-.089	.042	-.093	-2.110	.035	-.055	-.092	-.091	.946	1.057
	Q47b	.122	.033	.163	3.693	.000	.142	.159	.159	.946	1.057
a. Dependent Variable: WTS											

2.5.5.8.2 Time spent with doctors and waiting time experience

Using the waiting time experience (cognitive waiting time aspect) as an indicator of waiting time satisfaction, we found in the results that there was a statistically significant (P=0.001) negative relationship between it and the expected time spent with the doctors (β= -.180), and a statistically significant (P=0.037) positive relationship with the perception that they always spent enough consultation time with the doctors (β=.069).

After re-running the regression analysis and removing the non-significant variables, we found that only one variable was statistically significant. The patients' expectation of the time to be spent with the doctor was found to be statistically significant (P=.000), showing a negative relationship (β=-.205) with the waiting time satisfaction. Yet the patients' perception that they always spent enough time with the doctor was found not to be statistically significant (P=.092). The analysis was re-run, removing the non-significant variable, and was found to be statistically significant (P=.000), showing a negative relationship (β=-.207) with the waiting time experience. (refer to Table 2.32).

Table 2.32: Regression analysis: H8 – time spent with doctor and waiting time experience

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.319	.105		22.111	.000					
	Q20a	-.207	.043	-.200	-4.751	.000	-.200	-.200	-.200	1.000	1.000
a. Dependent Variable: Q23											

2.5.5.8.3 Time spent with doctors and feelings about waiting time

Using the feelings about waiting time (the affective waiting time aspect) as an indicator of waiting time satisfaction and as a dependent variable, we found in the results that there was a statistically significant (P=.000) positive relationship with the patients' perception that they always spent enough consultation time with the doctors (β=.159).

After re-running the analysis and removing the non-significant variables, we found that patients' perception that they always spent enough consultation time with the doctors was statistically significant (P=.001) showing a positive relationship (β=.134) with the feelings about waiting time. (refer to Table 2.33).

Table 2.33: Regression analysis: H8 – time spent with doctors and feelings about waiting time

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.558	.157		9.893	.000					
	Q47b	.134	.040	.147	3.340	.001	.147	.147	.147	1.000	1.000
a. Dependent Variable: Q24											

Therefore, we cannot reject H8, that time spent with doctors affects patients' waiting time satisfaction.

2.5.5.9 Perceived technical and interpersonal skills of the doctors and healthcare providers and waiting time satisfaction

Here we tested the following hypothesis:

H9: The perceived technical and interpersonal skills of the doctors and healthcare provider affect patients' waiting time satisfaction

Perceived technical and interpersonal skills are measured through several questions in this study: staff sympathy, reassurance and willingness to help (see Q27b); whether staff are ever too busy to respond to patients' problems or inquiries (see Q28b); whether the hospital has the patients' best interests at heart (see Q29b); whether staff understand patients' specific needs (see Q30b); whether hospitals diagnose cases correctly the first time (see Q33b); whether hospital employees are knowledgeable (see Q34b); whether doctors help patients to be cured and relieved of their suffering (see Q46b); and whether doctors always explain the diagnosis, treatment and care in language that patients can understand (see Q48b).

2.5.5.9.1 Perceived technical and interpersonal skills of the doctors and healthcare providers and waiting time satisfaction

Using the waiting time satisfaction as a dependent variable, we found in the results no statistically significant (P=.257) relationships between the perceived technical and interpersonal skills of the doctors and healthcare providers and the patients' satisfaction with their waiting time (refer to Table 2.34).

Table 2.34: Analysis of variance: H9 – Perceived technical and interpersonal skills and waiting time satisfaction

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.518	8	.565	1.270	.257[b]
	Residual	218.362	491	.445		
	Total	222.880	499			
a. Dependent Variable: WTS						
b. Predictors: (Constant), Q48b, Q28b, Q33b, Q46b, Q30b, Q34b, Q27b, Q29b						

2.5.5.9.2 Perceived technical and interpersonal skills of the doctors and healthcare provider and waiting time experience

Using the waiting time experience (cognitive waiting time aspect) (Q23) as an indicator of waiting time satisfaction and as a dependent variable, we found in the results a statistically significant (P=.012) positive relationship (β=.103) with patients' perception that a doctor had diagnosed their case correctly from the first.

After rerunning the regression analysis and removing all the non-significant variables, the patients' perception that doctors should correctly diagnose their cases from the first was found to be statistically significant (P=.000), showing a positive relationship (β=.112) with the waiting time experience (refer to Table 2.35).

Table 2.35: Regression analysis: H9 - Perceived technical and interpersonal skills of the doctor and waiting time experience

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.443	.108		13.375	.000					
	Q33b	.112	.030	.160	3.752	.000	.160	.160	.160	1.000	1.000
a. Dependent Variable: Q23											

2.5.5.9.3 Perceived technical and interpersonal skills of the doctors and healthcare providers and feelings about waiting time

Using the affective waiting time aspect (Q24) as an indicator of waiting time satisfaction and as a dependent variable, we found in the results a non-statistically significant (P=.054) relationship between the perceived technical and interpersonal skills of the doctors and healthcare providers and the affective aspect of waiting time satisfaction (refer to Table 2.36).

Table 2.36: Analysis of variance: H9 - Perceived technical and interpersonal skills and feelings about waiting time

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.019	8	1.377	1.930	.054[b]
	Residual	333.966	468	.714		
	Total	344.985	476			
a. Dependent Variable: Q24						
b. Predictors: (Constant), Q48b, Q28b, Q33b, Q46b, Q30b, Q34b, Q27b, Q29b						

Therefore, we cannot reject H9, that the perceived technical and interpersonal skills of the doctors and healthcare providers affect patients’ waiting time satisfaction

2.5.5.10 Socio-demographic characteristics and waiting time satisfaction

Here we tested the following hypothesis:

H10: The socio-demographical characteristics of the outpatients influence their waiting time satisfaction

The socio-demographics which are measured here are gender (Q1), age (Q2), educational level (Q3), and monthly salary range (Q53).

2.5.5.10.1 Socio-demographic characteristics and average satisfaction with waiting time

Using the waiting time satisfaction as a dependent variable, we found in the results that the model was not significant (P=.314) and there was no relationship between the variables. (refer to Table 2.37).

Table 2.37: Analysis of variance: H10 - Socio-demographics and waiting time satisfaction

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.233	4	.558	1.191	.314[b]
	Residual	232.132	495	.469		
	Total	234.366	499			
a. Dependent Variable: WTS						
b. Predictors: (Constant), Q53, Q1, Q3, Q2						

2.5.5.10.2 Socio-demographic characteristics and waiting time experience

Using the waiting time experience (cognitive waiting time aspect) (Q23) as an indicator of waiting time satisfaction and as a dependent variable, we found in the results that there was a statistically significant (P=.018) positive relationship with gender (β=.146), a statistically significant (P=.000) negative relationship with age (β= -.120), and a statistically significant (P=.027) positive relationship (β=.077) with monthly salary (income).

After removing the non-significant variable (education level), we re-ran the regression analysis using the significant variables only. We found in the results that all the variables were statistically significant. The results show that there was a statistically significant (P=.009) positive relationship (β=.160) between the waiting time experience and gender, a statistically significant (P=.000) negative relationship (β=-.113) with age, and a statistically significant (P=.009) positive relationship (β=.090) with income. (refer to Table 2.38).

Table 2.38: Regression analysis: H10 - Socio-demographics and waiting time experience

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.658	.136		12.214	.000					
	Gender	.160	.061	.120	2.607	.009	.174	.116	.113	.883	1.133
	Age	-.113	.028	-.199	-4.011	.000	-.194	-.177	-.174	.766	1.305
	Income	.090	.034	.123	2.614	.009	.033	.116	.113	.856	1.168
a. Dependent Variable: Q23											

2.5.5.10.3 Socio-demographic characteristics and feelings about waiting time

Using the feelings about waiting time (affective waiting time aspect) (Q24) as an indicator of waiting time satisfaction, we found in the results that the model was not statistically significant (P=.440). (refer to Table 2.39).

Table 2.39: Analysis of variance: H10 - Socio-demographics and feelings about waiting time

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.678	4	.669	.941	.440[b]
	Residual	336.611	473	.712		
	Total	339.289	477			
a. Dependent Variable: Q24						
b. Predictors: (Constant), Q53, Q1, Q3, Q2						

Therefore, we cannot reject H10, that the socio-demographics of the patients influence their waiting time satisfaction.

2.5.5.11 Framework result

The hypotheses testing results are presented in Figure 2.12 noting that the arrows denote a significant correlation but the results do not reflect the statistical significance of each of the hypotheses this is because most of the hypotheses have sub hypotheses which make them difficult to present in full detail. The detailed results of each hypothesis are discussed and presented in section 2.5.5, above.

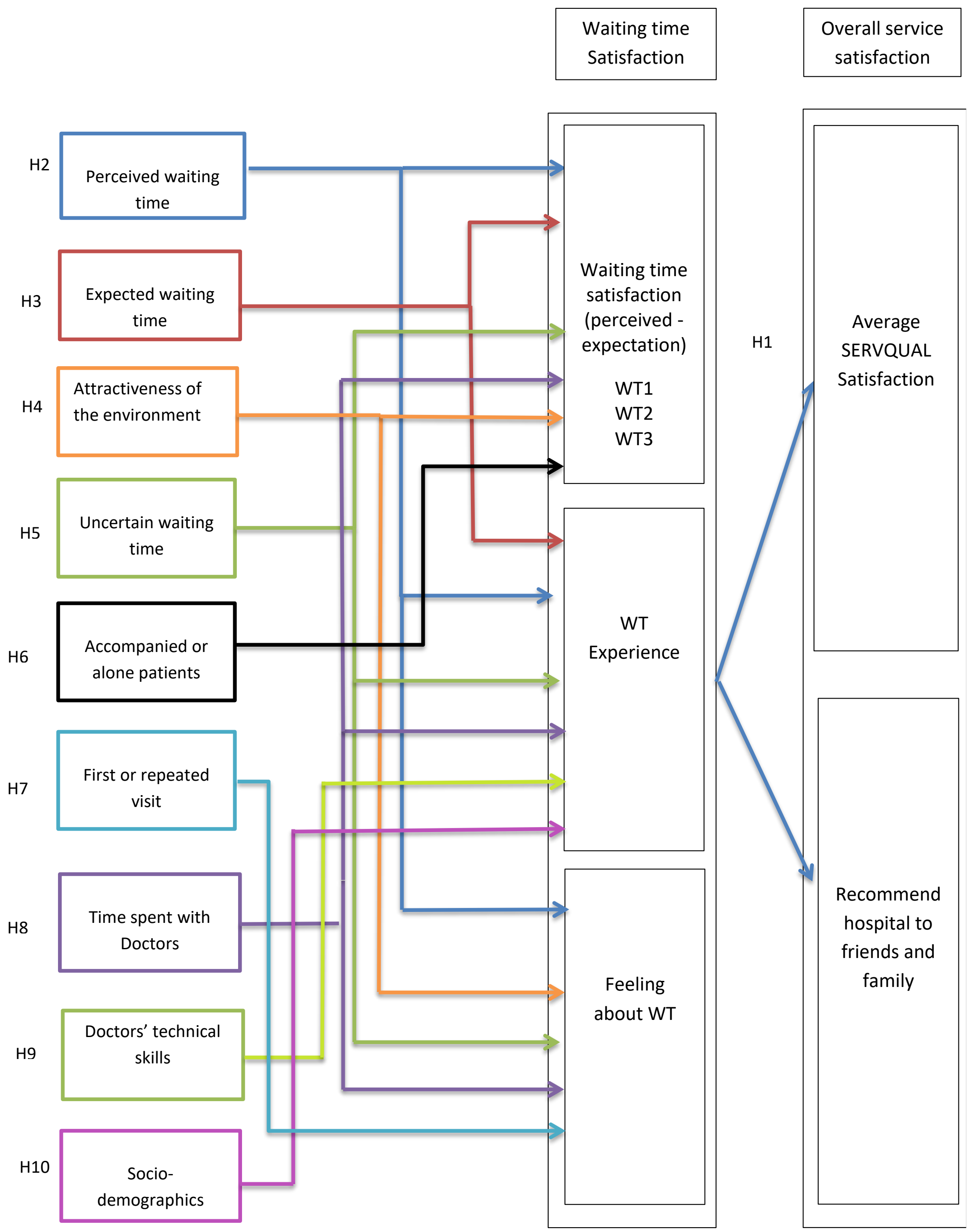

Figure 2.12: Framework results – hypotheses testing results

2.6 Discussion and conclusion

The first objective is to assess the relationship between the waiting time satisfaction and the service quality satisfaction which answers the first research question which is: Q1: Is there a relationship between the patients' waiting time satisfaction and their satisfaction about the services provided in the healthcare sector?. This objective was assessed through the hypothesis 1 (H1). The results indicate that when patients are answering direct questions they tend to say that they are satisfied (65.54%), but 27.50% are in fact in some state between satisfaction and dissatisfaction; only 6.96% said they were not at all satisfied. Recalling, however, that when patients are satisfied they will recommend the healthcare facility to their friends and family members, we found that 76.80% said they would recommend it, 25.80% remained unsure and 6.40% would not.

We find when debating indirect ways of evaluating a healthcare service that there is a gap between what patients expect and what they receive, which results in the dissatisfaction that is represented in Tables 2.9 and 2.10 in the negative average scores for all the dimensions in general and all the question statements. Numbers of psychological determinants may affect the expression of patient satisfaction (LeVois, Nguyen, & Attkisson, 1981). Some writers argue that patients may report a higher level of satisfaction than they actually feel, since they believe that positive feedback is more acceptable to the survey administrator or the management. Seen from their standpoint, positive feedback is in their interests in so far as it ensures that the service will continue to be provided. They may also exaggerate positive elements because they fear unfavorable treatment in the future (Ley, 1982). In addition, patients are likely to report satisfaction with the services as a way of justifying the time and effort that they themselves have invested in their treatment (Sitzia & Wood, 1997). But it is becoming a familiar experience for managers to receive a certain amount of dissatisfaction with specific components, such as waiting time, communication, patient information and rigid routines (Ley, 1982).

The results from this study have some similarities with and some differences from previous studies in this field. The present study found that waiting time satisfaction affects the overall satisfaction with the service provided and the willingness to recommend the hospital to family and friends. The findings tell us that the greater the patients' satisfaction with their waiting time from their arrival to registration, the higher their satisfaction with the services provided. It also tells us that when patients evaluated their overall waiting experience as short, they were more satisfied with the services provided. It also tells us that when patients feel that they were satisfied with the waiting time and not stressed or bored they were more satisfied with the services. The shared factor in both cases was satisfaction with the waiting time from arrival to registration, which is the service-entry or pre-service segment. This may remind us of the findings of (Hensley & Sulek, 2007), who examined the relative importance of customer perceptions of waits in a multi-stage service in a restaurant context; they found that the only wait satisfaction that consistently affected customers' perceptions of service quality involved the service-entry wait. This may recall other research revealing that pre- and post-process waiting generates more intense negative affective responses than in-process waiting (Davis & Vollmann, 1990; Dube-Rioux, Schmitt, & Leclerc, 1989).The other factor that affects satisfaction with the services provided is the waiting time experience and the evaluation of the waiting time, which is the cognitive aspect of the waiting time. Smidts and Pruyn (1998) explained with respect to this cognitive aspect that what affects satisfaction is the subjective transformation of the minutes that have been waited into a judgment that a long or short time had been involved. In this cognitive aspect (the long/short judgment) the individual's frame of reference is used to appraise the waiting situation. The findings of their study support the findings of Hui and Tse (1996) that the affective response to waiting influences the evaluation of the service, and, as demonstrated by Smidts and Pruyn (1998), that the appraisal of the wait (whether cognitive or affective) positively influences the satisfaction with the service. It is interesting to see both the pre-process and cognitive aspects of waiting time affecting the satisfaction with the services provided, in addition to the feelings which are the affective aspect of waiting time. Dube-Rioux et al. (1989) refers to Kurt Lewin’s field theory, that individuals’ behavior (including cognitions and feelings) is the result of the psychological forces acting upon them at any given time. The psychological forces depend on the strength of the individual's needs (internal forces) and the nature of the situation (external forces and barriers). Accordingly, changes in an individual's feelings, cognitions and behavior are the result of changes in the combination of the psychological forces acting on the individual. The closer an individual is to a goal, the more pressing are the forces toward the goal. Therefore, a barrier or a delay occurring during the pre-process phase is likely to be experienced as more unpleasant by the individual than a delay occurring in the in-process phase.

The second objective was to assess the relationship between patients’ satisfaction about waiting time and the perceived and expected waiting time, which was assessed through hypotheses H2 and H3. The third objective was to assess the relationship between the waiting time satisfaction and some of the identified variables, which was assessed through a number of hypotheses, from H4 to H10. The findings of this study indicated that patients’ perceptions about the three variables of waiting time – from arrival to registration, from registration to consultation and at the pharmacy – has a positive relationship with waiting time satisfaction, which means that the more warmly the patients perceived their waiting time (i.e. the less waiting they had), the more they were satisfied with the waiting time, and the shorter they felt the waiting time was. Meanwhile, the two variables that have a positive relationship with the way that patients feel about the waiting time and while this lasts the (the affective aspect) are the perceived waiting time from registration to consultation and the perceived waiting time at the pharmacy. The results of this study support the conclusions of healthcare and service researchers, such as Pakdil and Harwood (2005), who found that one of the most important waiting time variables to affect patients' satisfaction is the in-service wait (the waiting time once in the clinic to be seen by the doctor) Ward et al. (2017). also found that when patients recounted many experiences of longer 'in-service waiting' in public hospitals and also in dentists' clinics, according to Bergh, Ghijsen, Gelderman, and Tuninga (2015) it led to frustration and anxiety; hence in questions of patients' satisfaction the in-service wait is the most important one. In another service sector (the banking service) Katz et al. (1991), for example, found that customer satisfaction tends to decline as perceptions of waiting time increase. It is well recognized that the subjective waiting time influences service evaluation (Katz et al., 1991; Kumar, Kalwani, & Dada, 1997) and that subjective waiting time predicts overall patient satisfaction (Thompson et al., 1996).

The key to providing superior service is understanding and responding to customer/patient expectation (Parasuraman, Berry, & Zeithaml, 1991). Managers' emphasis on the expectation of waiting time is confirmed in the present study, which found that the expected waiting time had a negative significant relationship with waiting time satisfaction, and a positive relationship with waiting time experience. This means that the lower patients' expectations are about the time they will have to wait, the more satisfied they are and the shorter they perceive the time they have waited. Because satisfaction is the difference between expectation and perception and, as mentioned above, customers' satisfaction tends to decline as their perception of waiting time increases, so it is mathematically logical to conclude that the customers' satisfaction increases when their expectations are lowered. Hence, if patients have a very minimal expectation, then we may predict that they will be satisfied once their expectations have been matched or exceeded. Our findings are similar to those of (Kumar et al., 1997), who showed that waiting length expectations influence satisfaction with the waiting experience. But with the recent changes in the business world, expectations are higher, people are impatient and they want everything "just-in-time". As patients visit different healthcare facilities more often, they learn more and have more to compare with, and they value good service above keen pricing. The patients' experience thus causes the desired service level to rise. The more experienced they are, the more likely it is that they will become more sophisticated and have higher service expectations. This may also be applicable to our finding that a patient's last visit was found to have a statistically significant relationship with the affective aspect of waiting time, that is, the feelings about waiting time. The experience of the recent visit shapes and affects the feelings about waiting during the next visit.

Bagozzi, Gopinath, and Nyer (1999) wrote that the emotions were states of readiness that arise from cognitive appraisals of events or one's own thoughts. They also suggested that emotions typically have a specific referent from previous experience. Therefore, as mentioned by Maister (1985), it is important to meet customer expectations early in the service delivery process so that negative first impressions do not affect the perceived service quality later.

In this study it was found that perceiving the waiting room as clean, comfortable, accessible and attractive has a positive relationship with waiting time satisfaction. In addition, it was found that the perception that the hospital has the best physical environment in the industry has a positive impact on the affective aspect, which focuses on feelings. These two features leave patients more satisfied with waiting time and less stressed or bored. The finding is in line with that of Smidts and Pruyn (1998), that the perceived attractiveness of the waiting environment has an impact on the affective response to the waiting time and the satisfaction with the service. Bielen and Demoulin (2007) found that the satisfaction with the waiting environment influenced not only the satisfaction with waiting time but also the satisfaction with the service. Here the tangibles in the environment influence the perception of the service and help customers to tolerate their wait better. The findings are similar to those of Becker and Douglass (2008), who demonstrated that the attractiveness of the physical environment of the waiting area was a significant predictor of patients' perception of the quality of care and the reduction of patient anxiety. To reduce the first responses to waiting, that include uncertainty, annoyance, irritability, stress and anger, healthcare providers introduce in the waiting areas such methods of distraction as television and/or magazines. Larger healthcare organizations nowadays provide, for example, indoor and outdoor views, patient-education resources, and refreshments. In addition, some authorities let patients choose something to do while they wait, and this has been shown to help reduce stress and anxiety (Hosking & Haggard, 1999). In the present study, the appearance of the healthcare educational materials, and the generally comfortable environment of the hospital, in addition to the physical environment as the best in its industry, were found to have no effect on waiting time satisfaction. Instead, the belief that, among healthcare facilities, this hospital had one of the best physical environments was found to influence the affective aspect.

The service environment can affect consumers' emotional, cognitive, and physiological responses, which will influence their evaluations and behaviors (Bitner

(1992). The importance of the environment in a healthcare facility is that it reflects the institution's goal of promoting wellbeing, and technical and professional capacity. The association between the features of the patients' wellbeing and the physical environment has been demonstrated in several studies (Baker & Cameron, 1996; Taylor, 1994). In addition, the ability of the physical environment to influence behaviors and to create an image is acknowledged in several studies (Booms & Bitner, 1982; Zeithaml, Parasuraman, & Berry, 1985). Social studies papers recognize the influence of the physical environment on people's beliefs about a place and the people and products found in it. It is viewed as a form of non-verbal communication, conveying meaning through what is called "object language" (Bitner, 1992). In this context and because the service and waiting time are intangible experiences, the patients perceive the environment as the best in the industry, using their beliefs about their surroundings to determine their beliefs about the service quality and other attributes of the service such as the waiting time and the people who work in the healthcare facility. The quality of the services that is perceived through the perception of the physical environment in return make the waiting time worthwhile, since the attention and care that they have been led to expect will be high. The findings of Andrade et al. (2013) confirm this explanation, showing that the objective quality of the environment affects satisfaction through perceptions of environmental quality, and that patients' status moderates this relationship. Becker and Douglass (2008) and Arneill and Devlin (2002) also agree on the above explanation.

In the present study, the results reveal a positive relationship between receiving information in cases of delay and waiting time satisfaction. It is also revealed that information provided about waiting time has a positive influence on the affective and cognitive aspects of waiting time. Bielen and Demoulin (2007) found that information provided in cases of delay is one of the determinants of waiting time satisfaction. In their study, too, Hui and Tse (1996) found that information provided about the expected duration of waiting time influenced the affective aspect and the acceptability of the wait. Katz et al. (1991) and Antonides et al. (2002) are examples of other studies that concur with our finding, in addition to the above researchers.

Information provided about waiting time in cases of delay may reflect attentiveness and empathy towards patients. When patients receive information about waiting time, for instance, in cases of delay, it means that the people in charge are sensitive to the value of patients' time and their needs, and mindful of the patients' welfare. Attentiveness, helpfulness and responsiveness appear to be the outstanding determinants of satisfaction in the service industry, as identified by Johnston (1995); Parasuraman et al. (1991). The lack of information increases the sense of uncertainty and increases the psychological distress (Maister, 1985). The psychological stress experienced by individuals during a wait is due to their inability to observe the whole service process and to their uncertainty about the duration of the wait (Osuna, 1985). When an expected waiting time is communicated, patients can then decide to wait, or to spend their time on something else. If patients decide not to leave, then their expectation is set to the new duration and they are mentally prepared to wait and decide how they can fill the waiting time. With this type of information, they are more likely to be understanding and tolerant of waiting. Osuna (1985) demonstrated mathematically that the intensity of stress increases during the waiting process and, subsequently, that the psychological cost of waiting is an increasing function of waiting time.

The results of our study indicate that patients who come accompanied by a friend or a family member are more satisfied with their waiting time than patients who come alone.

In the psychology of queuing, most studies, including those by Davis and Heineke (1993); Katz et al. (1991); Maister (1985) reached the same conclusion: that unaccompanied waits seem longer than accompanied ones. Maister (1985) explains this by asserting that there is some form of comfort in group waiting not found in waiting alone and that group waiting tended to increase the tolerance for waiting time.

Two important determinants of satisfaction were defined by some researchers, namely, how long the patient will wait to see a doctor and the duration of the consultation (Patwardhan et al., 2013; Ridsdale, Carruthers, Morris, & Ridsdale, 1989; Verby, Holden, & Davis, 1979). Our study supports this finding, indicating that the expectations and perceptions of the patients that they always spend enough time with the doctor have a relationship with their waiting time satisfaction. The lower their expectations, the more they are satisfied, and the higher their perceptions, the more they are satisfied, with the waiting time. This is in line with other findings, such as those of McMullen and Netland (2013) and Anderson. et al. (2007). Patients acknowledge that the expected time will be spent and perceive it to be d to be necessary and so is the perception that they always spend enough time with the doctor; these have a relationship with the cognitive and affective aspects of their waiting time which determine their evaluation of the waiting time, their experience of it and their emotional feelings about it.

Patients are concerned with the content of each visit; they want enough consultation time with their doctors, and this makes the wait worthwhile. Patients are involved in all aspects of their visits and the processes involved because their health status and wellbeing are concerned, as well as their time, which is precious and not to be wasted. In this, we can see the relationship between the affective aspect of waiting and the waiting time. As social psychologists, Fiedler (1990); Forgas (1995) suggest that affective states have a stronger influence on evaluation when a judgment requires a higher degree of meaningful processing (for instance, when patients are put in a queue). This means that patients who are more involved in the details and the on-going process will evaluate their experience differently from those who are not interested in the process or what is happening around them. A patient's mood affects the interpersonal and assurance aspects of the service encounter and perceived service quality (Chebat, Filiatrault, Gelinas-Chebat, & Vaninsky, 1995). Therefore, it may not be surprising to read our findings about the interpersonal and assurance dimension of the service quality, which confirm the positive relationship between the perceived ability of doctors to diagnose the case correctly the first time - which represents the technical knowledge of the doctors – and a statement of the assurance dimension of the service quality with the cognitive aspect of waiting time satisfaction. The findings are inconsistent with the findings of McMullen and Netland (2013) that satisfaction was related to the affective and cognitive aspects of waiting time, except that in our study we found a relationship with the cognitive aspect of waiting time alone.

In this study, a cognitive relationship was found with respondents' gender, age and income. Here it was learned that females have a perception of shorter waiting times and therefore tend to be more satisfied with their waiting time. Surprisingly, it was found that the younger the patients are, the shorter the wait that they perceived; and the higher the income range the shorter the perception of waiting. Barlow (2002) found that females perceived waiting times as shorter than males did; the latter were the most dissatisfied group. The same was found by Jones and Peppiatt (1996), so our findings are in line with the general findings in this area. In the case of age, different inferences can be drawn. Barlow (2002) divided his sample into two groups, one under fifty-five years old and the other above it. Patients who were under fifty-five perceived the waiting time as much longer than the remainder. Jones and Peppiatt (1996) divided the respondents into four groups. The lowest waiting time perceived by any of the group was found in those aged sixty-one years old or more, followed by the group of twenty years old or younger, although the differences in means were not significant, and no explanation was offered for these findings. The reported findings in relation to income level or social class and general satisfaction or waiting time satisfaction are less consistent because socioeconomic variables are often simply not assessed (Sitzia & Wood, 1997).

Interpreting the results of this study in relation to socio-demographics, the gender results related to satisfaction, on the basis of the study by Weisman et al. (2000) which suggests that women and men experience basic healthcare differently and accordingly, may evaluate it according to different factors or weightings of factors. Women make more primary care visits and confront and overcome different barriers; they take advantage of the perceived ease of scheduling appointments or changing physicians, and this makes them react less impatiently if an emergency situation arises which needs the doctors to leave immediately for the emergency department. This in general had a stronger effect on women's overall satisfaction than on men's (Clancy & Massion, 1992; Kolodinsky, 1998).

The youngest age group in our contained people of eighteen to twenty-four years old, representing 33% of the sample, and they were the most satisfied group. This may be related to their electronic technology; they keep themselves busy all the time with mobile devices and surfing on the web or interacting with others on social media. Time for them may have been less precious, since they were of university/college age (27% of the sample were students). We found a significant relationship with a higher level of income, as Hall and Dornan (1990) also reports. A greater level of satisfaction was always associated with higher social status, and Hall et al. also explain that in the U.S. wealthier patients receive better treatment from physicians than less wealthy patients, even within the same healthcare facility. The same was reported from the UK by Salvage (1988). This study took no account of social class but rather the income level (earnings per month); however, the above explanation may be applicable to our study, possibly also because about 66% of our sample visited a private hospital where waiting is managed differently; other variables may also be associated.

Chapter 3: A Simulation Study to Assess the Effect of Delayed Arrivals and to Determine Appropriate Capacity Levels in a Healthcare System

3.1 Introduction

Visiting an outpatient clinic in a hospital is a very common way for patients to access healthcare. Most of these clinics receive patients on the basis of scheduled appointments. Such patients expect to receive medical service at the scheduled time. However, patients typically face having to wait. Although the healthcare system has many resources, it suffers at the same time from a number of inefficiencies; thus “everybody in the system; patients, families, nurses, doctors and administrators are frustrated” (Armony et al., 2015). Studies such as (Noon, Hankins, Cote, & Lieb, 2003; Xu, 2014; Zhu et al., 2012) have addressed the issue of waiting times,. They find that waiting time at healthcare facilities results from the following factors:

- Capacity does not match demand, or the system is not well managed
- There is significant variability over time in the demand for healthcare services and the time they take,
- Patients are unpunctual and consultation time is overrun
- Physicians vary in age,
- Patient health status/mortality varies
- There is understaffing/Lack of resources
- Clinical workflow and patient flow design are inappropriate
- Facilities are inadequate and facility design is inappropriate.
- Physicians’ workload/Physicians’ work schedules vary

From the survey study (refer to Chapter 2, section 2.5.3.2.5), it was found that, from the patients' point of view, out of 16 listed reasons, patients' unpunctuality and understaffing are two of the major reasons for long waits (47% and 41% of the patients believe that they are the causes of long waiting time). Contributing to the long wait is the fact that many patients cannot always keep or do not respect their appointment time. They often arrive early or late, which creates frustration and inefficiencies.

In this chapter, a simulation model based on of the findings of the empirical study is developed; its results are presented in section 2.5.3.2.5 of Chapter 2. Using authentic data obtained from a public hospital in the UAE, a simulation study was run to examine the effect of a) the available resources on patients' waiting time and b) delayed arrivals on waiting time, which allowed us to vary several parameters.

3.2 Literature review

Healthcare facilities seek to improve the efficiency of outpatient services, mainly due to the increasing expenditure on healthcare. Non-clinical Key Performance Indicators (KPIs) for hospital operations have not been widely imposed on healthcare services (Weerawat, Pichitlamken, & Subsombat, 2013). The main focus of the national health service associations is on measuring clinical performance rather than the efficiency of outpatient department operations (Berg et al., 2005; Mainz, 2003; Weerawat et al., 2013). Various types of clinical indicator can assess health: structural, process, outcomes of healthcare (Mainz, 2003). Some examples of clinically focused KPIs are the average length of stay for inpatients, bed occupancy rate, surgical site infection rate, inpatient mortality rate, and others (Berg et al., 2005; Mainz, 2003; Weerawat et al., 2013). In addition, the level of satisfaction with service quality may be considered (Weerawat et al., 2013).

3.2.1 Lack of healthcare resources (understaffing)

The demand for healthcare is increasing due to the aging and growing population. According to the World Health Organization (Organization, 2006), there is globally a critical deficiency of the number of healthcare providers of all types: doctors, physicians, nurses, etc. One of the major operational issues in healthcare delivery systems is the goal of maximizing resource use while minimizing patients' waiting times.

To meet the increasing need and demand for the existing capacity of human resources, they should be better used, by means of operational management tools such as simulation. Simulations have demonstrated their capability and viability for improving resource use and reducing patient waiting times (Barjis, 2011). (Refer to Table 3.2 for some simulation studies which address the allocation of resources in outpatient clinics.

3.2.2 Patients' delayed arrivals (unpunctuality)

Patients' unpunctuality and long waiting time has been an area under investigation and study since the 1950s (White & Pike, 1964). Patients have been known for decades to arrive early for their appointment at outpatient clinics (Tai & Williams, 2012; White & Pike, 1964). This study found that only 2.51% arrived at their exact appointment time, while 47.42% arrived earlier, and 50.07% arrived later. Taking into consideration the patients' opinion that the delayed arrival of patients is the main reason for the long waiting time and looking at the records of the hospital, which shows that more than 50% of the patients arrive late, it was decided to study this case. The analysis shows that the patients arrive on average 12.29 minutes later than their appointment, with a standard deviation of 24.45 minutes. For such a distribution of patient lateness, the order in which the patients arrive is often different from the order in which they are scheduled, which means that patients often arrive after the appointment time of the patient after them. The problem is that the arrival of a single patient late in a session causes overtime to occur, reduces the efficiency of doctors whose utilized time is reduced, and extends the waiting time for patients (LaGanga & Lawrence, 2007). This type of challenge is usually addressed in simulation studies under ‘studies of scheduling’.

3.2.3 Operational research applications in healthcare

Operational research is increasingly becoming a recognized activity in healthcare services (Duncan & Curnow, 1978). Healthcare in Britain used the application of operational research in planning health services in the early 1970s (Clague et al., 1997). Globally, many researchers in healthcare organizations apply theories of operations management, in such areas as quality management, simulation, scheduling and queuing. This has especially been applied in healthcare studies such as those on internal, external, competitive analysis and strategic management. It has been used, for example, for scheduling healthcare staff such as nurses, physicians, or medical technicians and the model is optimized by using patients’ staying time as a weight factor.

Many healthcare organizations are concerned about improving quality, which can increase patient satisfaction. Moreover, it reduces the overall cost of organizations and services and thus increases the overall competitiveness of the organization (Cheng-Hua et al., 2006). Healthcare organizations vary in scope and scale. Healthcare processes also vary in complexity and scope, but they all consist of the same set of activities and procedures (medical and non-medical) that constitute the required treatment. Patients wait for services in several queues, where the patient arrives, waits behind the patients who have arrived first for service/treatment, obtains the service/treatment, and then leaves the facility (Fomundam & Herrmann, 2007). Given the amount of waiting in the healthcare system, and the fact that many are trying to meet increased demands with limited resources, queuing models are very useful in developing more effective operating policies and identifying where services can improve. With the financial constraints that many healthcare facilities are facing, queuing analysis is an extremely valuable tool for using resources in the most cost-effective way to reduce waiting times. It is also an important tool for identifying future capacity requirements (Green, 2006).

Queuing analysis is used to estimate the manpower demand from those in the queue for the services provided, such as scheduling patients in hospital clinics, allocating beds in hospital wards, estimating the size of a fleet of ambulances and other similar activities (Mital, 2010).

Improving patient flow is a major element in improving the efficiency of healthcare services. A good patient flow minimizes the patient's queuing time (Hall, 2006). In a queuing system, minimizing the waiting time of the customers (patients, in the case of healthcare) and maximizing the use of servers or resources (doctors, nurses, hospital beds, etc.) are complementary goals (Fomundam & Herrmann, 2007).

3.2.4 Simulation to improve the efficiency of clinics and waiting time

Among the approaches used in the healthcare systems to resolve problems in outpatient clinics is simulation. Simulation has become more popular recently (Clague et al., 1997; Huarng & Hou Lee, 1996; McGaghie, Issenberg, Petrusa, & Scalese, 2010;

Rau et al., 2013; Rohleder et al., 2011). Studying outpatient clinics by means of simulation is well documented within the operations research and healthcare literature.

Simulation has been used to support decision-making and to evaluate scheduling methods, principles of patients' waiting, assessments of effectiveness and efficiency, and the use of equipment (Cheng-Hua et al., 2006). In addition, it is used for process improvement or understanding bottlenecks in a system (Weerawat et al., 2013). It is also used to facilitate patient flow, and change human or service capacity (Chen et al., 2010; Günal & Pidd, 2010). It is the science of constructing and applying mathematical models to provide better strategies for planning and operating the system (Patrick & Puterman, 2008). The approach depends on the modelling, which provides alternatives for the prediction and comparison of outcomes on the way to evaluating potential decisions.

One of the advantages of simulation is that it can help forecast where the performance of an existing system can be evaluated when its operating conditions change, for instance in patient flow, human resources, or physical capacity, and investigating the complex relationship between such variables as patient arrival rate or patient service rate (Hall, 2006; Jun, Jacobson, & Swisher, 1999).

Many studies have adapted computer simulation to solve outpatient clinic problems and improve the quality of service delivery, aiming for an efficient and effective patient flow. This can be maintained by obtaining a high patient throughput with an acceptable rate of use of medical staff, shorter idle time for doctors, shorter patient waiting time, and low overtime for clinical staff (Hall, 2006; Jun et al., 1999). To achieve this objective, past studies have addressed the challenges of the outpatient clinic under three headings: scheduling, patient flow, and allocating resources (Van Sambeek, Cornelissen, Bakker, & Krabbendam, 2010).

Attempts to improve patient waiting time have mainly adjusted the appointments schedule. In the absence of an appointments system, in most healthcare institutions, the queue system works on the basis of first-in-first-out or depends on the priorities and level of emergencies and life-threatening injuries, as emergency departments do (Afrane & Appah, 2014). Rising, Baron, and Averill (1973) built a computer simulation model of an outpatient clinic. They compared appointment scheduling techniques to move the additional work to the shortest busy time of the day. A more generic system was developed by Clague et al. (1997) to improve clinic efficiency, on the basis of reliable data and using a computer program which simulated patient flow in the clinic. It examined the effects of clinic size, patient mix, consultation time, appointment scheduling and non-attendance. Su and Shih (2003) used an existing outpatient simulation model to examine the effect of a scheduling scheme on the waiting time. Harper and Gamlin (2003) developed and applied a simulation model of an ENT outpatient department in a UK hospital, which allowed the writers to examine different appointment schedules and their effects on the department. The proposed schedule dramatically reduced patients' waiting time with no additional resources. Carman (1990) studied the appointment systems in outpatients' clinics and the effect of patients' unpunctuality on doctors' idle time and made recommendations on doctors and patients' schedules. Reidenbach and Sandifer-Smallwood (1990) developed a simulation model to analyze the performance of a physiotherapy clinic in Brazil, which was applied to select an operational strategy (involving a patients' schedule and a number of staff) to optimize the patients' waiting time. Onwuzu, Ugwuja, and Adejoh (2011) analyzed the appointment scheduling system in an

Obstetrics/Gynecology Department in KSA, constructing a simulation model for the evaluation and optimization of scheduling rules and waiting times.

Below are some other studies that have addressed the scheduling of outpatient clinics using simulation (Table 3.1).

Table 3.1: Some studies of the scheduling of outpatient clinics

Author	**Type/Focus**
Fetter and Thompson (1966)	Doctors' punctuality
White and Pike (1964)	Patients' punctuality
Hill-Smith (1989), Rising et al. (1973)	Patients' arrival pattern
Harper and Gamlin (2003), Zhu et al. (2012)	Evenly distributed appointment slots
Bailey (1952),Bailey (1954), White and Pike (1964)	Unevenly distributed appointment slots
Klassen and Rohleder (1996), Cayirli, Veral, and Rosen (2006), White, Froehle, and Klassen (2011)	Scheduled patients with low service time variance
Chew (2011); Ho, Lau, and Li (1995)	Variable interval appointment rule
Yang, Lau, and Quek (1998), Huang, Hancock, and Herrin (2012)	Generalized appointment rule that works in most environments
Klassen and Rohleder (1996), Murray and Berwick (2003)	Urgent appointments

Broyles and Roche (2008) studied the queuing network in an outpatients' clinic and quantified the effects of the clinic's seating capacity on waiting time in Arizona and Colorado. Weerawat et al. (2013) used the Discrete-event simulation and Dynamic System to estimate the capacity of the system and the service level, quantifying the impact of the new initiatives on the outpatient department and the new site of the hospital. Bahadori, Mohammadnejhad, Ravangard, and Teymourzadeh (2014b) developed a simulation technique using queuing theory to optimize the management of a pharmacy in Iran. Raouf and Ben-Daya (1997) studied an outpatient clinic in Saudi

Arabia that aimed to provide quality healthcare to patients, minimizing patient waiting time and optimizing the number of physicians needed.

Below are some studies that have addressed the resources allocation in outpatient clinics using simulation (Table 3.2).

Table 3.2: Some studies of the allocation of resources in outpatient clinics

Author	Type/Focus
Iskander and Carter (1991)	Capacity of new facilities
Levy, Watford, and Owen (1989)	Effect of integrating different services or facilities
Romero et al. (2013)	Capacity of new services
Weng and Houshmand (1999), Jun et al. (1999); Swisher and Jacobson (2002)	Staff allocation
Rohleder et al. (2011), Santibáñez et al. (2009)	The pooling of resources

Côté (1999) examined the impact of examination room capacity on patient flow; to do so he developed a discrete-event simulation model of the physician's practice. Weng and Houshmand (1999) modeled an outpatient clinic with the objectives of maximizing patient throughput and reducing patient time in the system. They compared three resident staffing scenarios in terms of patient throughput, the total time in the system and cost. Hu (2013) used a simulation model to reduce patient waiting time in Arkansas. Aeenparast, Tabibi, Shahanaghi, and Aryanejhad (2013) used simulation to provide a model for reducing outpatient waiting time in the orthopedic clinic of a general teaching hospital in Tehran, Iran.

Below are listed some other studies that address the patient flow in outpatient clinics using simulation (Table 3.3).

Table 3.3: Some studies of the patient flow in outpatient clinics

Author	Type/Focus
Zhu et al. (2012); Chand et al. (2009); Rohleder et al. (2011)	Improving patient flow
Weerawat et al. (2013); Groothuis et al. (2002)	Changing patient flow in a new physical setting
Ramakrishnan et al. (2004); Weerawat et al. (2013)	Change of patient flow due to a new service

3.2.5 Simulation and the limitations of queueing theory

Computer simulation has emerged as a very powerful and effective tool for planning the use of resources in the service industries (Mital, 2010). Simulation is broadly used in healthcare, but an increasing number of researchers in many other fields are also using queuing theory because of its ease of calculation, few data requirements, ability to be presented in spreadsheets (Cochran & Roche, 2009) and more generic results than simulation (Fomundam & Herrmann, 2007). Queuing theory can be used to get approximate results and these can be refined using simulation models (Albin, Barrett, Ito, & Mueller, 1990).

According to Aeenparast et al. (2013), simulation is applied rarely to complex, integrated, and multi-facility systems. This is due to the complexity of the model, and the many resources needed (time and money). They report that most studies are either unit- or facility-specific, like the findings in our present review. Simulation is a reliable and accurate tool for decision making when planning and operating complicated systems. It is used to present the current situation according to information fed into the system. In addition it presents alternatives and possible solutions through modeling and simulating the system (Bahadori, Mohammadnejhad, Ravangard, & Teymourzadeh, 2014a).

Although queueing theory is a useful tool, it is useful only for simple system studies. In real life, these are not representative because they make unrealistic assumptions and over-simplify the system, which leads to inaccurate representation of the complexity of an outpatient clinic (Harper & Gamlin, 2003).

In healthcare organizations, the operations within each department are linked together; therefore when the organization needs to deal with a certain issue, not only the targeted department but the related departments have to be looked into and analyzed at the same time (Cheng-Hua et al., 2006). Mital (2010) explains why queuing analysis may not be the best approach to resolving issues of congestion and resource planning. It is because in healthcare there are many interacting queues; therefore, it is not valid to treat each queue individually. Combining queuing analysis and computer simulation might in this case be a better alternative. The queuing analysis will limit the number of possibilities, which then could be evaluated by the simulation. Applying simulation in healthcare lags behind manufacturing practices, due to the dynamic and complex nature of the healthcare system (Aeenparast et al., 2013). One of the attractive features of simulation modeling in the context of healthcare is its ability to model complex systems with different inputs, such as patient arrival rates, patient types, treatment types, and treatment times, which are all probabilistic. Simulation models can run experiments that take less time and money, make what-if analyses and compare options without interfering with daily operations.

3.2.6 Theory of constraints, lean manufacturing, six-sigma and simulation

Many of manufacturing process improvement techniques is being adopted by the service sector such as theory of constraints (TOC), lean manufacturing (developed by Toyota Motor Corporation), six-sigma (developed by Motorola Corporation) and simulation. All of the processes have similar motivation, which is the improvement of processes and service delivery and are being used to analyze and improve manufacturing processes to maximize the throughput or profit and to create efficiencies in the overall manufacturing process that resulted in a radical change in quality improvements and lower cost. Similar methods are valuable in healthcare system to deliver higher quality of care at a lower cost.

All the above methods and techniques are process improvement methodologies that aim to facilitate flow which their application has been successfully applied to the various demands of healthcare (Goldratt et al., 1994; Jones et al., 2006; Silvester et al., 2004), but they are rarely used together (Robinson et al., 2012). The core of lean philosophy is to continually improve a process by removing the non-value added activities, with the aim of optimizing the efficiency, quality, speed and cost (Holweg, 2007).

In the healthcare system constraints could be identified wherever patients are found in queues. While the TOC's objective is to increase the patients flow or throughput focusing on the main identified constraints in the system the lean thinking's objective is to reduce the flow time by reducing waste at every point in the entire system (Goldratt et al., 1994; Nave, 2002). Six-sigma on the other hand aims to reduce the variation to cut costs, improve processes and maximize production value.

In a complex system such as healthcare, there are always bottlenecks. The bottlenecks are evidence constraints which are in this case related to equipment, staff, or a policy which are stopping the process from functioning effectively. The location of the bottleneck in healthcare is not obvious, and a rigorous analysis is needed (Young et al., 2004). In healthcare systems, there is complex interaction of individual activities, and for efficient and effective system and interaction it is important to coordinate and balance the activities to identify those considered as constraints which constitute weak links and bottlenecks, and to take appropriate remedial action. In healthcare, the manufacturing improvement techniques perspectives are applicable aiming to resolve the bottlenecks, reduce the waiting time, improve the process and increase the throughput of patients which are the common challenges in the outpatient clinics worldwide and specifically in the case of this study. The cases in healthcare are complex and solutions cannot be implemented without solid evaluations due to the high cost and risk associated with the failure. One method to identify the impact of the recommended changes and realized the benefits is through computer simulation (Jun et al., 1999). Simulation has also been widely identified as a powerful technique for improving healthcare processes (Barjis, 2011). The literature dealing with the application of simulation in healthcare is still at an early stage, although it has shown its practicality and capability in the design and improvement of complex processes and systems in the manufacturing sector (Barjis, 2011; Mustafee, 2010) and the extent of simulation applications in healthcare processes is as yet uncertain (Simwita, 2016).

3.2.7 Studies that address both walk-in and by-appointment patients

Few studies have considered both the waiting time for by-appointment (scheduled) and walk-in patients; however Potisek et al. (2007) used a simulation model to study the different alternatives of these scheduling decisions on patients' throughput time and waiting time; they suggest a scheduling system which can be applied in any outpatient clinic with a mixed registration type of this kind, particularly where the percentage of walk-in patients is high. (Zhu et al., 2012) analyzed the appointment scheduling systems in specialist outpatient clinics but with a low percentage of walk-in patients to detect the factors causing long waiting times for patients and clinical staff overtime. Four improvement settings related to scheduling were suggested for these factors. Simulation and implementation results showed a significant reduction in patient waiting times/clinic overtime. (Jamjoom et al., 2014) analyzed the appointment scheduling system in an outpatient clinic at King Abdul-Aziz University Hospital in Saudi Arabia and constructed a simulation model to evaluate and optimize the scheduling rules and waiting times. They analyzed various appointment scenarios in comparison with the existing one to determine prioritization rules so as to give the system maximum throughput. A sensitivity analysis indicated that patient waiting time could be reduced without the need for extra resources by adjusting the distribution of patients in the scheduling system on the basis of their type (whether new, follow up, etc.).

3.3 System under study

The present system under study is that of a typical outpatient clinic, in this case one for orthopedic cases. The data have been provided by the hospital management representative of a public hospital in The Emirate of Abu Dhabi for a period of 6 months (July – Dec 2016) for all clinics. The data were rich and allowed us to estimate relevant parameters, such as arrival rates.

3.3.1 Problem formulation and scope

The hospital management had identified the Orthopedic Clinic as the most crowded and busiest clinic with the longest waiting times, and provided the relevant data. This, therefore, was the clinic chosen for study.

This outpatient clinic makes patient appointments for the whole hospital, including fractures, some spinal injuries, hand and wrist disorders, and some joint replacement patients. The clinic sees a variety of patients, comprising:

- New Patients
- Repeat patients returning for follow-up checks
- Walk-in Patients

Most patients visit the clinic several times during their orthopedic care. The clinic has an average monthly volume of 1416.17 visits with some variation in different months; see Table 3.4.

Table 3.4: Average number of patients served per month

Months	Number of Patients served
Jul-16	855
Aug-16	1493
Sep-16	1118
Oct-16	1790
Nov-16	1844
Dec-16	1399
Total	8499
Average Patients/month	1416.17

According to information from the management, the clinic is generally open from 8-12 noon and from 12:30 -16:30 pm every Sunday to Thursday and is closed on holidays. It was noted that the clinic generally works later than the management has specified: the latest hour we found in the data generated by the system was 8:18 pm. It was also noted that the clinic was open on some Saturdays. It is worth mentioning, too, that the clinic closed for some public holidays, such as the National Day. Over the period, some data were found to be missing.

Several meetings took place to review the patients flow map with the quality team, the head of the nursing unit and a nurse from the clinic in question. It was noted that several unnecessary activities are done by the patients; this was highlighted, discussed and agreed to be modified. This is an example of the application of the lean strategy to a clinic and the patient activities scale, which was aiming to provide more efficient processes by improving the patient flow and reduce their waiting time and movement through the clinic. To strengthen the validity, the patient flow and process as mapped were reviewed by the quality team member and the head of the nursing unit in addition to a nurse from the clinic under review.

3.3.2 Basic scenario

3.3.2.1 Staff/Resources

Every day 2-4 doctors work on the morning shift and 3-4 doctors work after the lunch-break. On 3 days out of 5, the clinic has 3 doctors scheduled on the morning shift, and on 4 out of 5 days 4 doctors are scheduled on the evening shift. While the doctors control the operations of the clinic, the following staff and resources are also key elements of the clinic's operations:

- 11 doctors in total (see Table 3.5). The number of doctors are counted per working shift
- 4 receptionists, who check patients in when they arrive and schedule appointments;
- 7 full time nurses
- 2 x-ray radiographers;

- Pharmacists: Total 3; 2 work on the morning shift and 3 on the afternoon/evening shift (Table 3.6). The following table shows the number of doctors scheduled per day.

Table 3.5: Number of doctors per day

Doctors	Sun		Mon		Tue		Wed		Thu	
	am	pm	am	pm	am	pm	am	pm	am	pm
Dr. 1	1	1		1			1	1		
Dr. 2	1	1				1	1	1		
Dr. 3				1	1	1			1	
Dr. 4			1	1			1		1	1
Dr. 5								1		
Dr. 6						1				
Dr. 7		1								
Dr. 8										1
Dr. 89			1		1	1	1	1		
Dr. 10										1
Dr. 11			1	1	1				1	1
Total/Day	2	3	3	4	3	4	4	4	3	4

Table 3.6: Full time employees

Full Time Employees	**No**
Physician	11
Ortho Reception	4
Nursing	7
Radiographer	2
Pharmacists	3

3.3.2.2 Operations

Patients are assigned to see particular doctors, who decide on the overall strategy for scheduling their patients. The receptionists do the work of producing the schedules, on the basis of a combination of patient availability and doctors' preferred strategy.

Daily volumes at the clinic typically vary between 56 and 74 patients per doctor. A proportion of patients “walk in” to the clinic without a pre-scheduled appointment time, since any patient may choose to come to the clinic for an emergency visit without previous notice. If the patients have visited the clinic in the past, all reasonable efforts are made to accommodate them. If this is their first visit to the clinic, then the receptionist checks the schedule of the clinic/doctors and asks the nurses to check the status of the patient before asking the doctor to let the patient join the queue for admission.

Patients’ flow through the clinic depends on the seriousness of the cases; it is not uncommon for a patient to see the same resource more than once during a visit to the clinic, see Figure 3.1.

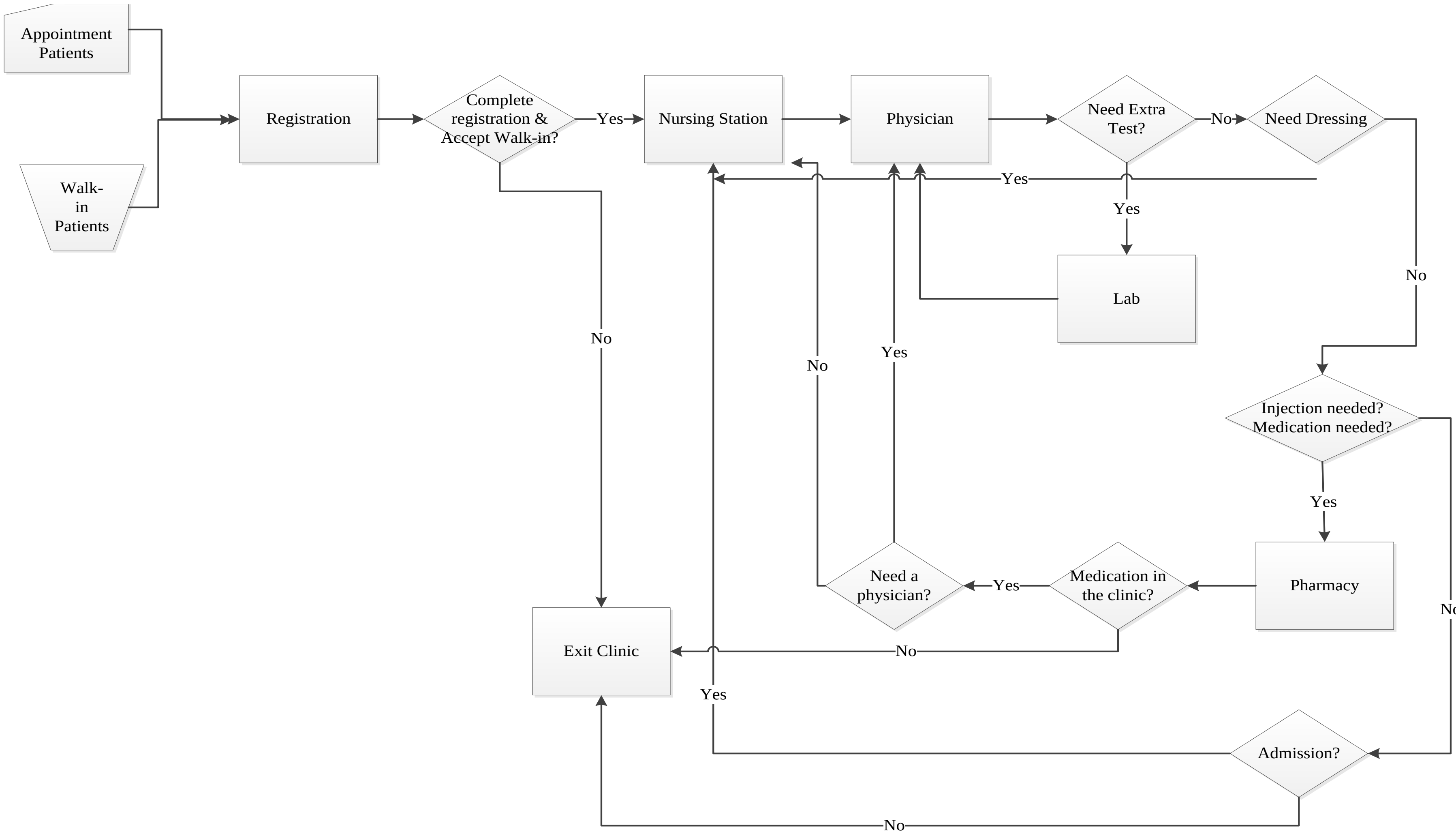

Figure 3.1: Modified version of the flow of patients at the Orthopedic Clinic

The by-appointment patients are those whose appointment as a follow-up patient, a new patient, or a patient by referral was arranged earlier. The walk-in patients come without an appointment; they might be new patients or for follow-up. Both types of patient on arrival go through a registration process. The follow-up patients complete their registration and move to the next service station, where they are called by nurses who check for vital signs, make initial assessments and provide documentation. When walk-in patients arrive at the registration station the receptionist who is responsible checks with the nurses whether they can be accepted (this depends on their condition and the doctors' schedule. If accepted, they go through the registration process and move on to the next station. If they cannot be accepted, then they are scheduled for an appointment in the near future. After the vital signs are recorded and case is initially assessed and documented, patients wait to be called for consultation with a doctor, whom they see in the presence of a nurse. Cases may need such actions as lab tests (x-rays and blood tests), dressings, injections (which they must buy from the hospital pharmacy) or admission to an inpatient ward. Sometimes patients need not come back to see a doctor, for example, those who need dressings or admission; these are then put in the charge of nurses. In other cases, such as patients who require x-rays, blood tests, or injections, they afterwards return to the nurses and inform them that the tests/procedures have been completed, before waiting to see a doctor. Such patients are given priority to see the doctor before any of the newly arrived patients. Some of the patients who have had x-rays or blood tests need to be admitted; then the nurses take care of their completing all the necessary actions and coordinate their admission to the inpatients' wards. When patients return from the hospital pharmacy they must wait till they are called to the treatment room where a doctor and a nurse give them the injection they have purchased. Before leaving the clinic, the patients who see a doctor and need no further procedure; or who need further treatment or a further procedure and have come back to see a doctor; or who need an injection and come back to see the doctor may need to go to the reception desk to make a follow-up appointment or go to the pharmacy to buy medication.

3.3.2.3 Performance indicators

In order to compare the different scenarios it is important to identify the indicators that measure the results. We identify the following indicators for measuring the efficacy of the various system configurations:

1. The number of resources: doctors, nurses, lab technicians, pharmacists, and receptionists)
2. The use of the resources
3. The waiting time in the clinic
4. The total time spent in the clinic
5. The total number of patients seen

3.4 Methodology and objectives

3.4.1 Methodology

Discrete event simulation has been shown to be a powerful and flexible modelling approach, which is characterized by its ability to replicate the complex behavior and interaction between individuals in an identified environment (Karnon, 2012). The discrete simulation model is normally used in an environment where people queue for resources and there is a problem of resource constraints and interaction between individuals and resources. Discrete event simulation and healthcare processes have the same characteristics: the processes in healthcare organizations are similarly very complex and characterized by resource constraints, with queues for resources and services and interactions between patients and healthcare resources. Therefore, discrete event simulation is considered suitable for this study, in addition to its capacity to identify bottlenecks and resource adjustments without disturbing the actual system. Considering the complexity in the healthcare system and its processes, the discrete event simulation model seems to be a promising tool for helping to formulate improvement strategies by testing and running scenarios before they are implemented. In the complex healthcare system, it would be costly to implement new models or modifications before testing their impact on healthcare delivery.

3.4.2 Objectives

In this research project, we study the patient flow as presented in Figure 3.1. We develop a simulation model and conduct a simulation study to:

1. Determine the effect of patients' delayed arrivals on the system's performance.
2. Determine the effect of the number of resources on the system's performance.
3. Provide insights into how the waiting times can be made more tolerable.

Addressing these objectives will allow us to provide insights for the hospital/clinic management on ways of setting resources and the effect these will have on the overall system performance in an outpatient clinic; it will also give them some an insight into the effects of delayed arrivals on waiting times so that they can implement suitable alternatives to the present arrangements.

3.5 Input Data

The rich data provided by the hospital management contain data of all the patients who visited the hospital from July 2016 until December 2016. It has in total 168,361 items.

The data contained the following information:

- Location of the facility where the patient appointment was scheduled,
- The nurse unit or the ambulatory location where the patient was registered,
- The patients' Medical Record Numbers,
- The Visit Number of the patient uniquely defined within the organization,
- Nationality of the patient,
- Date and time of the appointment,
- The check-in date, the date and time when the patient was registered and then checked at the registration desk,
- The 'patient seen date/time' which is the date and time stamped by the physician on opening the patient chart,
- The appointment type, either new or follow-up,
- The appointment status – short – which is the appointment status, either Checked In or Checked Out,
- The appointment starting week number, which is the number of weeks from the beginning of the year in which the appointment is scheduled,
- Waiting time, which is the difference between the checked-in date and the patient-seen date,
- Waiting time range which is a pre-defined time interval for measuring waiting time,
- Walk-in, which indicates if the patient walked in without a scheduled appointment,
- Vital signs date/time, which is the date and time of first documenting the vital signs of the patient,
- Vital signs waiting time, which is the difference between the date that a patient was checked in and documentation of the vital signs,

- Vital signs-waiting time range, which is a pre-defined time interval for measuring waiting time,
- Waiting time vital signs – patient seen, which is the difference between the vital signs documentation and date that the patient was seen,
- Waiting time range vital signs – patient seen, which is a pre-defined time interval for measuring waiting time.

First, we cleaned the data and then analyzed the data provided for all the hospital clinics on the following three variables among the waiting times:

1) Waiting time from being checked-in to the case and vital signs documenting,

2) Waiting time from vital signs and case documentation to patient's being seen by the doctor, and

3) Waiting time from the check-in to patient's being seen by the doctor.

We focused on the orthopedic clinic with an overview of the clinic, its resources, operation and process and the classification of patients' visits. Then we analyzed the waiting time by the classes of visits to it, analyzed the patients' scheduled appointments and checked the earliness and lateness of checking-in against appointment times, the appointment times vs. the time when the doctors saw the patients, and the earliness of the doctors' examination compared with the compared with the appointment time, the lateness of the doctors' examination than the appointment time, the waiting time from check-in to vital signs, and the check-in time vs. the time when the doctors examined the patients. The analysis included the derivation of the arrival distribution, service time distribution and the parameter estimation.

Then we started the simulation modelling process building a simplified generic simulation model using Arena Software, with the objective of seeing how capacity building (the number of servers in the system) and patients' delay in the arrival process (not arriving on time) affected the patients' waiting time.

3.5.1 Data cleaning

The purpose of data cleaning is to detect and remove errors and inconsistencies in the data set that are due to incomplete, inaccurate or irrelevant data. Incorrect or inconsistent data can create a number of problems which lead to the drawing of false conclusions.

As part of the data cleaning process, we removed all data on:

1. Patients who came days before or after their appointment.
2. Waiting times which were longer than 8 hours.

We checked whether the appointment day was the same as the registration day. We found that, out of 168,361 visits, 84 came before their appointment days, 167,990 visits were on the same day as the appointment and 287 visits were after the appointment date. Table 3.7 shows average waiting time for all clinics (before data cleaning).

Table 3.7: Average waiting time for all clinics (before data cleaning)

Waiting Time (WT)	Average WT for all clinics (minutes)	
From Check-in to vital signs and documentation	7.48	
From check-in to Patient being Seen by doctor	37.21	
From Vital signs and documentation to Patient Seen	-59.30	The negative sign shows that the vital signs were registered after the patients had seen the doctor
Registered vital signs after doctor's examination	-232.82	40,286 vital sign documentations took place after a doctor had seen the patient
Registered vital signs before doctor's examination	45.82	66,649 vital sign documentations took place before a doctor had seen the patient

The next step of data cleaning was taken after noticing that the maximum waiting times were shown in thousands of minutes, which meant days of waiting (though no wait should last more than 8 hours); see Table 3.8. We decided also to clean the data and to keep around eight hours of waiting (= 480 minutes) and as 499 minutes the maximum; see Table 3.9.

Table 3.8: Initial analysis before data cleaning

	WT from Check-in to vital signs Documentation	WT from check-in to Patient being Seen by doctors	WT from vital signs to Patient being Seen by doctors
Count	99923	145091	61036
Min (min)	1	1	1
Max (min)	9716	9992	7440
Average (mm)	18.98	33.29	29.68

Table 3.9: Initial analysis after data cleaning

	WT from Check-in to vital signs Documentation	WT from check-in to Patient being Seen by doctors	WT from vital signs to Patient being Seen by doctors
Count	60172	113298	53292
Min (min)	1	0	1
Max (min)	260	499	263
Average (min)	13.54	31.09	20.03
St. Deviation	13.10	34.54	17.52
Median	10	22	15

3.5.2 Waiting time distributions and analysis

3.5.2.1 Waiting time from checked-in to vital signs and documentation

The number of checked-in patients who fit the criteria set after cleaning the data and had the required records was 60,172. We found that the maximum waiting time from checking-in to Vital signs documentation was 260 minutes (more than 4 hours), with an average waiting time of 13.5 minutes (see Table 3.10 and Figure 3.2).

Table 3.10: Summary of waiting time from check-in to vital signs documentation for all clinics

Count (n)	60,172
Min (in minutes)	1
Max (in minutes)	260
Average (in minutes)	13.5
St. Deviation	13.104
Median	10

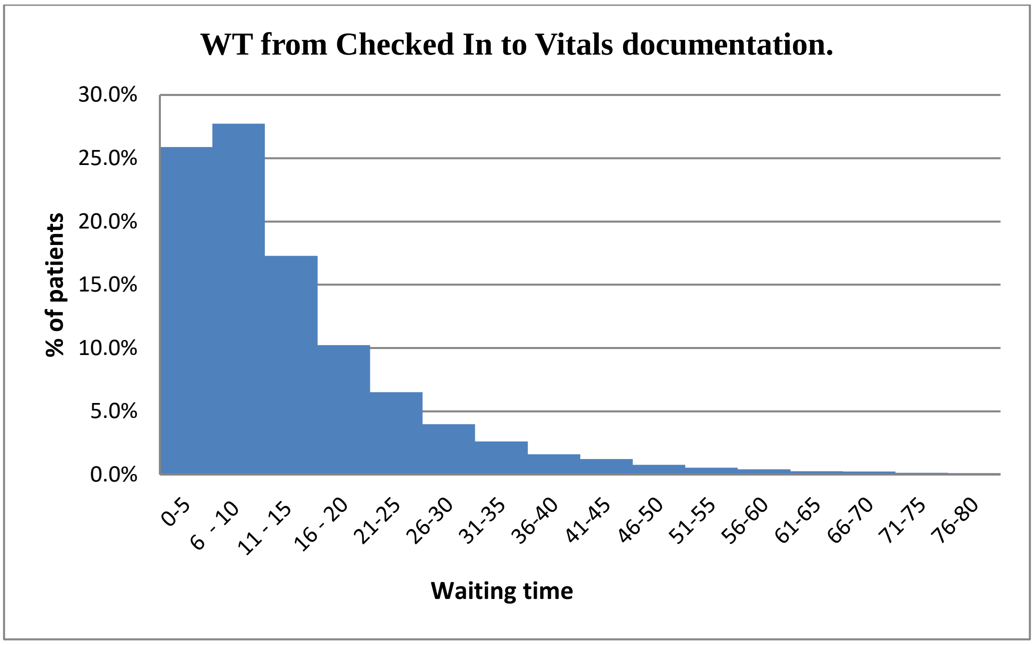

Figure 3.2: Histogram of waiting time distribution from check-in to vital signs documentation for all clinics

3.5.2.2 Waiting time from checked-in to patient seen by doctor

The number of checked-in patients who fit the criteria set after cleaning the data and had the required records was 113,298. We found that the maximum waiting time from checking-in to Patient being seen by Physician was 499 minutes (around 8 hours), with an average waiting time of 31.1 minutes (see Table 3.11). Plotting the data shows that the data follow an exponential distribution (see Figure 3.3).

Table 3.11: Summary of WT from check-in to patient seen by doctor for all clinics

Count (n)	113,298
Min (in minutes)	0
Max (in minutes)	499
Average (in minutes)	31.1
St. Deviation	34.546
Median	22

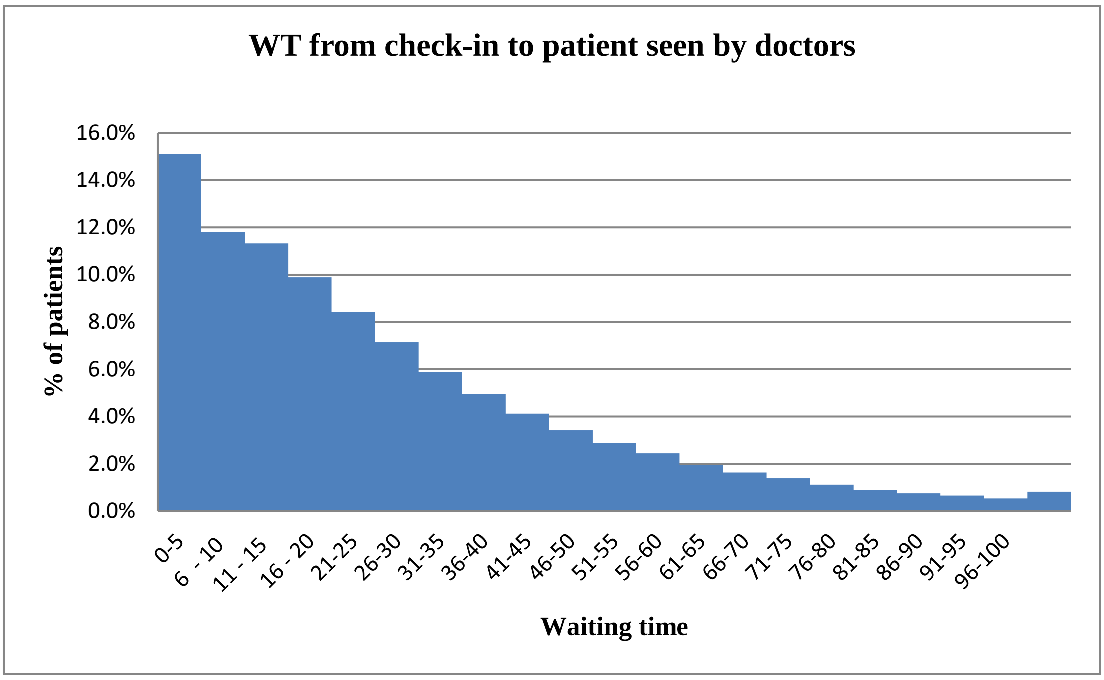

Figure 3.3: Histogram of waiting time distribution from check-in to patient being seen by doctor for all clinics

3.5.2.3 Waiting time from vital signs documentation to patient being seen by doctor

The number of patients' records that meet the criteria set after cleaning the data and had the required records was 53,292. We found that the maximum waiting time from vital signs documentation to the patient's being seen by a doctor was 263 minutes (around 4 hours), with an average waiting time of 20 minutes (see Table 3.12). Plotting the data shows that they follow an exponential distribution (see Figure 3.4).

Table 3.12: Summary of WT from vital signs documentation to patient seen by doctor for all clinics

Count (n)	53,292
Min (in minutes)	1
Max (in minutes)	263
Average (in minutes)	20
St. Deviation	17.52643
Median	15

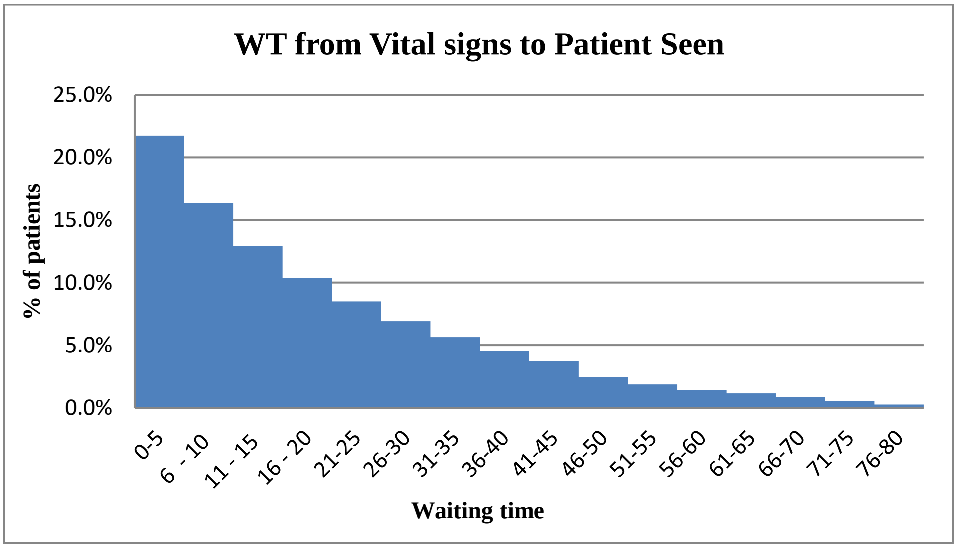

Figure 3.4: Summary of WT from vital signs documentation to patient being seen by a doctor for all clinics

3.5.2.4 Classification of patient's visits to the outpatient clinic under study

Out of 8,499 patients' records in the orthopedic clinic, 6,133 (72.16%) patients had a follow-up appointment, while 2,039 (23.99%) patients were visiting the clinic for the first time or had a new appointment, and 327 (3.85%) visits were unclassified in this respect. (see Table 3.13 and Figure 3.5). Out of 8,174 patients (follow-up and new), the records showed that 710 patients, both follow-up and new, had walked in with no previous appointment but there are records of 561-566 patients only, some of the data entered for them being incomplete.

Table 3.13: Classification of visit

	Frequency	Percent
Follow Up	6133	72.16%
New	2039	23.99%
Not Entered	327	3.85%
Total	8499	100%

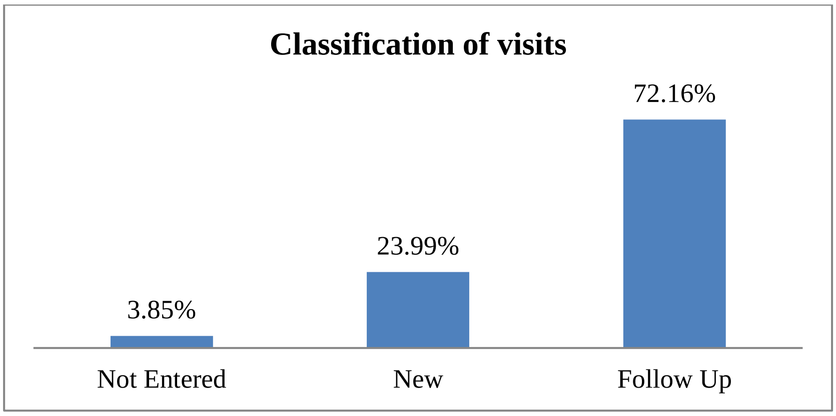

Figure 3.5: Classification of visit

A goodness of fit test using the Arena input analyzer was conducted showing that the exponential distribution was a good fit for the inter-arrivals of the patients. The fit of the arrival behavior of patients (earliness and lateness against their appointment time) was found to be the normal distribution. The best fit for the data distribution for the waiting time for vital signs and documentation was found to be Beta, and the best fit for the data distribution for the time that it took for patients to be seen by doctors was found to be Gamma. (refer to Appendix 3.2).

3.5.2.5 Earliness and Lateness of check-in against appointment time

Here we check if the patients came to their appointments on time, or before or after it. It was found that 47.42% of the patients checked in on average 24.83 minutes before their appointment, and 50.07% of the patients checked in later than their appointment by an average of 12.29 minutes. The remaining 2.51% checked-in at their appointment time (see Table 3.14).

Table 3.14: Patient's checked-in time vs. appointment time

	Checked in before appointment time (Earliness)	Checked-in at appointment time	Checked in after appointment time (Lateness)
% of 8673	47.42%	2.51%	50.07%
No. of patients	4029	213	4254
Max	-1.00	0	373.00
Min	-432.00	0	1.00
Average	-24.83	0	12.29
median	-15.00		4.00
St. deviation	33.66		24.45

Further analysis was conducted to understand better the earliness and lateness of patients' checking-in time compared to their appointment time. Regarding the patients who checked in earlier than their appointment time, four categories were identified, with a range size of 30 for each category: 30 minutes before their appointment, 31-60 minutes, 61-90 minutes and more than 90 minutes. It was also found that 1 patient had checked in one day before the appointment. It was found that out of the 47.42% of the patients who checked in before their appointment time, 36.13% checked in less than 30 minutes before, the average time being 12.44 minutes, 7.62% checked-in between 31 and 60 minutes before their appointment with an average time of 41.52 minutes, 1.88% checked in 61 - 90 minutes before their appointment with an average of 73.02 minutes, and 1.73% checked-in more than 90 minutes before their appointment with an average of 154.99 minutes; see Table 3.15). It was also found that of the 31 patients, representing 20.67%, of the 150 patients who checked in more than 90 minutes earlier than their appointment, 1.73% checked in >200 minutes earlier than their appointment.

Table 3.15: Patients checking in before their appointment (Earliness)

	Before 30 minutes from Appointment	Before (31-60 minutes) from Appointment	Before (61 - 90 minutes) from Appointment	Before (>90 minutes) from Appointment	Total
%	36.13%	7.62%	1.92%	1.75%	47.42%
no. of patients	3070	647	163	149	4028
Min	-30	-60	-90	-432	-432
Max	-1	-31	-61	-91	-1
Average	-12.44	-41.52	-73.02	-154.99	-24.83
Median	-11	-40	-73	-128	-15.00
St. Deviation	8.04	8.20	8.62	71.48	33.66

Of the patients who checked in late, four categories were identified, with a range size of 30 for each category, namely, more than 30 minutes late for the appointment, 31-60 minutes, 61-90 minutes and more than 90 minutes. It was also found that 1 patient had checked in one day after the appointment. It was found that out of the 50.07% of the patients who checked in after their appointment time, 45.92% checked-in within 30 minutes from the time of their appointment, on average 6.98 minutes after it; 2.55% checked in from 31-60 minutes of their appointment, on average 41.27minutes late; 2.78% checked in between 61 and 90 minutes from their appointment, on average 75.08 minutes late; and 0.89% checked-in up to 90 minutes late for their appointment, on average 152.68 minutes late; 13 of the 76 patients who checked in more than 90 minutes after their appointment time (17.11%) were found to have checked in more than 200 minutes later than they were due (see Table 3.16).

Table 3.16: Patients checking in after their appointment time (Lateness)

Time of checking in	Up to 30 minutes after appointment	31-60 minutes after appointment	61 - 90 minutes) after appointment	More than 90 minutes) after appointment	Checked in more than 24 hours later	Total
%	45.92%	2.55%	2.78%	0.89%		50.07%
no. of patients	3901	217	236	76	1	4254.00
Min (min)	1	31	61	91		373.00
Max (min)	30	60	90	373		1.00
Average (min)	6.98	41.27	75.08	152.68		12.29
Median	4	39	76	124		4.00
St. Deviation	6.89	8.54	9.13	64.18		24.45

Because most patients (>97%) checked in between one hour earlier and one hour later than their appointment, we limited our distribution of checking in behavior against the appointment time to start from -58 minutes and extend to 62 minutes; see Figure 3.6.

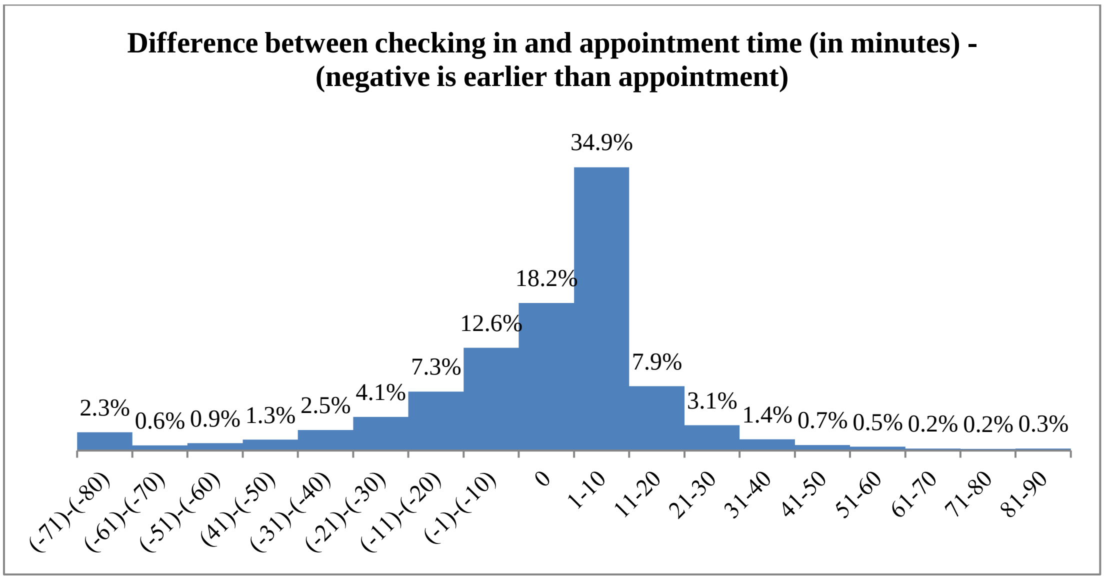

Figure 3.6: Distribution of checking in earliness and lateness against the appointment time

3.5.2.6 Appointment time vs. time seen by doctors

It was noted that 14.89% of the patients were seen by the doctor on average 30.86 minutes before the appointed time and that 84.24% were seen on average 40.96 minutes after the appointed time. Only 0.81% were seen by the physician at the due time (see Table 3.17 and Figure 3.7).

Table 3.17: Appointment time vs. time seen by a doctor

	Patients seen before their appointment time (Earliness)	Patients seen at the exact appointment time	Patients seen after their appointment time (Lateness)
%	14.89%	0.81%	84.24%
no. of patients	1217.00	66	6883
Min (min)	-408	0	1
Max (min)	-1	0	429
Average (min)	-30.86	0	40.96
Median	-15		29
St. Dev	44.96		40.63

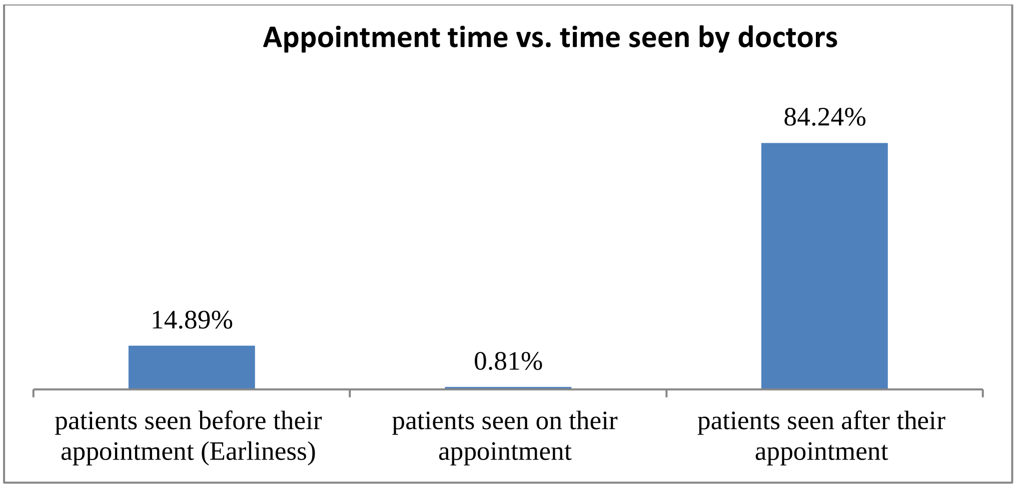

Figure 3.7: Percentage of patients seen before/at/after their appointment time

3.5.2.7 Waiting Time from checking in to vital signs

From the results of the time that patients had to wait from first checking in to their first interaction with the medical staff at the vital signs check, it was found that

61.23% of the patients had their vital signs checked 1-15 minutes after their check-in, the average waiting time being 7.63 minutes. 22.03% of the patients had their vital signs checked 16-30 minutes after their check-in time, on average 21.75 minutes after. So a substantial majority, 83.24% of the patients, had their vital signs checked within 30 minutes of their first checking in. 10.7% of the patients had to wait from 31-60 minutes for their vital signs to be checked. It was also noted from the results that some patients had to wait for more than 60 minutes before their vital signs were checked, on average for 94.02 minutes (see Table 3.18, Figure 3.8 and Figure 3.9).

Table 3.18: Waiting time from checking-in to checking vital signs

	Vital signs before check-in	Check-in time = vital time	in 1-15 minutes	in 16-30 minutes	in 31-45 minutes	in 46-60 minutes	in >60 minutes	Total
%	1.75%	0.49%	61.23%	22.03%	7.74%	2.96%	3.80%	100%
no. of patients	119	33	4159	1496	526	201	260	6792
Min (min)	-483	0	1	16	31	46	61	-419
Max (min)	-1	0	15	30	45	60	478	353
Average (min)	-60.46	0	7.63	21.75	41.08	52.17	94.02	16.40
Median	-31		7	21	39	51	78	11
St. Deviation	88.8371		3.85	4.21	8.09	4.28	49.45	25.22
missing data	1705							

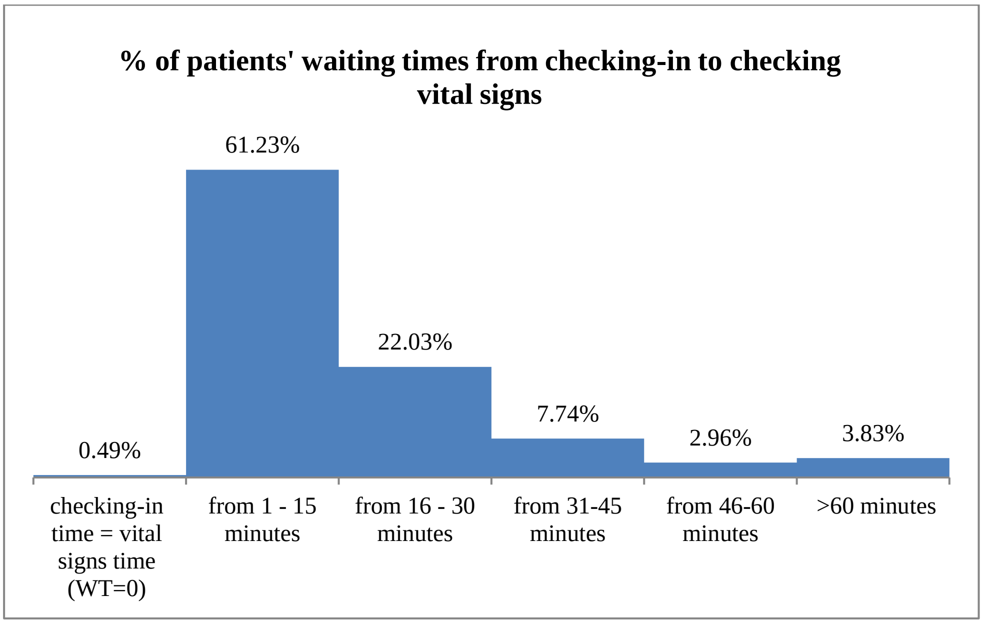

Figure 3.8: Percentage of Patients' delays from checking-in to checking vital signs

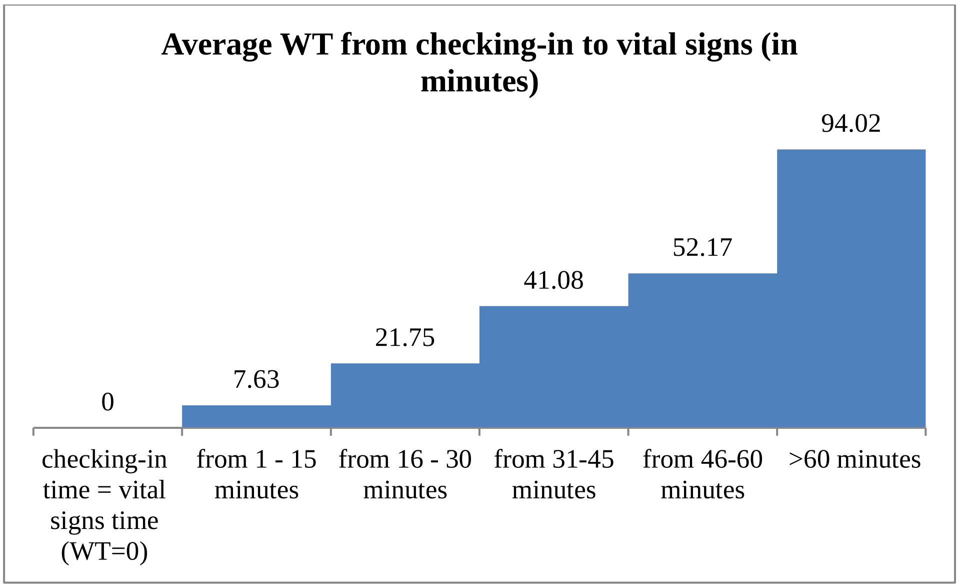

Figure 3.9: Average WT from checking-in to checking vital signs (in minutes)

3.5.2.8 Checking-in time vs. the time when seen by a doctor

To improve understanding of the length of time that patients had to wait after they checked in, we calculated the delays in four categories, ≤ 30 minutes, ≥ 31-60 minutes, ≥ 61-90 minutes and > 90 minutes. It was found that 56.70% was seen by a physician within 30 minutes from their initial check-in, on average 13.94 minutes. 24.71% was seen by a physician between 31 and 60 minutes after their check-in, on average 43.11 minutes. 9.77% was seen by a physician within 61-90 minutes of their check-in, with an average waiting time of 73.18 minutes. A further 7.66% of the patients had to wait for more than 90 minutes after their check-in, on average 136.27 minutes (Table 3.19 and Figure 3.10).

Table 3.19: Patients' check-in time vs. the time taken to see a doctor

	seen within 30 minutes of their check-in	seen 31-60 minutes after their check-in	seen 61-90 minutes after their check-in	seen >90 minutes after their heck-in	Total
%	56.70%	24.71%	9.77%	7.64%	98.7%
no. of patients	4626	2016	797	623	8062
Min (min)	1	31	61	91	1.00
Max (min)	30	60	90	450	450.00
Average (min)	13.94	43.11	73.18	135.02	36.45
Median	13	42	72	119	25.00
ST. Deviation	8.418	8.446	8.599	50.879	38.10

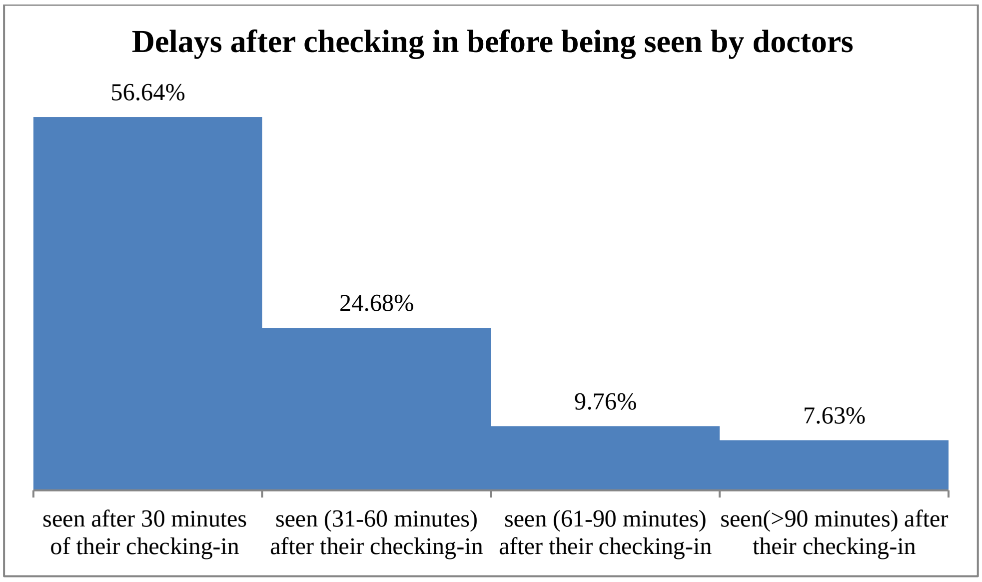

Figure 3.10: Delays after checking in before being seen by doctors

We cleaned the data provided from the period from June to December 2016 and calculated the waiting times from checking-in to checking the vital signs and the waiting times from checking in to being seen by the physician. We removed all the waiting times of ≥ 450 minutes, which equals 7.5 hours and data < 0 minutes (see Table 3.20, Figure 3.11 and Figure 3.12 and Appendix 3.2.3 and 3.2.4).

Table 3.20: Patients' waiting time in the Outpatient Clinic

	WT from check-in to vital signs	WT from vital signs to being seen by doctor
Count	5123	5136
Min (min)	1	1
Max (min)	188	391
Average (min)	14.99	27.17
Median	10	18
St. Dev	15.88282	30.96802

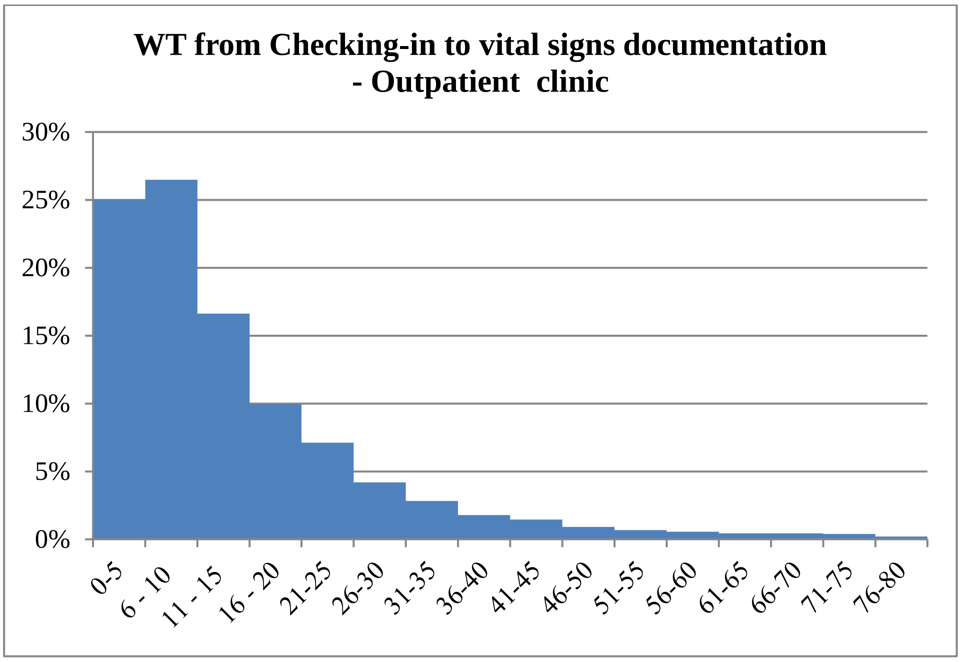

Figure 3.11: Waiting time distribution from patients' checking-in to checking vital signs

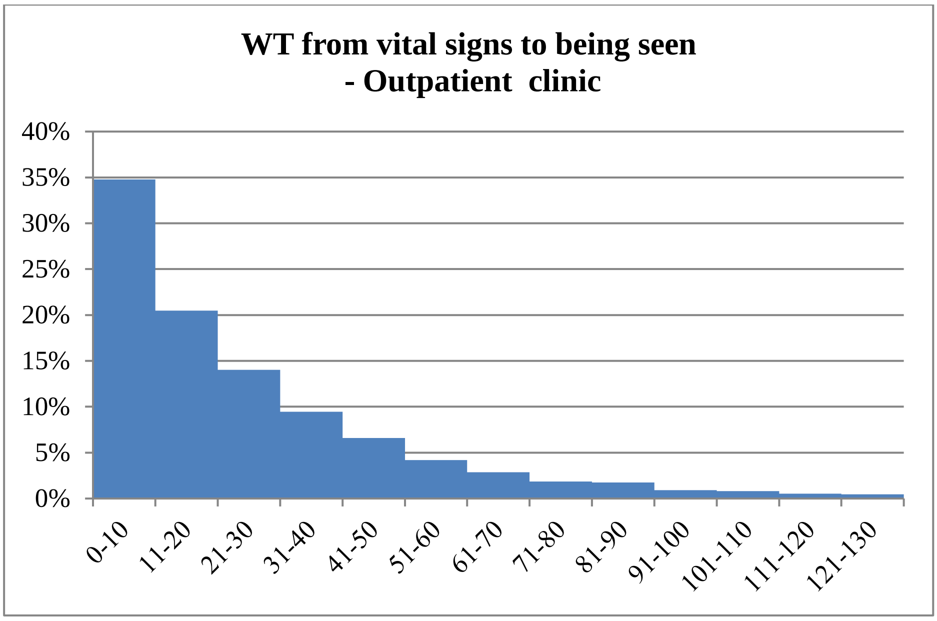

Figure 3.12: Waiting time from checking vital signs to patients being seen by a doctor

3.6 Simulation study

This chapter describes the steps taken in the simulation study for analyzing and comparing the effects of the number of resources.

3.6.1 Simulation model construction

We developed our simulation model using version 15.00.00004 of Arena (Rockwell Automation). Arena is a widely-used example of DES software. It consists of a module template, which uses a process view where an entity is created and pushed into the system following an already created flowchart.

The simulation model was designed to represent the operation of the orthopedic clinic. Its parameters, for instance, the arrivals rate, number of resources, the duration of each shift, service time, proportion of patient types (appointment or walk-in), and percentage of patients requiring additional testing/procedures, can all be changed easily.

The simulation model measures the following variables:

- Average waiting time for patients with appointments: time spent in waiting to be called and excluding service time.
- Average waiting time for walk-in patients.
- Average total time in clinic for patients with appointments; length of time between a patient's entering the registration process and leaving the outpatient department (OPD).
- Average total time in clinic for walk-in patients.
- Percentage of time used by doctors for examining patients.
- Percentage of time used by nurses for attending to patients.
- Percentage of lab technicians' time used for patients.
- Percentage of pharmacists' time used for patients.
- Percentage of receptionists' time used for patients.
- Average time spent in queueing for registration.
- Average time spent in queueing for vital signs measurements and documentation.
- Average time spent in queueing for a doctor's consultation.
- Average time spent in queueing for lab tests.
- Average time spent in queueing for the pharmacy.

The process of developing a simulation model shed light on the actual process flow and the quantitative data required from the system in practice. These were supplied from the data provided to us by the representative of the Quality team, as described earlier.

3.6.2 Assumptions

- The service time; see Table 3.21.
- The ratio of patients who needed extra procedures, such as blood transfusions, or x-ray tests, injections or dressings, was estimated, since details of this type were not included in the data generated from the system; see Table 3.22.

Table 3.21: Assumptions of average service times

Service Time (minutes)		Min	Mode	Max
Registration	Appointment	2	3	4
	Walk in	3	4	6
vital signs & documentation		15	20	25
Consultancy	Status 1	15	20	30
	Status 2	10	15	20
	Status 3	2	3	4
STAT/Lab		10	20	40
Dressing		10	20	30
Admission		45	80	120
Pharmacy		5	10	15

Table 3.22: Assumptions of the percentage of patients requiring different procedures

	Type of Patient	Percentage
Follow Up Patients		70%
Additional Procedures	Follow UP	20%
	NEW	80%
Medication Required	Follow UP	50%
	NEW	90%
Additional Tests	Follow UP	30%
	NEW	80%
Dressing	Follow UP	70%
	NEW	80%
Admission	Follow UP	2%
	NEW	1%

3.6.3 Sensitivity study design

We considered three scenarios in our simulation study: no delay, reasonably long delay, and long delay. In the first scenario, we assumed that there was no delay and that all patients came exactly on time. The second scenario fits the observations in practice, when patients' arrivals were delayed for 0 minutes (minimum), 4 (average) and 45 (maximum). The third scenario fits the observations when the delays are longer: 0 minutes (minimum), 8 (average) and 90 (maximum). We analyzed and compared the effect of different allocations of resources and the effect of late arrivals on the waiting time. Thus the design of this experiment was basically to use different settings of delay, as in the three above scenarios, and to change the number of resources one by one by increasing and/or decreasing them. The resources in this experimental study were the doctors, nurses, lab technicians, pharmacists, and receptionists. In summary, then, the two factors that we varied in this experiment were delays and human resources. (See Table 3.23)

Table 3.23: Sensitivity study design framework

Type of resources	Delay setting (min, avrg, max)	Number of resources	Parameter of the system under study
Doctors	(0,0,0)	1,2,3,4,5,6,7,8,9,10,11	1. Percentage of patients served 2. Total time spent in the clinic 3. Waiting time in the clinic 4. Waiting time for processes related to the resources 5. Utilization of the doctors
	(0,4,45)	1,2,3,4,5,6,7,8,9,10,11	
	(0,8,90)	1,2,3,4,5,6,7,8,9,10,11	
Nurses	(0,0,0)	4,5,6,7,8,9,10,25	1. Percentage of patients served 2. Total time spent in the clinic 3. Waiting time in the clinic 4. Waiting time at related processes to the resource 5. Utilization of the nurses
	(0,4,45)	4,5,6,7,8,9,10,25	
	(0,8,90)	4,5,6,7,8,9,10,25	
Lab technicians	(0,0,0)	2,3,4,5	1. Percentage of patients served 2. Total time spent in the clinic 3. Waiting time in the clinic 4. Waiting time at related processes to the resource 5. Utilization of the lab technicians
	(0,4,45)	2,3,4,5	
	(0,8,90)	2,3,4,5	
Pharmacists	(0,0,0)	1,2,3	1. Percentage of patients served 2. Total time spent in the clinic 3. Waiting time in the clinic 4. Waiting time at related processes to the resource 5. Utilization of the pharmacists
	(0,4,45)	1,2,3	
	(0,8,90)	1,2,3	
Receptionists	(0,0,0)	1,2,3,4	1. Percentage of patients served 2. Total time spent in the clinic 3. Waiting time in the clinic 4. Waiting time at related processes to the resource 5. Utilization of the receptionists
	(0,4,45)	1,2,3,4	
	(0,8,90)	1,2,3,4	

3.6.4 Verification and validation of the simulation model

Verification is a major step in simulation modeling; it is taken to ensure that the model is correctly translated into a working simulation program. This was achieved using Arena animation to ensure that the model was running without errors. In addition, a simulation expert helped in this stage.

In order to ensure that the outcomes of a simulation model are sufficiently accurate, the model must be verified and validated. The verification of the model is the process of ensuring that the model design has been translated into a computer model with great fidelity and that the simulation model is built properly. The validation of the model, meanwhile, is the process of ensuring that the model is sufficiently accurate for the purpose in hand; in other words, it is the overall process of comparing the model and its behavior to the system itself (Robinson, 1997).

The model was verified gradually while developing the process in the simulation model. In each extension of the model with new procedures we made sure that the simulation model represented the process that was being mapped. The model was verified by checking the animated version of the simulation model and debugging it whenever necessary.

To validate the outcomes of the simulation model, we used the waiting time from check-in to the vital signs and case documentation and the waiting time from the vital signs and case documentation to the patients' being seen by the doctor. Then we compared these with the data in practice.

Using the default delays of 0, 4, and 45 minutes and the number of nurses, doctors, receptionists, pharmacists and lab-technicians, we found the following (see Table 3.24).

Table 3.24: Comparison between the average waiting time of the simulation model and that of the database in minutes

	Simulation Average	Actual Average
Waiting Time from Registration to vital signs and documentation	13.48	14.99
Waiting Time for Consultancy Services	33.96	27.17

As discussed earlier, the consultancy process might be repeated more than once, though this was not included in the data. Therefore, the waiting time for the consultancy process in the simulation model is not equal to the waiting time recorded in the data. Therefore, a slight difference between the two values is predictable. We conclude that our simulation model accurately represents the situation in the clinic.

3.6.5 Simulation results

In this section, we first present the analysis of the existing Base Scenario derived from the Orthopedic Clinic. Then we present the configurations which we analyzed and compare them. We also present the outcomes of the experimental simulation design. In this study, the software used was Arena, the run length of the simulation model is one day, the number of replications is 500, and the run time is approximately 1:23:47 minutes on an Intel ® Processor 5Y70 CPU @ 1.10GHz 1.30 GHz, with 8.00 GB installed memory, 64-bit operating system x 64-based processor

3.6.5.1 Results of the Base Scenario – simulation output

As noted above, the objective of this research is to describe how the capacity of the human resources (number of servers in the system) and patients' delay in the arrival process (not arriving on time) affect all the patients' waiting times and satisfaction. Therefore, we ran the simulation model using the assumptions of the data provided in section 3.6.2.

The outputs of the simulation showed that the average time spent in the clinic was 153.34 minutes for by-appointment patients and 124.78 minutes for walk-in patients, while the average waiting time for by-appointment patients was 65.69 minutes and for walk-in patients was 51.14 minutes. Patients spent about 47.04% of their waiting time in a queue waiting to be seen by the doctors/physicians, 23.37% in a queue for a dressing procedure, and 18.67% waiting for their vital signs to be checked and documented. The remaining average percentages of waiting time were spent waiting for the STAT process (5.55%), Admission process (5.20%), pharmacy (0.16%), and no time (0.00%) on the registration process (see Table 3.25).

Table 3.25: Average waiting time for the various services

Service	Admission	Consultancy	Dressing	Pharmacy	Registration	STAT	vital signs & Documentation
AVG WT-minutes	3.75	33.96	16.87	0.12	0.00	4.01	13.48
%	5.20%	47.07%	23.37%	0.016%	0.00%	5.55%	18.67%

Table 3.26: Average utilization of resources

Nurse	Pharmacist	Doctors	Receptionists	Lab Technicians
87.96%	23.82%	86.98%	10.95%	54.00%

The utilization of resources is summarized in Table 3.26. The simulation model at a default setting showed that walk-in patients waited less (51.14 minutes) than by-appointment patients (65.69 minutes), and that the average total time spent in the clinic by the walk-in patients was less (124.78 minutes) than the average total time spent in the clinic by patients with appointments (153.34 minutes) (see Table 3.27).

Table 3.27: Average time in base scenario – in minutes

Waiting Time		Total time spent in clinic	
By-Appointment Patients	Walk-in Patients	By-Appointment Patients	Walk-in patients
65.69	51.14	153.34	124.78

3.6.5.2 Results of sensitivity study

Delay setting was tested in 3 cases: no delay (0,0,0) minutes, default system delay (0,4,45) minutes and maximum delay (0,8,90) minutes. We analyzed the impact of changing the amount of resources setting a different number of resources for each shift and then taking the average of the number of patients; the waiting time and use of doctors; the nurses, lab technicians, pharmacists, and receptionists on the percentage of patients served and not served, the patients' waiting time, and the use of resources.

3.6.5.2.1 Doctors

3.6.5.2.1.1 Number of patients

Bearing in mind the number of patients in and out of the system, we ran the model, changing the number of doctors as listed below. We found that no matter what numbers of doctors the model included, the number of patients in the system suffering delays (registered) did not change (69.07-70.02) (see Table 3.28).

Table 3.28: Total number of patients in the system in function of the number of doctors

Number of doctors	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	69.64	69.28	69.44
2	69.57	68.97	69.62
3	69.58	69.42	69.52
4	69.51	69.71	69.29
5	69.78	69.46	69.41
6	70.02	68.98	69.39
7	69.68	69.49	69.23
8	69.52	69.37	69.34
9	69.98	69.72	68.99
10	69.96	69.43	69.07
11	69.73	69.24	69.33

However, the percentage of patients served in relation to the number of doctors varied between 10.09% and 70.51%.The maximum number of patients who can be attended to when there is no delay could be achieved if there were 8 instances of this type of resource; see Table 3.29 and Figure 3.13.

Table 3.29: Percentage of patients served from the total number of registered patients in function of the number of doctors

Number of doctors	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	10.36%	10.25%	10.09%
2	20.86%	20.94%	20.25%
3	31.57%	30.87%	30.32%
4	41.80%	40.56%	40.29%
5	51.52%	50.40%	49.58%
6	60.62%	59.94%	58.35%
7	66.92%	64.77%	63.65%
8	70.51%	68.29%	66.59%
9	69.86%	67.83%	66.87%
10	69.74%	68.34%	67.13%
11	70.05%	68.30%	68.16%

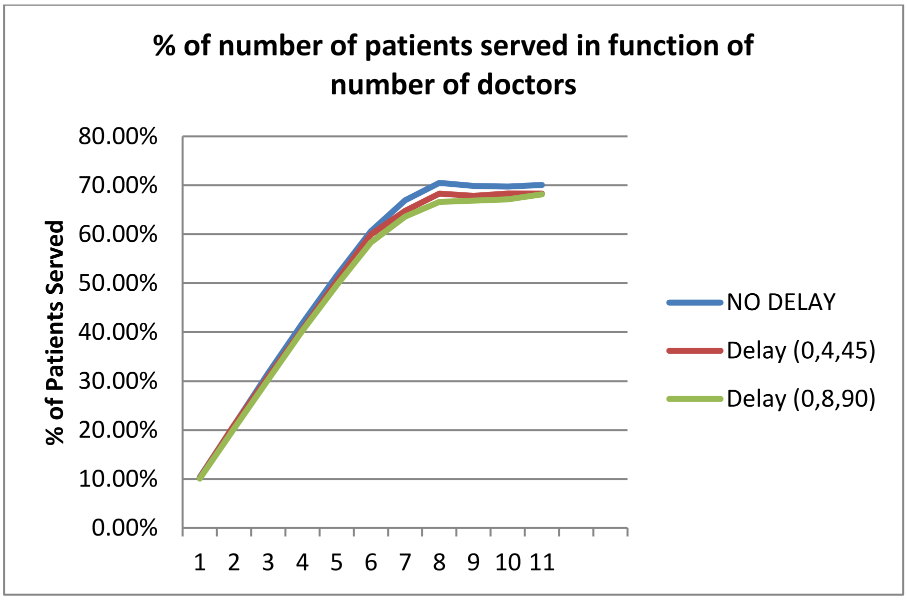

Figure 3.13: Percentage of patients served from total number of patients registered in function of the number of doctors

This means that the number of patients entering the system (registered) does not change whatever delay is set. Hence, no effect from the delayed arrival of patients was observed on the number of patients entering the system, regardless of changes in the number of doctors. But the highest number of patients that could be attended to would be found in cases where no delay to patients is allowed for in the system and this highest figure (70.50%) occurs whenever 8 doctors are on duty. If delayed arrival were allowed for, the minimum percentage of patients could be served.

3.6.5.2.1.2 Patients' Waiting Time

Here we looked at the average waiting time with the same number of doctors for by-appointment patients and walk-in patients with maximum delays of 0, 8, and 90 minutes, a default delay of 0, 4, and 45 minutes and no delay. It was noted that the minimum average waiting time for by-appointment patients was 46.10 minutes in case of delays of 0,8,90 minutes and when 10 doctors were on duty. In general, it was found that the lowest waiting time for by-appointment patients occurred when a maximum delay in the system was allowed for (see Table 30 and Figure 3.14.)

Table 3.30: Average by-appointment patients' waiting time in function of the number of doctors

Number of doctors	No delay	Delay (0,4,45)	Delay (0,8,90)
1	178.90	173.33	168.15
2	159.49	157.82	153.07
3	143.24	137.12	131.43
4	123.15	117.33	110.71
5	103.17	96.82	90.39
6	81.31	75.06	69.13
7	67.17	61.40	56.29
8	56.63	51.76	46.72
9	57.76	52.14	46.75
10	57.72	51.70	46.10
11	57.96	52.06	52.68

It was found for the walk-in patients that the minimum average waiting time occurred when 8 doctors were on duty (a delay of 0,8,90 minutes). It was also noted that the minimum average waiting time for the walk-in patients occurred when the system allowed for a delay of 0,8,90 minutes. (See Table 3.31 and Figure 3.14.)

This means that allowing for the delayed arrival of patients to the system provides minimum waiting times for both by-appointment patients and walk-in patients.

Table 3.31: Average walk-in patients' waiting time in function of the number of doctors

Number of doctors	No delay	Delay (0,4,45)	Delay (0,8,90)
1	118.14	126.69	127.24
2	145.86	122.36	100.06
3	135.90	107.37	91.12
4	110.42	86.97	72.34
5	88.57	71.15	57.42
6	69.28	54.98	43.08
7	59.53	46.76	37.58
8	51.92	40.43	32.00
9	53.19	40.42	32.43
10	53.31	40.35	32.09
11	53.15	40.86	41.07

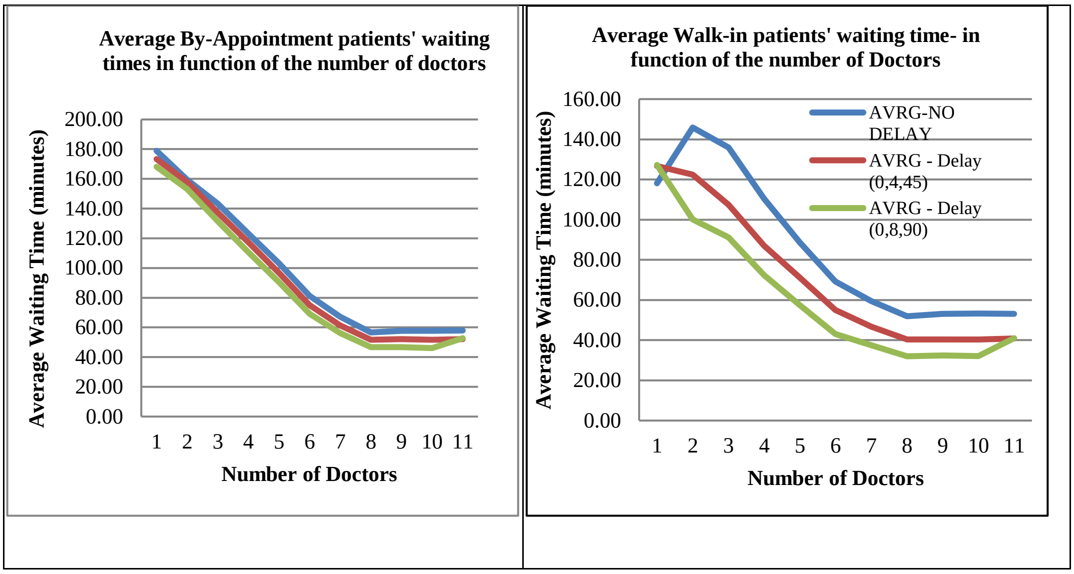

Figure 3.14: Average by-appointment and walk-in patient's waiting time in function of the number of doctors

Looking at the waiting time of patients at a service point where resources are involved (the consultancy process for doctors and the dressing process for nurses), we noted that patients wait less to see a doctor when maximum delay is allowed in the system and when 8 doctors were available the time was 16.96 (see Table 3.32 and Figure 3.15).

Table 3.32: Patients waiting time for consultancy services/processes

Number of doctors	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	138.75	131.91	126.42
2	125.12	119.39	113.21
3	108.30	101.61	96.13
4	90.86	85.35	79.56
5	70.53	66.04	61.03
6	50.44	45.84	42.29
7	33.16	30.60	27.95
8	20.18	19.16	16.96
9	22.58	20.66	18.07
10	22.14	19.61	17.24
11	23.29	20.64	20.99

For the dressing services/processes we noted that patients' waiting less in cases of maximum delay is allowed for in the system and that the waiting time was 0.38 minutes when 1 doctor was scheduled (see Table 3.33 and Figure 3.15).

Table 3.33: Average waiting time for dressing services/processes in function of the number of doctors

Number of doctors	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	0.41	0.49	0.38
2	0.39	0.50	0.38
3	1.31	1.37	1.29
4	1.92	2.00	1.72
5	5.97	5.56	5.00
6	9.99	8.87	8.01
7	19.74	17.10	14.96
8	27.91	24.32	21.83
9	25.93	22.21	19.51
10	26.53	23.18	20.15
11	24.71	21.77	22.07

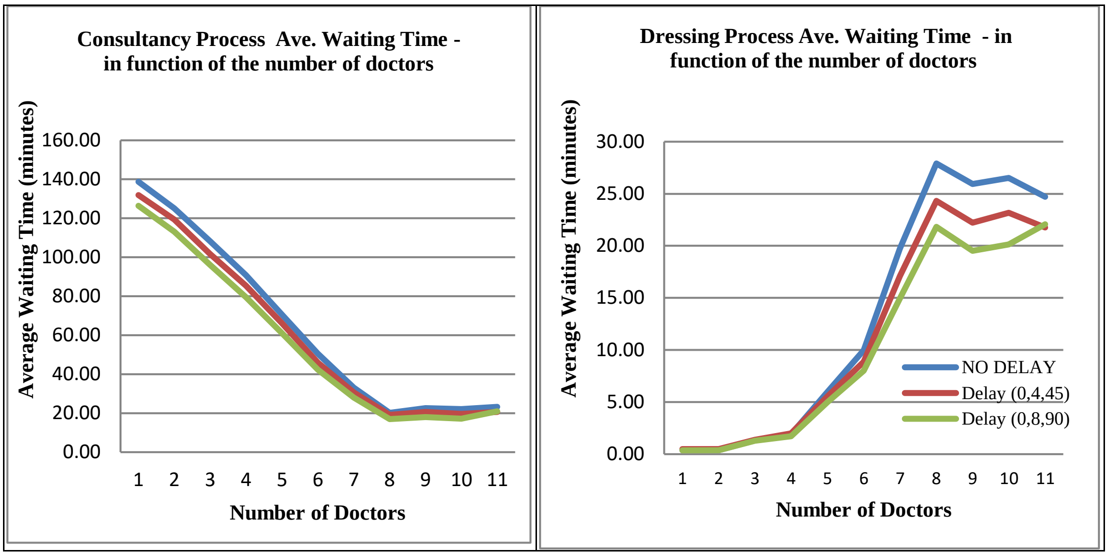

Figure 3.15: Average waiting time for consultancy and dressing processes in function of the number of doctors

3.6.5.2.1.3 Average utilization of doctors

Keeping the same number of doctors and looking at the average utilization of doctors for the maximum delay, default delay and no delay configurations, it was found that the maximum utilization of doctors could be found when there were two doctors, where 92.99% of patients experienced no delay. It was also noted that the utilization of doctors is highest when there is no delay in the system (see Figure 3.16).

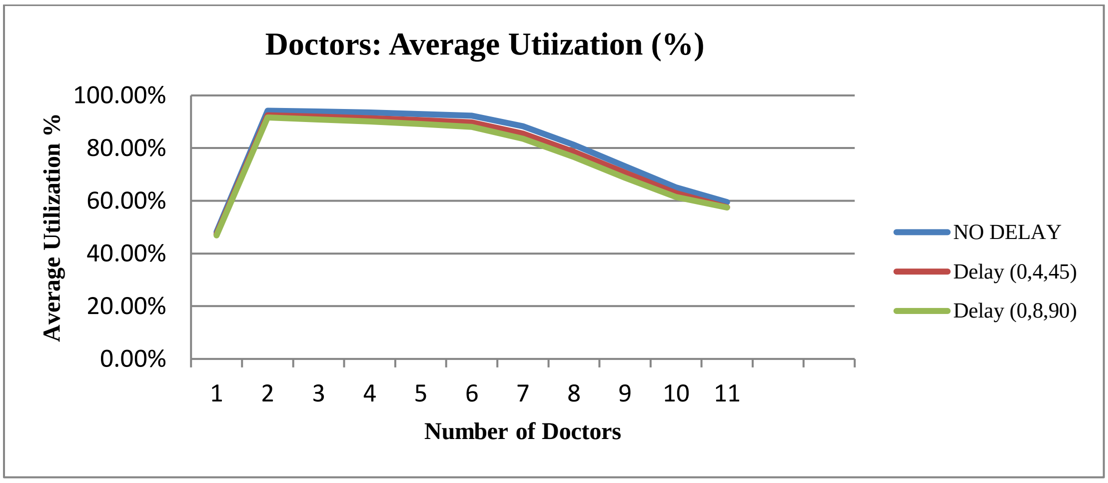

Figure 3.16: Average utilization of doctors

3.6.5.2.2 Nurses

Here we study the effect of changing the number of nurses on the following factors:

3.6.5.2.2.1 Number of Patients

Looking at the number of patients in and out of the system, we ran the model changing the number of nurses (see Table 3.34 below). We found that there is not much difference between the number of patients in the system in the three scenarios (68.97-70.15). But the maximum number of patients registered is 70.15, when no delay was allowed for in the system and when 6 nurses were on duty. This means that delayed arrival has no effect on the number of patients being registered or checked in the system.

Table 3.34: Number of patients in the system (registered) in function of the number of nurses

Number of Nurses	No Delay	Delay (0,4,45)	Delay (0,8,90)
4	69.54	69.15	69.27
5	69.67	69.03	69.07
6	70.15	69.12	69.06
7	69.61	69.33	69.51
8	69.88	69.43	69.38
9	69.60	69.30	69.55
10	69.88	69.21	69.43
25	70.08	69.33	68.97

Looking at the percentage of patients served (see Table 3.35), the highest is 71.31% when no delay is allowed for in the system and 10 nurses are on duty. It was noted that the maximum percentage of patients being served could be found in cases of no delay being allowed for in the system with marginal differences in the other two scenarios made by delayed arrivals (see Figure 3.17).

Table 3.35: Percentage of patients being served in function of the number of nurses

Number of Nurses	No Delay	Delay (0,4,45)	Delay (0,8,90)
4	27.43%	27.06%	26.84%
5	41.75%	41.45%	40.73%
6	54.05%	53.77%	52.96%
7	67.73%	65.96%	64.82%
8	69.48%	67.83%	66.67%
9	71.13%	69.55%	69.17%
10	71.31%	69.96%	69.21%
25	71.19%	69.92%	70.46%

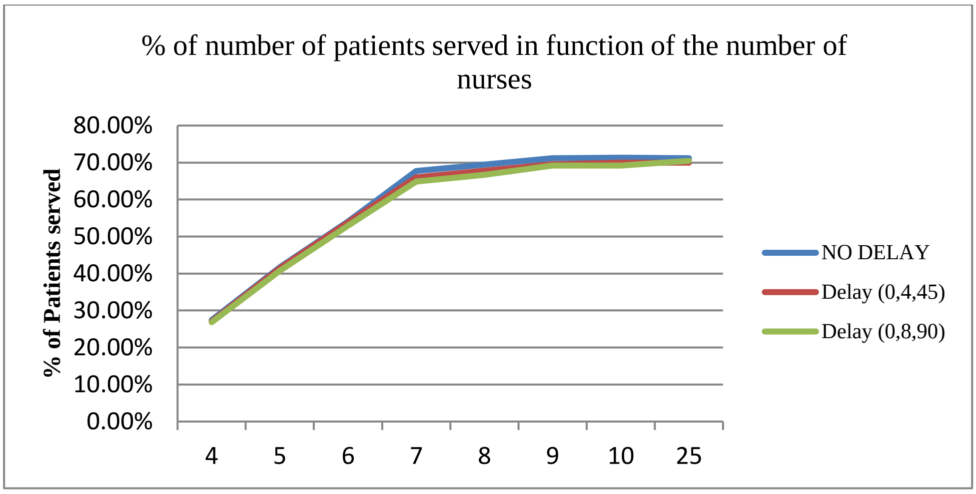

Figure 3.17: Percentage of patients being served in function of the number of nurses

3.6.5.2.2.2 Patients' Waiting Time

Here we are looking at the average waiting time for by-appointment patients and walk-in patients with different settings of delay for the same number of nurses that we studied earlier. It is noted that the minimum average waiting time for by-appointment patients was 55.94 minutes when the system allowed for maximum delay and the number of nurses was 8. Generally, it was noted that delayed arrivals resulted in lower waiting time (see Table 3.36: and Figure 3.18).

Table 3.36: Average by-appointment patients' waiting time in function of the number of nurses

Number of Nurses	No Delay	Delay (0,4,45)	Delay (0,8,90)
4	160.62	155.30	146.29
5	129.04	122.51	114.35
6	99.67	93.46	85.73
7	72.18	65.69	59.93
8	69.07	63.24	55.94
9	66.13	60.57	60.63
10	65.54	59.63	57.55
25	65.50	59.02	59.24

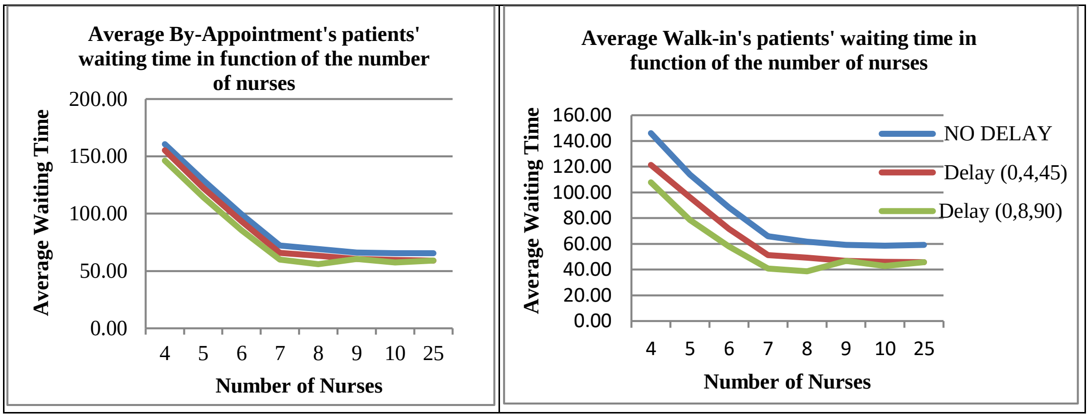

Figure 3.18: Average by-appointment and walk-in patients' waiting time in function of the number of nurses

For the walk-in patients' waiting time, it was found that the shortest wait was 38.65 minutes when maximum delay was allowed for and 8 nurses were on duty. It was also noted that delayed arrivals generally result in a lower waiting time (see Table 3.37 and Figure 3.18).

Table 3.37: Average walk-in patients' waiting time in function of the number of nurses

Number of Nurses	No delay	Delay (0,4,45)	Delay (0,8,90)
4	146.08	121.36	107.82
5	113.77	96.29	78.50
6	88.36	71.58	57.95
7	65.85	51.14	40.92
8	61.61	49.26	38.65
9	59.14	46.77	46.68
10	58.57	46.13	42.70
25	59.14	45.75	45.74

Among the processes that the nurses are involved in, and the related patients' waiting time, we can identify 4 processes; admission checking vital signs and documentation, consultancy, and dressing. In the vital signs and documentation process (and not considering the results of 25 nurses), it was noted that the maximum delayed arrivals resulted in a shorter waiting time (0.84 minutes when 10 nurses were available). In general, the maximum delay in arrivals resulted in the shortest average waiting time for the processes of checking vital signs and documentation (see Table 3.38 and Figure 3.19).

Table 3.38: Vital signs and documentation service/process average waiting time - in function of the number of nurses

Number of Nurses	No Delay	Delay (0,4,45)	Delay (0,8,90)
4	75.82	70.83	67.25
5	59.13	55.03	50.49
6	39.54	36.69	33.49
7	14.84	13.48	12.50
8	7.99	7.52	6.57
9	2.70	2.54	2.58
10	1.01	0.85	0.84
25	0.00	0.00	0.00

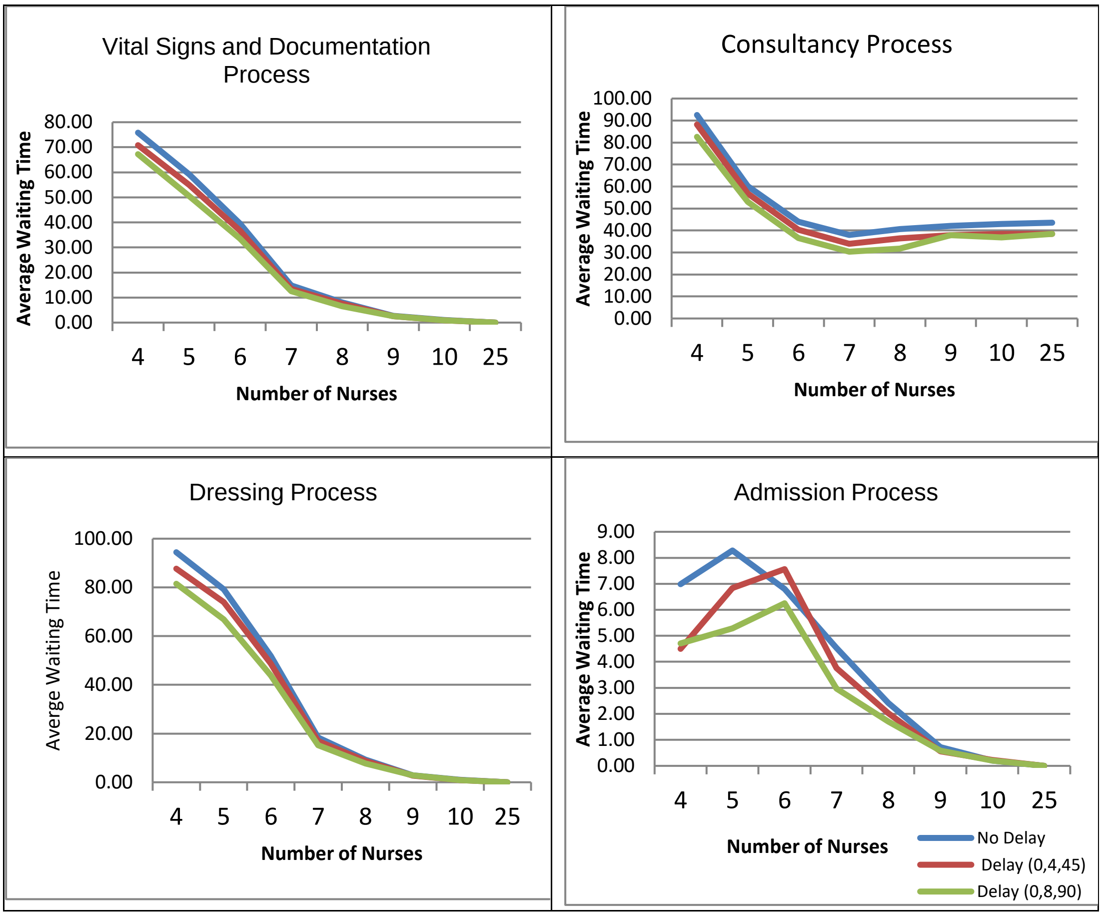

Figure 3.19: Average waiting time for processes in function of the number of nurses

The other process that the nurses are involved in is consultancy, where it was noted that the shortest average waiting time was 30.36 minutes when 7 nurses were used and a maximum delay in arrivals was allowed for. In addition, with a maximum delay allowed for, the average waiting time was noted to be the shortest (see Table 3.39 and Figure 3.19).

Table 3.39: Average waiting time for a consultancy in function of the number of nurses

Number of Nurses	No Delay	Delay (0,4,45)	Delay (0,8,90)
4	92.52	88.17	82.60
5	60.21	56.75	52.97
6	43.98	40.36	36.60
7	37.97	33.96	30.36
8	40.58	36.47	31.69
9	42.08	37.93	37.82
10	42.92	38.52	36.83
25	43.59	38.42	38.51

Another process that the nurses are involved in is dressing wounds, etc., and the same was noted as above. When maximum delay was allowed, the minimum average waiting time resulted. The minimum average waiting time for this process was 0.83 minutes when 10 nurses and a maximum delay of (0, 8,90) minutes in patients' arrival was allowed for (see Table 3.40 and Figure 3.19).

Table 3.40: Dressing process average waiting time in function of the number of nurses

Number of Nurses	No Delay	Delay (0,4,45)	Delay (0,8,90)
4	94.43	87.69	81.49
5	79.19	74.00	66.93
6	51.84	48.66	43.89
7	18.34	16.87	15.21
8	9.34	8.77	7.66
9	2.83	2.73	2.79
10	1.04	0.84	0.83
25	0.00	0.00	0.00

In addition to the vital signs and documentation, consultancy, and dressing processes, the nurses are responsible for the admission processes, where it was found that the shortest average waiting time, 0.20 minutes, occurred when the maximum delay in arrivals was allowed for and with 10 nurses available. Generally, the shortest average waiting time at the admission process occurs when a maximum delay is allowed in the system (see Table 3.41 and Figure 3.19).

Table 3.41: Admission process average waiting time in function of the number of nurses

Number of Nurses	No Delay	Delay (0,4,45)	Delay (0,8,90)
4	6.99	4.50	4.70
5	8.28	6.84	5.29
6	6.80	7.56	6.25
7	4.53	3.75	2.98
8	2.42	2.03	1.70
9	0.72	0.55	0.58
10	0.20	0.22	0.20
25	0.00	0.00	0.00

3.6.5.2.2.3 Average utilization of nurses

Keeping the same number of nurses and looking at the average utilization of nurses for different configurations of delay, it was found that the maximum utilization of nurses in cases of delay is allowed for in the system: it was 97.18% when 4 nurses were on duty. It was noted that the utilization was generally higher when no delay was allowed for in the system (see Figure 3.20).

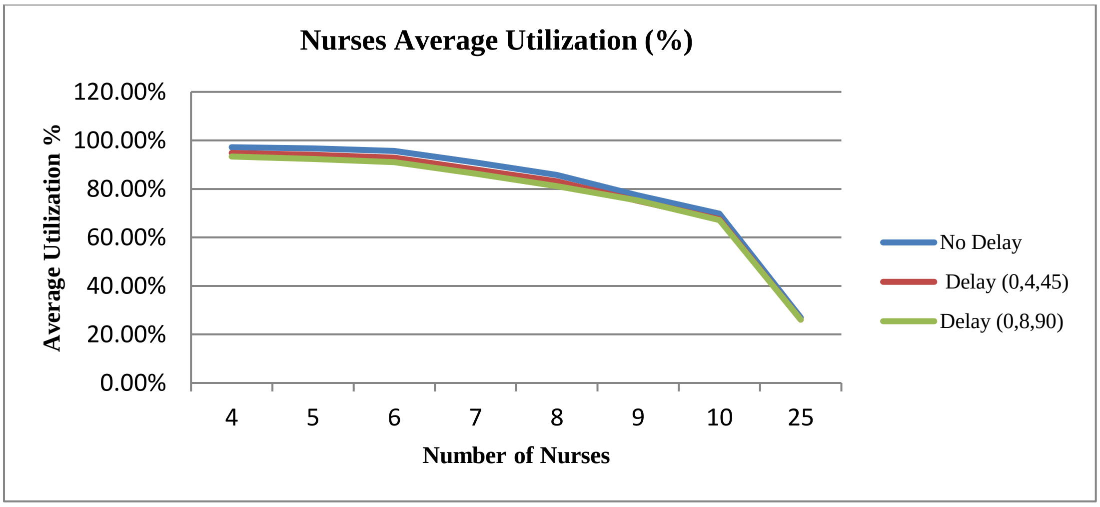

Figure 3.20: Average utilization of nurses

3.6.5.2.3 Lab Technicians

Here we study the effect of changing the number of lab technicians on the following different factors:

3.6.5.2.3.1 Number of Patients

Looking at the number of patients in and out of the system, we ran the model changing the number of lab technicians. The results are shown in Table 3.42. It was found that throughout the three scenarios, the number of patients in the system was between 68.64 and 69.75, which means that the delayed arrival of patients does not affect the number of patients registered in the system.

Table 3.42: Number of patients in the system (registered) in function of the number of lab technicians

Number of lab technicians	No Delay	Delay (0,4,45)	Delay (0,8,90)
2	69.60	68.64	69.15
3	69.69	69.44	69.42
4	69.61	69.33	69.51
5	69.75	69.26	69.41

Looking at the percentage of patients being served, it was found that the maximum number, 67.73%, occurred when no delay was allowed for in the system, and when 4 lab technicians were at work. The minimum percentage of patients served, 61.83%, was found when maximum delay was allowed for (0, 8, 90) minutes and was reached when 2 lab technicians were available (see Table 3.43).

Table 3.43: Percentage of patients being served in function of the number of lab technicians

Number of lab technicians	No delay	Delay (0,4,45)	Delay (0,8,90)
2	63.34%	62.64%	61.83%
3	66.40%	64.71%	64.65%
4	67.73%	65.96%	64.82%
5	67.67%	66.29%	66.13%

3.6.5.2.3.2 Patients' Waiting Time

By looking at the average waiting time for by-appointment patients for the same number of lab technicians that we studied above, we noted that the minimum average waiting time for by-appointment patients was 59.93 minutes when the system was accepting maximum delay and the number of lab technicians on duty was 4. It was also noted that a delayed arrival of (0, 8, 90) minutes resulted in the shortest waiting times in general (see Table 3.44).

Table 3.44: Average by-appointment patients' waiting time in function of the number of lab technicians

Number of lab technicians	No delay	Delay (0,4,45)	Delay (0,8,90)
2	74.47	67.29	68.15
3	74.22	67.05	67.40
4	72.18	65.69	59.93
5	72.04	65.67	65.78

For the walk-in patients, the minimum average waiting time, 40.90 minutes, was found when 4 lab technicians were set and when a maximum delay in the arrival of patients was allowed for. In general, the shortest average waiting time was observed when the maximum delay in the arrival of patients was allowed for (0, 8, 90) minutes. (See Table 3.45).

Table 3.45: Average walk-in patients' waiting time in function of the number of lab technicians

Number of lab technicians	No Delay	Delay (0,4,45)	Delay (0,8,90)
2	74.30	56.30	56.77
3	69.47	53.57	53.64
4	65.85	51.14	40.92
5	65.45	51.15	51.56

It was found that the shortest average waiting time for a lab process was when a delay of (0,8,90) minutes was allowed and was generally 2.07 minutes when 5 lab technicians were on duty, the maximum delay in arrivals resulting in the shortest average waiting time for the lab process (see Table 3.46 and Figure 3.21).

Table 3.46: Lab process average waiting time in function of the number of lab technicians

Number of lab technicians	No delay	Delay (0,4,45)	Delay (0,8,90)
2	53.39	50.25	50.69
3	22.07	20.94	21.50
4	3.97	4.01	3.70
5	2.20	2.12	2.07

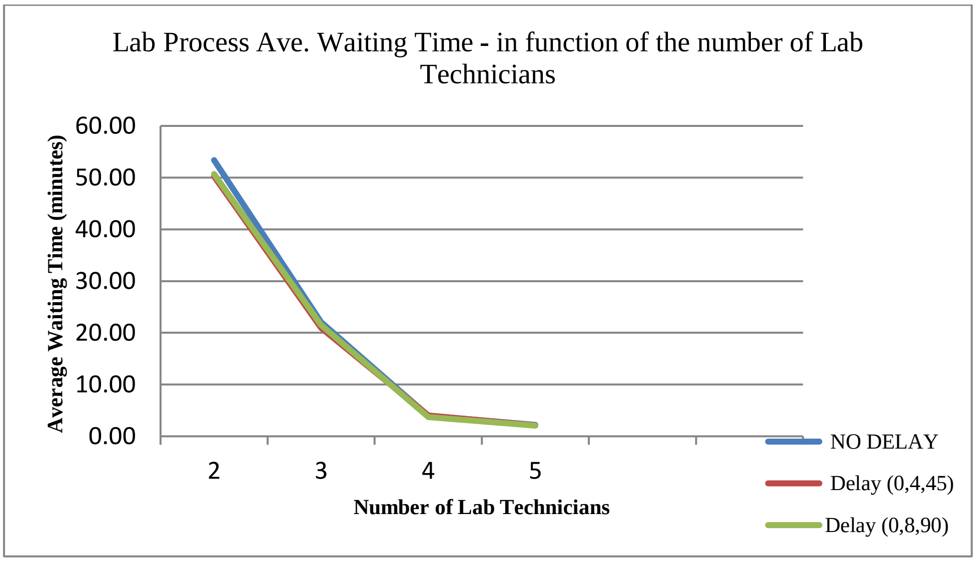

Figure 3.21: Lab process average waiting time in function of the number of lab technicians

3.6.5.2.3.3 Average utilization of lab technicians

Using the same number of lab technicians and looking at the average utilization made of them, it was found that the maximum utilization was 84.54% when no delay was occurring and 2 lab technicians were on duty. Generally, the utilization of lab technicians is higher when no delay is allowed for in the system (see Table 3.47).

Table 3.47: Average utilization of lab technicians

Number of lab technicians	No delay	Delay (0,4,45)	Delay (0,8,90)
2	84.54%	81.68%	81.87%
3	71.37%	68.36%	68.76%
4	56.05%	54.00%	53.01%
5	46.81%	45.18%	45.04%

3.6.5.2.4 Pharmacists

3.6.5.2.4.1 Number of Patients

The maximum average number of patients registered in the system was 69.68 with no delay allowed for in the system, when only 1 pharmacist was on duty and the minimum average number was 69.17 when maximum delay was allowed for in the system and with the same single pharmacist on duty (see Table 3.48). In general, delayed arrival has no effect on the number of patients registered in the system.

Table 3.48: Average number of patients in the system (registered) in function of the number of pharmacists

Number of Pharmacists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	69.68	69.20	69.17
2	69.67	69.45	69.36
3	69.56	69.33	69.35

The minimum percentage of patients being served when there was a delay of (0, 8, 90) minutes was 63.28% in the case of 1pharmacist and the maximum was 68.01%

with 3 pharmacists, when there was no delay. It was also noted that the maximum number of patients can generally be served with no delay in the system (see Table 3.49).

Table 3.49: Percentage of patients being served (out of the system) in function of the number of pharmacists

Number of Pharmacists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	66.55%	65.23%	63.28%
2	67.15%	65.60%	64.27%
3	68.01%	66.01%	64.74%

3.6.5.2.4.2 Patients' Waiting Time

With 3 pharmacists the minimum average waiting time for by-appointment patients and with maximum delay allowed for in the system (0, 8, 90) minutes is 60.02 minutes. Generally, it is noted that if the maximum delay in arrivals is allowed for, patients wait less (see Table 3.50).

Table 3.50: Average by-appointment patients' waiting time in function of the number of pharmacists

Number of Pharmacists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	75.55	69.70	64.20
2	73.56	67.22	61.53
3	71.96	65.77	60.02

The minimum average waiting time for walk-in patients occurs when maximum delay is allowed for in the system (0, 8, 90) minutes; it is 40.75 minutes with 3 pharmacists available. Generally it is noted that if maximum delay in the arrival of patients is allowed, they all have less to wait (see Table 3.51).

Table 3.51: Average walk-in patients' waiting time in function of thenumber of pharmacists

Number of Pharmacists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	69.10	54.45	44.42
2	66.76	52.64	42.07
3	65.17	51.37	40.75

Looking at the process in relation to pharmacists' waiting time, it was noted that this process does not take long (between 0.17 and 7.03 minutes), with almost no difference between the scenarios. Nevertheless, there is a minor difference in favor of the maximum delay scenarios (see Table 3.52 and Figure 3.22).

Table 3.52: Pharmacy process average waiting time in function of the number of pharmacists

Number of Pharmacists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	7.03	6.96	6.96
2	2.58	2.66	2.56
3	0.18	0.17	0.18

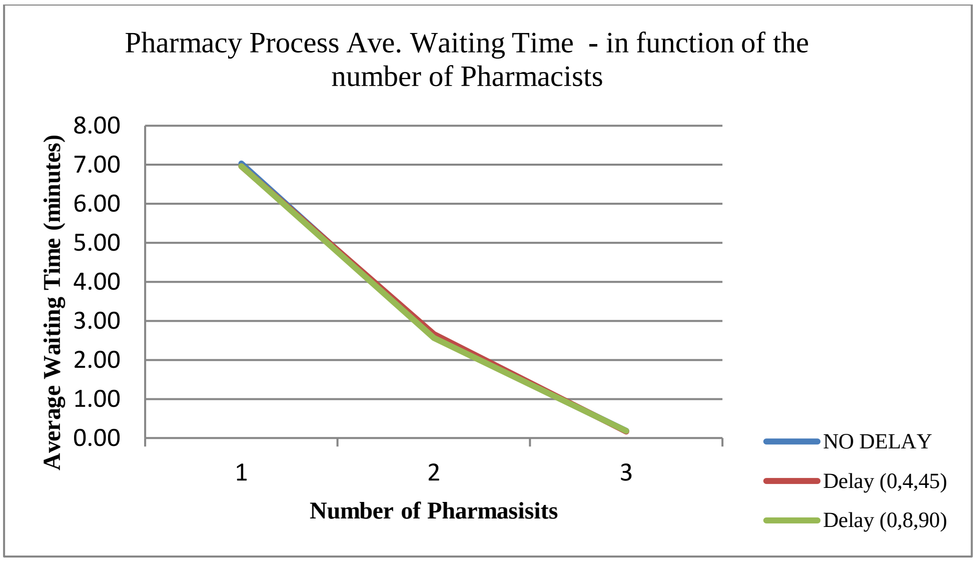

Figure 3.22: Pharmacy process average waiting time in function of the number of pharmacists

3.6.5.2.4.3 Average utilization of Pharmacists

The maximum average utilization of pharmacists is 60.21% when 1 pharmacist is on duty and no delay is allowed for in the system, and the minimum occurs when maximum delay is allowed for, 23.00% when 3 pharmacists are at work (see Figure 3.23).

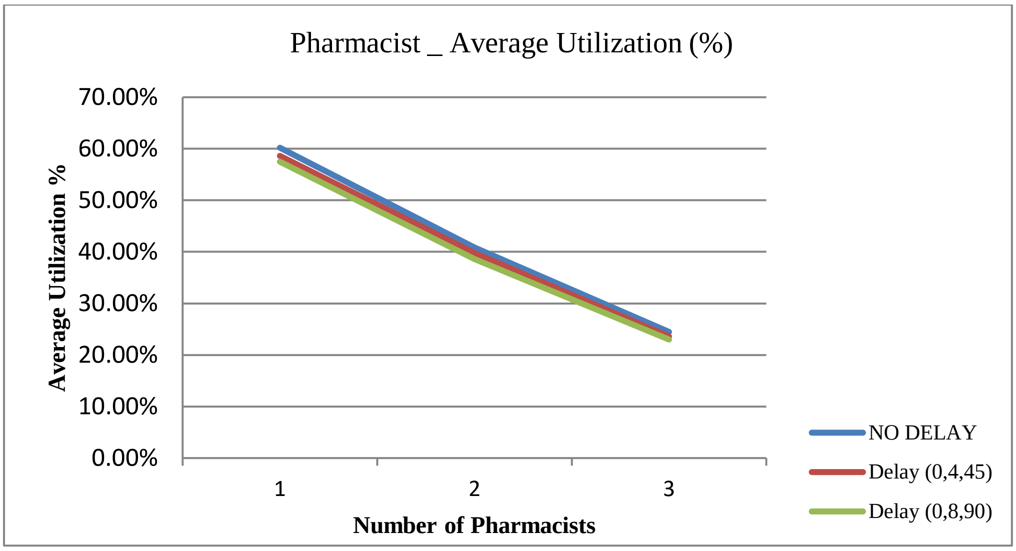

Figure 3.23: Average utilization of pharmacists

3.6.5.2.5 Receptionists

3.6.5.2.5.1 Number of Patients

It is noted that changing the number of receptionists makes minimal changes to the number of patients registered in the three delayed scenarios (69.19-69.85). The maximum numbers were registered when no delay was allowed for in the system (see Table 3.53). Therefore, we can conclude that delayed arrival has no effect on the number of patients registered in the system.

Table 3.53: Total number of patients registered in the system in function of the number of receptionists

Number of Receptionists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	69.58	69.33	69.24
2	69.54	69.37	69.47
3	69.85	69.28	69.19
4	69.78	69.33	69.44

The maximum percentage of patients being served, 67.97%, occurs when there is no delay and 2 receptionists are available; generally, when no delay is allowed for, a higher percentage of patients is served (see Table 3.54).

Table 3.54: Percentage of patients being served in function of the number of receptionists

Number of Receptionists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	67.82%	66.27%	66.16%
2	67.97%	66.33%	66.03%
3	67.52%	66.06%	65.05%
4	67.50%	65.91%	64.90%

3.6.5.2.5.2 Patients' Waiting Time

With a change in the number of receptionists, it was found that the minimum average waiting time for by-appointment patients was 59.54 minutes, with 3 receptionists registering them; this applied to delays of 0,8,90 minutes. As a rule, it was noted that maximum delays in arrivals resulted in less waiting time (see Table 3.55).

Table 3.55: Average waiting time for by-appointment patients in function of the number of receptionists

Number of Receptionists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	70.73	65.63	65.39
2	70.49	66.29	66.27
3	72.54	66.26	59.54
4	72.63	65.86	59.88

With 3 receptionists, the walk-in patients had to wait a minimal average time, even when the maximum delay was 40.45 minutes. It was also noted that the shortest waiting time for the walk-in patients generally occurred when maximum delay in the system was allowed (see Table 3.56).

Table 3.56: Average walk-in patients' waiting time in function of the number of receptionists

Number of Receptionists	No delay	Delay (0,4,45)	Delay (0,8,90)
1	61.83	48.00	48.09
2	61.41	50.50	50.43
3	64.52	51.56	40.45
4	65.88	51.27	40.74

Looking at the process the receptionists were involved in, namely registration, we noted that this process generally requires little or no waiting time (0.00 – 1.66 minutes) with the shortest allowing for a maximum delay of (0,8,90) minutes (see Table 3.57 and Figure 3.24).

Table 3.57: Registration process average waiting time in function of the number of receptionists

Number of Receptionists	No Delay	Delay (0,4,45)	Delay (0,8,90)
1	1.66	1.56	1.53
2	0.64	0.59	0.59
3	0.05	0.05	0.04
4	0.01	0.01	0.00

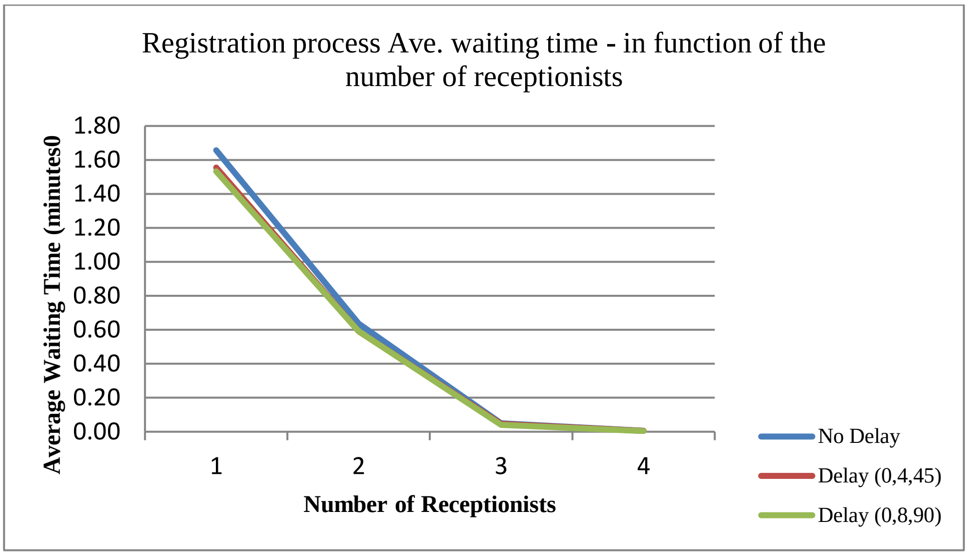

Figure 3.24: Average waiting time in the process of registration in function of the number of receptionists

3.6.5.2.5.3 Average utilization of Receptionists

The maximum utilization of receptionists, 44.89%, is made when no delay is allowed for in the system and when 1 receptionist is available. In general the utilization of receptionists was higher in cases of no delay (see Figure 3.25).

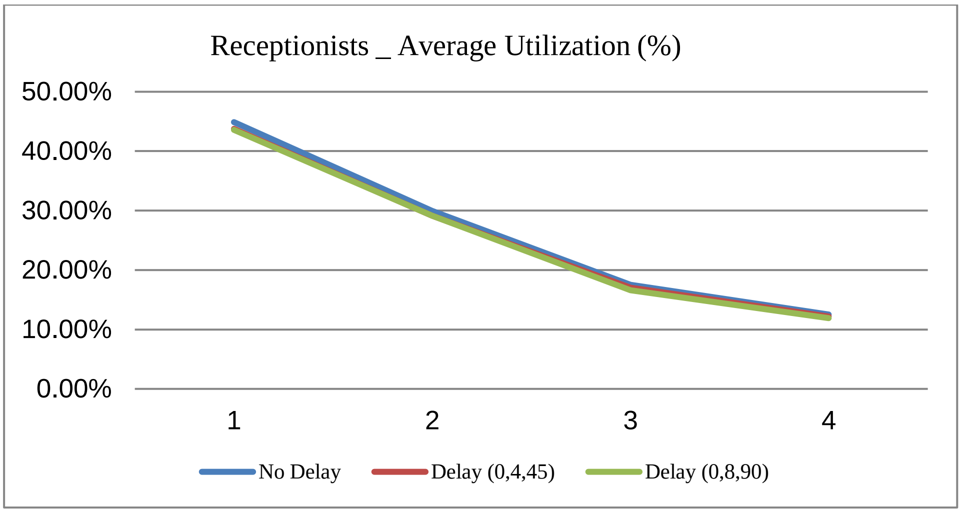

Figure 3.25: Average utilization of receptionists

3.7 Discussion and conclusions

Patients are spending a long time in outpatient clinics waiting for medical treatment. The current situation in the outpatients' clinic under review is that the patients who have an appointment wait for more than an hour (65.69 minutes) out of a total time of 153.34 minutes and spend on average 20 minutes in consultation with their doctors. So, they spend more than two hours and a half in the clinic to see a doctor for only 7.67% of the total time that they must sacrifice. This is worse for them than it is for walk-in patients, who spend in total about two hours (124.78 minutes), of which 51.14% is spent waiting.

The simulated model with the experimental process focused on ways of reducing the waiting time in relation to the number of resources and the effect of delayed arrivals on waiting time. It was noted that changing the number of resources changed the patients' waiting time and also the total amount of time spent in the clinic. The best average waiting time that could be achieved is in reference to the number of doctors; a total of 8 doctors seems to be best (with equal numbers of 4 doctors in each shift). Less waiting time could be achieved even with maximum delays in the system. It would reduce the waiting time for the by-appointment patients by 28.88% from the base scenario (from 65.69 minutes to 46.72 minutes) and reduce the consultancy waiting time by 50.06% (from 33.96 minutes to 16.96 minutes), but it would increase the time required to wait for a dressing from 16.87 minutes to 21.83 minutes. This option slightly reduces the total time spent in the clinic by patients with an appointment (2.49%, from 153.54 to 149.72 minutes) and by walk-in patients (14.85% from 124.78 minutes to 106.25 minutes). This option would also reduce the utilization of doctors by 11.91% (from 86.98% to 76.62%), and would reduce the utlization of nurses by

0.65% (from 87.96% to 87.39%). Although this option would not give us the highest percentage of patients that could be served if there were no delays at all (70.51% served), it would improve the current situation which serves only 66.59%. Our findings about the delayed vs. on-time arrivals recalls similar findings by Okotie, Patel, and Gonzalez (2008), who studied the effect of patients' arrival on waiting time and the utilization of resources and found that on-time patients, once they had waited in the exam room for the physician, had a longer waiting time altogether than those who arrived late.

There may not be one pre-eminently best solution from the options listed, but we must not forget the underlying aim of the study, which is to reduce the waiting time while taking account of the impact of lateness. We should recall too, as (Ameh et al., 2013) conclude, that the waiting time spent by patients before seeing the doctor is very critical for the patients and their image of the hospital, so that adding one doctor (part-time, or perhaps 4 doctors per day for a full time clinic) would have a huge impact on the waiting time of patients with appointments. It would reduce the waiting time by 28.88%, i.e. 18.97 minutes. This option considerably modifies the length of time that patients must wait before seeing a doctor; it would be reduced by more than 50%, from 33.96 minutes (the current waiting time) to 16.96 minutes. It would, however, also increase the waiting time for the 70-80% of the patients who might need the dressing service, from 16.87 minutes to 21.83 minutes.

In this study it was noted that the walk-in patients wait less than the by-appointment patients. A similar finding was made in a study by Jamjoom et al. (2014), who found that the waiting time for the walk-in patients (30.1 minutes) is not quite half the waiting time of a follow-up patient (64.56 minutes) in the Obstetrics and

Gynecology Department at a hospital in the Kingdom of Saudi Arabia. The writers recommended some solutions by analyzing several methods of structuring appointment systems.

It worth mentioning that a process to alleviate bottlenecks should be operated below its maximum capacity, to avoid long queues at or near the bottleneck and avoid the loss of resources where they are not needed, such as at reception where delays are non-existent or minimal in length (0,4,45 minutes).

From the simulation results discussed above, we can see the effect of changing the number of resources and of delayed arrivals on the waiting time and the total time spent in the clinic. It shows us that allowing for delayed arrivals improves the total waiting time for by-appointment patients and walk-in patients in general, but it affects the number of patients who could be served and the use of resources.

Chapter 4: Recommendations and Practical Implications

4.1 Summary of the results

When patients spend a long time in a hospital, this is not only a waste of time for them, but also a sign that additional cost is being incurred due to the inefficiency of the service. This inefficiency entails avoidable extra work for the doctors, nurses, lab technicians, pharmacies, and administrative and support service staff. The amount of overtime worked in clinics was shown in the original data received; moreover, the additional working hours and stress affect staff morale. This inefficiency may itself be reflected in the number of seats and waiting areas, for they indicate a loss of space that could be used to serve other purposes/clinics, which might increase the financial return to the hospital.

There are two main approaches to managing the waiting time and improving patients' satisfaction. In this thesis, we studied the waiting time experiences in the UAE's healthcare systems. We first conducted an empirical study by collecting data from 552 patients, to better assess the level of patients' satisfaction with the quality of the healthcare service provided and with the time they needed to wait. The results of this study were reported in Chapter 2. Using authentic data, and the findings from the first study, we also simulated the flow of patients in a typical outpatient clinic to verify the current waiting times, determine an effective strategy to reduce the patients' waiting time, and eventually raise the level of satisfaction among patients and determine the effect of delayed arrivals by patients. The results of this study are reported in Chapter 3.

In Chapter 2, we conducted an empirical study of a convenience sample of patients selected in public places. They were asked about their waiting times and their satisfaction level. The latter was measured by using the SERVQUAL concept. In this study, it was found that about 62% of the patients reported that they were not satisfied with the waiting time, and 31% of them reported that they had experienced a long waiting time. Gaps were found between the patients' expectations and perceptions of the quality of the services on all five of the SERVQUAL dimensions. In summary, we tested the relationship between satisfaction with the service quality and with the waiting times (from arrival to registration (pre-service); from registration to consultation (in-service); at the pharmacy (post-service); feelings about the waiting time; and the waiting time experience as a whole). We found a statistically significant positive relationship between satisfaction with the service quality and the waiting time experience and satisfaction with waiting time from arrival to registration; which means that patients were satisfied with the quality of service provided to them only when they had to wait a short time. In addition, they were satisfied with the quality of service provided when they were satisfied with the waiting time from arrival to registration (pre-service/entry). Treating the willingness to recommend the hospital to family and friends as an indicator of satisfaction with the quality of services, we also found a statistically significant positive relationship between satisfaction with the waiting time from arrival to registration (pre-service) and the affective/emotional feeling about the waiting time; which means that when patients were satisfied with the waiting time from arrival to registration they were found to be willing to recommend the hospital to family members and friends and when they felt satisfied (instead of bored or stressed) while waiting for the service.

Various factors were tested, to learn their relationship with satisfaction with the waiting time (the cognitive and affective aspects of the waiting time). Satisfaction with the waiting time was found to have a statistically significant positive relationship with the following: perceived waiting time during the three stages of the service (pre-service; in-service; and post-service); the waiting time experience; and the feeling about the waiting time. This means that patients were satisfied with the waiting time when they perceived that they had waited relatively little time in all three stages of the wait for the service (from arrival to registration; from registration to consultation; and at the pharmacy for medicine). This also means that the better the patients' perception of their waiting time (the shorter the perceived time); the more satisfied they were with the waiting time and the shorter they felt the waiting time to have been, which means that customer satisfaction tends to increase as perceptions of waiting time deteriorate.

Satisfaction with the waiting time was also found to have a statistically negative relationship with the expected waiting time in the three stages of the service, and a positive relationship with the waiting time experience; which means that customers' satisfaction increases when their expectations decline, as reflected in the level of satisfaction among patients during the wait.

Our results show that the waiting-related variables that were studied mostly influence the tangibles and reliability dimensions more than the other dimensions of service quality. The independent variables referred to here, which were found to have a statistically significant positive relationship with the satisfaction with waiting time, are the perceived attractiveness of the hospital's waiting room; the perception of receiving information about the expected waiting time if a delay arises; the perception of patients that the doctor always spends enough time in consultation with them; the perception that the hospital has the best physical environment in its industry; and the presence of a family member or friend to accompany them.

The patients' cognitive experience (the judgment about their waiting time) was found to have a statistically significant positive relationship with the expected and perceived waiting time during the three stages of the service: the perceived information received about the expected waiting time in case of delay; the perception of patients that the doctor always diagnoses accurately from the first presentation; age; gender; and income level. It was also found that the cognitive experience has a statistically significant negative relationship with the expected waiting time in the three stages of the service; and the patients' expectation of the time that will be spent in consultation.

The patients' affective feelings about and during the waiting time were found to have a relationship with the perceived waiting time from registration to seeing the doctor (in-service) and the perceived waiting time at the pharmacy (post-service). It was also found to have a statistically significant positive relationship with 1) the perception among patients that the hospital they were visiting had the best physical environment in its industry; and 2) the information they received about the expected waiting time in case of delay. It was also found to have a statistically significant positive relationship with the last visit of the patient to the hospital (the more recent, the more they were satisfied); and the perception of the patient that they always spent enough time in consultation with the doctor. The affective aspect was found to impact on two dimensions of service quality, the empathy of the staff and their assurance.

In Chapter 3 of this study, using simulation, we studied the effect of the capacity level (the number of resources) on the waiting time; and also the effect of delayed arrivals on the waiting time and the total time spent in the clinic. To summarize the outcomes of the simulation study, in the basic scenario it was found that the average waiting time for a by-appointment patient was longer than the waiting time for a walk-in patient and that about two-thirds of all patients could be served during the official working day. It revealed that the longest waiting period in the service cycle is the waiting time to see a doctor (he in-process stage), followed by waiting for the dressing process which can form part of the in-process stage; then the period waiting for vital signs and documentation, which is the pre-process stage. The average time that a patient spent in a clinic altogether was more than two hours and a half, 20 minutes of which might be spent in consultation with a doctor.

From the simulation results we saw that increasing the number of doctors by one shift (or having four full-time doctors per day rather than the three and a half at present) would reduce the waiting time for by-appointment patients by about 29%, equal to 18.97 minutes. It would also reduce the patients' waiting time before seeing the doctor by more than 50% of the time they spent at present, from 33.96 minutes to 16.96 minutes. However, this would affect the waiting time for 70-80% of the patients who might need dressing services, increasing it from 16.87 minutes to 21.83 minutes. The study also shows that delayed arrivals improve the total waiting time for by-appointment patients and walk-in patients in general, but it affects the number of patients who could be served and the use of resources.

4.2 Recommendations for decision makers in healthcare

Nowadays, many hospital position themselves as high-quality healthcare providers; they do this because of intense pressure to reduce cost, changing attitudes among patients and aggressive competition (Babakus & Mangold, 1992). One of the most widely accepted methods of evaluating the success of patient-centered aims is patient satisfaction and this has been part of quality improvement programs for some time. Although some physicians argue that patient satisfaction may not be the best reflection of the quality of care provided, studies have shown that patients who are satisfied with the quality of care are more likely to comply with the recommendations made by the healthcare provider; they would also be more likely to return to the same healthcare provider for continuity of care and preventive health services.

Healthcare managers should pay special attention to what patients value and how they evaluate the quality of the services provided to them. It is important to measure their satisfaction with what is provided and what their expectations are, in addition to what they might want. It is also important to know when to measure expectations; should it be done before or after the service being consumed? Clow and Vorhies (1993) recommended measuring such expectations before the service is provided because consumers' expectations are affected by their experience. Clow et al. provide evidence that the experience of the service encountered (positive or negative) will bias the consumers' memory of their previous expectations. In other words, it is better to measure the expectations of patients before a service because, no matter what they experience, it affects their expectations.

Healthcare providers must convey to their patients that their expectations are not only reasonable and worth meeting but are also actually met by the staff at their facilities. Raising patients' expectations of service delivery without coming up to them destroys the providers' credibility and reliability and leaves a greater gap between the expectations and the perception of the services. It is worth knowing that current expectations are the basis of satisfaction in that they are unconsciously compared with the current perceived experience; and that the current perceived experience is the future expectation of the patients.

Managing patients' waiting time is crucial because our study shows that the variables related to it have a significant impact on the overall satisfaction with the services provided (see Chapter 2 and the summary provided in the present chapter). Knowledge of the variables influencing patients' satisfaction with their waiting time is vital for healthcare providers, who recognize that satisfaction with the service alone is insufficient to account for patients' satisfaction overall.

Our findings provide a framework which enables service managers to use customers' perceptions of waiting for rethinking operational issues such as the layout and design of the waiting areas; process choices; and service delivery. It is important to understand that patients build their ideas and expectations of waiting on combinations of aspects; the expected waiting time; the perceived duration of waiting time and the situational context of the wait. These all combine the service design characteristics with patients' individual characteristics (i.e. the feelings of patients before visiting and the value of time to them). The service design characteristics adapted by Johansson and Olhager (2004), such as the people's roles (the level of skills and degree of employee discretion); the role of technology and equipment (the degree of routineness and automation); and the role of location and layout (location and front office-back-office configuration) together influence the psychology of waiting. Hence, service providers should look into their processes and facilities and redesign them on the basis of the outcomes of this study. It was found here that satisfaction with the waiting from arrival to registration (pre-process) is a key to satisfaction with the service quality and consequent recommendation to family and friends; therefore healthcare providers should take account of making these moments acceptable, to avoid the negative emotions associated with a negative judgment of waiting time. Knowing that patients find it hard to wait for the main service (consultation with the doctors), comfortable seating could help to make the experience tolerable. Managing expectations, which leads to a more realistic perception of waiting time, could be achieved by either a queuing counter or a time counter. In other words, a counter could be installed that indicates either how many minutes a patient must wait (when the service time is well known and defined) or how many patients are ahead in the queue (when the time is not known due to the varied nature of the services). This would also address some of the uncertainty over the amount of waiting and provide some of the information needed by the patients about the time they might expect it to end. Given that patients are actively engaged in observing the service delivery process, they want to know the causes of the incidents (and their controllability) and wonder how persistent these causes are. They might be more tolerant if they could see that certain incidents are beyond the control or responsibility of the medical staff and do not recur. Communicating the reasons for delay might convey to the patients that they were important and the hospital agreed that their time was valuable. They could then decide what they wanted to do during their waits or they might decide not to wait but to reschedule their appointment if they thought it could be deferred. Such patients would benefit from being told which were the least busy days and times; as well as the value of the information itself, it would involve them in the timing of their next appointment, which might make them feel more satisfied and less stressed on their next visit. Staff should show more empathy and courtesy to patients; and should explain why they were expected to wait if they had an appointment and why their waiting time had been extended.

Other service design characteristics may influence the waiting experience, such as the physical comfort of waiting rooms and waiting areas in the facility; their cleanliness and attractiveness; and how easy they are to reach. Our study shows that the perceived attractiveness of the physical environment of the hospital influences people's satisfaction with waiting times. This means that the built environment and surroundings can be used to convey the hospital image and suggest the potential use and relative quality of the service (Solomon, 1985), which reflects the importance of the physical environment in influencing patients' overall experience of visiting it. In addition, service managers should use the design of the hospital environment (perhaps the sophisticated building design; the advanced technology used in the building; the art works in the public areas; water features and interior landscaping) to reassure the patient about the quality of care that they are about to receive. Moreover, the physical environment can significantly distinguish a market segment to target, position the organization and convey one competitor's distinctiveness from the rest (Bitner, 1992). It can also, in a patient's evaluation and feeling vis-à-vis the waiting experience, reduce some of the annoyance; irritation; stress; boredom; and anger that patients frequently associate with their medical visits.

Unoccupied time feels longer, thus affecting the waiting experience and the level of satisfaction. Service managers may consider providing the waiting areas in the hospital with hotspot/Wi-Fi points (which can also serve as positive distractions); where patients and their relatives can pass their time surfing on the web browsers; communicating over social media; or working off-site. If the patients' time is occupied they pay less attention to the delay itself; which results in less attention being paid to the factors that create a sense of delay: uncertainty and anger. Therefore patients spend less time worrying about the consequences of the delay. Filled waiting time is found empirically to be more pleasant than unfilled time, as Katz et al. (1991).and Maister (1985) maintain.

The technical skills of the service provider form another factor that affects the satisfaction with waiting time and can be managed as demonstrated in our findings. Qualified doctors who inspire patients' confidence should be hired and retained so that patients feel assured that they are getting the desired and expected healthcare. In healthcare there is no tolerance for any medical mistake and patients want to feel that the assurance aspect of the service quality dimension is not neglected. Service providers are supposed to be accurate and dependable and to provide the service they have promised to provide, in this case, well-being. One might think that patients who know very little about the science of diagnosis and medicine would find this difficult to assess. However, patients can easily assess any improvement in their symptoms and this may become an important influence on their satisfaction (Gabbott & Hogg, 1994). Their assessment relies on the state of their perceived health as a reflection of the instant diagnosis of their case and the quality of the technical skills of the healthcare provider.

Another factor that affects waiting time satisfaction is that patients need to feel that the doctors are listening to them, allocating enough time to diagnose and care for them. This may be done by managing patients' expectations; for instance, the perception of the time spent in consultation can be managed by informing patients about the average service time. Or it can be done through the interpersonal skills of the doctors; they should be trained to ask their patients if they want to tell the doctors about any other health-related matter. In addition, this issue may be managed by providing patients with more explanation and written information about the causes, investigation, treatment and preventive aspects of their disease. Sometimes doctors spend too long with a particular patient, which delays the next appointment; in this case the waiting time could be reduced by alerting the doctor through his computer or a member of staff keeping watch or a waiting time dashboard.

Dube-Rioux et al. (1989) has found that the most annoying times in waiting come at the beginning of a service (patients want to start) and at the end (patients want to leave), but in-service waiting seems to be more acceptable. The healthcare administrator and providers may also need to think of the waiting time that patients spend in the consultation rooms waiting for their doctor. This is part of the in-service process which affects satisfaction with the waiting time, but enhancing the environment in the consultation rooms might help to ease the perception and feeling of the waiting time as a whole.

An understanding of the way in which these factors can contribute to patients' satisfaction/dissatisfaction with waiting may lead to better management of the aspects of waiting that can be controlled. Other characteristics have been found to be related to the waiting time but beyond the control of the hospital management, including such socio-demographic characteristics as gender, age and income.

In general, measuring patient satisfaction via a survey helps healthcare providers to understand and manage their business in a competitive world. Healthcare providers need to know how they are performing, from the patients' point of view, and to identify areas for improvement. This should be a continuous practice for the better positioning and growth of the healthcare providers. Every person in the service chain has a responsibility to improve the institutional efficiency, which should be identified and explained and in everyone's charge. There should be better efficiency and effectiveness in daily operation and different action plans for different cases to reduce waiting times, measuring the return of the marketing investment. One of the practical actions promoting efficiency and effectiveness is would be to use the available technology to achieve objectives and KPIs.

The SERVQUAL instrument provides hospital management with a tool for measuring functional quality. A deficient (negative/zero/unsatisfactory) score on one or more SERVQUAL dimensions is normally a sign that an underlying problem exists in the organization. One of SERVQUAL's major strengths is its ability to identify symptoms and to provide a starting point for the examination of such underlying problems, which inhibit the provision of quality services. The patients' expectations as well as their perceptions provide valuable insight into the process by which the quality of healthcare service is evaluated. Healthcare managers should understand the areas in which expectations are likely to be high, such as those related to human health and well-being: empathy; assurance, etc., and should tailor the service delivery process to meet these expectations. In addition; the SERVQUAL scale can be used in its "weighted score version" to weight the priorities of quality of service to the patients, as calculated from the perspective of the hospital's management and employees.

As noted above, SERVQUAL is designed to measure functional quality only; however; it should accompany unbiased and accurate descriptions of the processes and procedures.

Of course, hospitals work under constraints in their operation: budgeting; resources; clinical; operational and financial KPIs that they must show. The hospitals' management can choose the best strategy for their case, following the major concerns of the hospital and healthcare authorities.

Below are listed some of the general outcomes from this study for consideration by the management of any outpatient clinic in setting up their operational strategies.

Long waiting times for patients are recognized indicators of inefficiency in patients' care processes. The causes of this inefficiency is the absence of a patient care process approach, and poor use of resources in healthcare has also been linked to the absence of a process approach (Vos et al., 2009). To improve the efficiency of the healthcare facility, the management needs to identify and eliminate no-added-value activities and process variation; in the present case work with the quality team suggested some processes that should be eliminated for greater efficiency and improved patient experience.

- Increasing the number of resources at one stage has only a limited effect on the waiting time; soon another bottleneck will lessen the effect of capacity-building at any stage.
- Delayed arrivals often reduce the patients' waiting times, but affect the quality of service in terms of the number of patients who have not been served by the end of the day and the use of resources.
- It is recommended to re-think the number of patients' appointments and the maximum number of walk-in patients allowed if they are all to be accommodated within the working day and staff overtime is to be avoided.
- While it was expected that walk-in patients would wait longer, lacking a prior reservation, our study found that by-appointment patients in fact wait longer. Therefore, a prioritizing strategy is recommended for registering walk-ins and allowing them into the system.

- For better understanding and analyzing the waiting time and resource capacity, a simulation study is recommended, which calculates, in addition to the effect of delay, what service time can be guaranteed to a maximum number of patients while still avoiding overtime.
- For a holistic understanding of the situation in an outpatient clinic, healthcare providers are advised to analyze the appointment system, patient flow and the utilization of the resources.
- It is recommended to the management to look into the possibility of redesigning good process/system for appointments in light of the patients' arrival behavior and its effect on the waiting time and other system's performance such as the utilization of the resources. It is also recommended to assess the patients' waiting time to reduce it at the bottlenecks, in addition to introduce some policy for better physician time management and improve the task organization.
- After implementing any change, it is important to measure patients' satisfaction with their waiting time, so as to assess the effect of the change and see whether it has increased patient satisfaction, measuring its financial impact and results.
- It is worth noting that the process of developing the simulation model for this study can be used generally in any outpatient clinic, subject to reflecting the specific characteristics of this outpatient clinic, such as arrivals' behaviors, number of resources, and the other assumptions listed earlier in this study.

4.3 Academic and practical implications

4.3.1 Academic implication

The present empirical study was conducted to help understand what contributes to satisfaction with the waiting time, and the relationship between waiting time satisfaction and satisfaction with the service quality. It aims to help plug the gap in the literature. It was conducted also to understand patients' views about the major causes of long waiting times.

The results of this study confirmed the effect of the studied variables on the waiting time satisfaction which is taking the side of literature that concluded of such a relationship. This is a contribution to the literature and the understanding of the phenomena. The results of this study also raised a new uncommon finding, which is about the relationship between the age and the cognitive aspect of waiting time satisfaction. This was not found to be reported in all the literature reviewed and need further studies and analysis from the human psychology aspect. Another area for consideration which came out from this study that, when patients are being asked directly to self-reporting their level of satisfaction, more than 65% reported that they are satisfied. Comparing that result with their expectations and perceptions it was found unsatisfactory results which also raise an area for consideration by researchers and management when asking their patients directly about their level of satisfaction, most probably they will receive a very good percentage in favor of present arrangements, which may not reflect reality. Another interesting finding which is related to the SERVQUAL dimensions concerns the satisfaction scores, which were found surprisingly unsatisfactory for every single question being asked and all dimensions. Moreover, this was not found in any reported study, possibly because the present study was based on responses gathered in public places and not in a single healthcare institution. But this fact still might reflect an opinion about the quality of the healthcare system in this country. What is also unique about this study is to do with not only its interesting findings, but its design, in which the findings from questions about the causes of the long waiting time were used to design the scenarios of the simulation model.

The simulation study was designed to use an outcome from the survey (the delayed arrival of patients and number of resources) to reduce the waiting time by means of a scenario-based analysis. The simulation study contributes to the literature about deploying operation management tools in healthcare. In addition, the simulation model study considered two streams of arrivals, one by appointment and the other unplanned (the walk-in patients), which to our knowledge had not commonly been studied. Another unique aspect of this study is that it kept two factors under review, namely the delayed arrivals and the number of resources, which is rarely done; and also studied them separately. The reported findings in relation to the average waiting time for the walk-in patients were found to be interesting: in fact they do not wait as long as the by-appointment patients do. This seems to be a promising area for further study and investigation; it needs to be controlled and a proper strategy to deal with it should be developed. In addition, some strategies should be considered to control the delayed arrival of patients which affects the efficiency of the resources and limits the access of other patients to care.

4.3.2 Practical implications

The results of the empirical study bring out the importance of listening to patients through patient satisfaction surveys. It is important to capture their expectations of the services provided, the waiting environment, communication and the technical quality of the resources and design the services accordingly. Meeting or exceeding patients' expectations will lead to more satisfied patients and more loyalty among them. Understanding what contributes to the long waiting time would help to take the necessary actions to reduce the delays, which would affect the overall level of satisfaction. Special attention needs to be paid to reducing the pre-, in- and post-services waiting time, perhaps modifying the number of resources, or redesigning the processes at every service station or perhaps introducing some operational strategies. The factors that affect waiting time satisfaction need to be reconsidered and given special attention. The physical environment of the healthcare facilities and waiting rooms, technical skills of the doctors and staff, the allocation of enough time to let doctors listen to and discuss cases, the valuing of patients' time and information about the length of time they must expect to wait – all the above factors need to be carefully looked at and investigated, proper actions need to be designed, implemented and tested. Managers could use the questionnaire as an instrument to identify the gaps in service delivery or as a starting point to identify underlying organizational problems.

The results from the simulation study provide significant insights to all healthcare providers who are aiming to improve patient care. The results draw attention to the effect of delayed arrival by patients on the use of resources, the extended waiting time and reduced access to care for patients who need to be seen. Therefore, the management should develop a strategy to reduce the delayed arrivals of the patients. In addition, looking at the results of the simulation model, it appears that the walk-in patients wait less time than by-appointment patients, therefore, it is recommended to develop a strategy for accepting and prioritize the walk-in patients within the system.

This paper explored the orthopedic care process to identify the factors that influence the patients waiting time; specifically the number of resources and the delayed arrivals of patients. It has shown the need to reconsider the process at this clinic, because of its effect on the use of resources; for example, x-rays and blood tests could be requested and scheduled earlier than the appointment time. That would reduce patients' waiting time and in addition would make better use of the doctors and nurses. Additional measures could be taken by the hospital management, such as assigning residents or assistants for the dressing process, which would also reduce the waiting time of the patients and improve the efficiency of the doctors. Appointments for dressings could be scheduled directly at the registration desk (rather than after seeing the doctors), further reducing the waiting time and allowing for better use of resources. This would improve all patients' access to healthcare by allowing more patients to be treated.

In a complex environment of interactive processes such as a hospital, it is important to prevent bottlenecks at all the server stations by carefully assigning the right number of resources at each of them.

Finally, hospitals are facing increasing challenges from constraints on human resources; hence, it is important for healthcare providers to adopt operational management tools such as simulation in order to improve their care of patients and the efficient delivery of healthcare services.

4.4 Limitations and suggestion for future research

In this study, the hypotheses were developed on the basis of previous studies with dissimilar results. As this may be one of the first studies of its kind in the UAE, there may be other factors to consider if we want a better understanding of what is affecting or might determine patient satisfaction with the waiting time, including waits at other server stations. Examples here are the availability of parking spaces (accessibility), billing, other waiting time such as the time needed to get a written request for further tests completed by a nurse, other administrative waits and total waiting time. There are also other factors that affect patients’ prior expectations, such as their evaluation of their health status, the level of pain they are feeling, etc. From the analysis of the patients’ satisfaction, it was found that their expectations were greater than their perception, which was reflected in negative results on all dimensions. It was also found to be not inconsistent with the level of satisfaction measured in the response to a direct question. This raises the possibility of introducing other questions about a patient’s willingness to switch to another clinic if his/her medical insurance will cover it and how s/he values the present service, as well as asking which aspects of the waiting time were not acceptable. To avoid bias, it is recommended to measure people’s expectations before encountering a service, but the other limitation of this study is that it asked patients to respond in the same survey to questions about the expected and perceived service quality and the waiting time. The reasons for this were time limitations and having no access to healthcare facilities. Another area of research that was not explored in the present thesis was what factors affect the tolerance to wait among different age groups, which might consider the effect of making it easier to connecting to the internet and social media.

This study could be affected in the near future with the global moving toward the artificial intelligent (AI), especially in healthcare. The machine learning algorithms will pore over admittance data to track and analyze how doctors, medical resources and patients move through the different clinics in the hospital and identifying potential bottlenecks. Different applications and used for the AI in the healthcare system could be introduced to improve the waiting time and the efficiency of the doctors such as prioritizing the patients based on their case severity or the by-appointment patients over the walk-in patients. AI could increase the efficient utilization of the doctors' time by reducing, for example, the no-show patients. As the AI machines could predict the potential patients who might miss their appointments, taking into account different factors such as age, address, and weather condition, and text them. Other areas that AI could be used are the diagnosis, which might reduce the time in consultation, and in the treatment such as using the robotics in surgery and in less invasive treatments. The machines will not replace the essential resources in the healthcare system, such as doctors, but the use of data and technology can radically change how the services are managed.

In the simulation research, the aim was to understand the impact of late arrivals and resource capacity on the waiting time. Another factor, too, needs to be considered when formulating a solution for the waiting time in an actual outpatient clinic: this is the holistic view of the system. It may include the appointments system in use and its policy, the number of available resources, the number and time of surgeons, working hours and overtime, etc., in addition to the priorities of the healthcare providers, KPIs, and restrictions, which were not included in the study.

A further limitation is that the study was made on the basis of many assumptions, such as using average service times and the average numbers of patients requiring different procedures. More comprehensive data would make a better model possible, one that reflected an actual system, which produced results that were closer to experience. Another limitation of this study, that in the statistical analysis the variables were not controlled as this study is not a prediction or experimental study. That means that when testing the effect of one variable the effect of all other contributing variable was not fixed or eliminated to clearly identify the relationship between an independent variable and a dependent variable.

The study did not consider the patients' early arrivals and doctors' late arrivals, though they too contribute to the length of patients' waiting time and the use made of the doctors. One of the ways of extending waiting time is to arrive early for an appointment, but if patients could arrive just a few minutes early this would reduce their waiting time. Likewise, if doctors arrived at the beginning of their clinical sessions patients' waiting time could also go down and doctors could be deployed more efficiently.

Although this study was conducted in one outpatient clinic, the results could be generalized to other similar operational settings; to tell the truth, long waiting time, a shortage of resources, and the delayed arrival of patients are common in other orthopedic clinics (Rohleder et al., 2011).

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Appendices

Appendix 2.1: Service quality dimensions

Authors	Year	Dimension/measurements
(Ware)	1977	Art of care (interpersonal manner of health provider), Technical quality of care, Accessibility/convenience, finance, Efficacy/outcomes, Continuity, Physical environment, Availability
Parasuraman, Zeithaml, and Berry	1985	Determinants of Service Quality: Access, communication, competence, courtesy, credibility, Reliability, Responsiveness, security, Tangibles, Understanding/knowing the customer.
Parasuraman, Zeithaml, and Berry	1988	SERVQUAL 5 dimensions: Tangibles, Reliability, Responsiveness, Assurance, Empathy
Larsson, Larsson and Starrin	1994	Quality from Patient's Perspective (QPP) measures: Medical care, treatment by doctor, treatment by nurse, participation, information, environment, accessibility
Eckerlund, Jonsson, Tambour, and Westlund	1997	Quality, Satisfaction, Performance (QSP): Patient satisfaction (perception of the visit, and to what degree they were satisfied) Quality factors (Accessibility, hospitality, service-minded personnel, environment, information advice, staff knowledge, participation influence, continuity, freedom of choice) Goal (increased medical awareness, willingness to seek advice by phone from the staff, recommending the department to others)
Sower, Duffy, Kilbourne, Kohers, and Jones	2001	Key Quality Characteristics Assessment for Hospitals KQCAH: Respect & Caring, Effectiveness & Continuity, Appropriateness, Information, Efficiency

Appendix 2.1: Service quality dimensions (Continued)

Authors	**Year**	**Dimension/measurements**
Eiriz and Figueiredo	2005	Quality of healthcare Customers' & providers' relationship Quality item: (customer service orientation, financial performance, logistical functionality and level of staff competence)
Badri, Dodeen, Al Khaili, and Abdulla	2005	16 dimensions of patient/inpatient satisfaction: transition to home, communication, involvement, courtesy and empathy, fairness and trust, competency and confidence, information, tangibles and physical attributes, other facilities and services, payment matters, management rules and regulations, timely matters, waiting times and delays, responsiveness and psychological aspects, availability and accessibility, and outcome and overall assessment.
Zineldin	2006	5Qs applicable in hospital setting model: Quality of object, quality of process, quality of infrastructure, quality of interaction, quality of atmosphere.
The Joint Commission on Accreditation of healthcare organizations	2008	Quality of hospitals: Efficacy, Appropriateness, Efficiency Respect and caring, Safety, Continuity, Effectiveness, Timeliness, Availability
Mejabi and Olujide	2008	Eight quality dimensions: resource availability, quality of care, condition of clinic/ward, condition of facility, quality of food, attitude of doctors and nurses, attitude of non-medical staff and waiting time for service

Appendix 2.2: Studies of different aspects of the waiting time in the literature

Study	**Time (Actual/perceived)**	**Conclusion**
(Barlow, 2002) Outpatient/eye clinic in UK	Subjective (Perception – Expectation) compared to the objective	Five unexpected results were found: 1. Accompanied queuers are less likely to be satisfied than solo queuers. 2. Distinct difference in the female patients over 55 and the females under 55. 3. The waiting time expectation of first time visitors was very low compared to revisiting patients. 4. Expectation in females under 55 was very much shorter irrespective of the frequency of visit. 5. Many early arrivals, regardless of the clinic's advice. Others: 1. Male patients have lower expectations of waiting time, 2. Most unsatisfied group was females under 55. (sub-group) 3. The most unhappy group was male patients (main group)
(Bielen & Demoulin, 2007) Outpatient/radiology in Belgian	objective, subjective, cognitive and affective	1. The results confirm that waiting time satisfaction is not only a service satisfaction determinant, but also moderates the satisfaction-loyalty relationship. 2. Determinants of customer waiting time satisfaction include the perceived waiting time, satisfaction with the information provided in case of delays, and the satisfaction with the waiting environment.
(Ir et al., 2011) Outpatients and ED in Malaysia	Objective, Subjective, affective	1. Although the average patient's wait is more than two hours from registration to getting the prescription slip, and the contact time with medical personnel is only on average 15 minutes, most of the patients were found satisfied with the service provided. 2. Employee surveys on factors contributing to the lengthy waiting time indicated: employee attitude and work process, heavy workload, management and supervision problems, and inadequate facilities

Appendix 2.2: Studies of different aspects of the waiting time in the literature (Continued)

Study	Time (Actual/perceived)	Conclusion
(Patwardhan et al., 2013) Convention care clinic	Objective	It was found 1. that patients using CCCs had significantly shorter waiting times from check-in to seeing a doctor than the waiting times reported by patients at family practice. 2. that CCC patients had significantly longer consultation times with the clinician than those reported by family practice patients
(Thompson et al., 1996) Emergency Department	Objective, subjective	1. Perceptions regarding waiting time, information delivery, and expressive quality predict overall patient satisfaction, but actual waiting times do not. 2. Providing information, projecting expressive quality, 3. Managing waiting time perceptions and expectations may be a more effective strategy to achieve improved patient satisfaction in the ED than decreasing actual waiting time.
(Smidts & Pruyn, 1998) Outpatient in Netherlands	Objective, subjective, cognitive, affective	1. Waiting influences satisfaction quite strongly. 2. The effects of waiting can be soothed more effectively by improving the attractiveness of the waiting environment than by shortening the objective waiting time. 3. Objective waiting time influences satisfaction mainly via a cognitive route: through perceived waiting time and the long-short judgment of the wait. 4. Perceived attractiveness of the waiting environment operates mainly through affect, and thus serves as a mood inducer. 5. The acceptable waiting time appears to be a critical point of reference, since it provokes strong affective responses. 6. Although the presence of TV did not result in the expected effect of distraction, the tendency to watch it was found to be dependent on the length of the wait and thus, boredom.

Appendix 2.2: Studies of different aspects of the waiting time in the literature (Continued)

Study	Time (Actual/perceived)	Conclusion
(Pakdil & Harwood, 2005) Preoperative/outpatient	Subjective	1. It was found that patients' most highly ranked expectation is 'adequate information about their case' and the second one is 'adequate friendliness, courtesy'. 2. The largest gap occurred between the expectation of clinic waiting time and overall quality perceived. 3. SERVQUAL model was found to be useful in revealing differences between patients' preferences and their actual experience.
(Pitrou et al., 2009) ED in France	Objective, subjective, affective	1. Elevated waiting times appeared as the unique independent risk factor of patient dissatisfaction. 2. Communicating information on delays and reasons for delay could be an effective strategy to reduce perceived waiting times and improve patient satisfaction
(Arshad, 2014) Outpatient	Objective	1. There was very little difference between the actual and expected waiting times, which reflected a high level of satisfaction. The patients' satisfaction was 70%. 2. 87% of patients were happy with the time given for consultation. 3. There is a significant difference in distribution of waiting times across different days of the week. 4. The waiting times across the study period increased with the number of patients seen each day. 5. The day of the week did not add significantly to the statistics for the prediction of waiting time.
(McMullen & Netland, 2013) Outpatient/eye clinic	objective	1. Minimizing the time patients spend waiting to see a provider can result in higher overall patient satisfaction scores, regardless of financial status 2. There was a significant correlation between the time patients spent waiting and overall patient satisfaction scores. 3. Patients who were not completely satisfied waited twice as long as those who were completely satisfied, regardless of whether patients received free care. 4. Satisfaction with the amount of time spent waiting was the strongest driver of overall satisfaction score.

Appendix 2.2: Studies of different aspects of the waiting time in the literature (Continued)

Study	Time (Actual/perceived)	Conclusion
(Anderson. et al., 2007) Outpatient	objective	1. Longer waiting times were associated with lower patient satisfaction; however, time spent with the physician was the strongest predictor of patient satisfaction. 2. The decrement in satisfaction associated with long waiting times is substantially reduced with increased time spent with the physician (5 minutes or more). 3. Importantly, the combination of long waiting time to see the doctor and having a short doctor visit is associated with very low overall patient satisfaction.
(Davis & Heineke, 1998) Fast-food	Objective, subjective (perception-expectation)	1. Findings tend to support the argument that perception of waiting time is a better predictor of customer satisfaction with waiting than either actual waiting time or the disconfirmation between perceived waiting time and expected waiting time. 2. Actual waiting time has a stronger influence over customer satisfaction with waiting time. 3. The perception of the waiting time is particularly important when customers feel time-pressured 4. The difference between the perceived wait and the expected wait (disconfirmation) does not predict satisfaction any better than the perception of the wait alone. 5. The study recommends using the measurement of perception alone to predict satisfaction with waiting time.
(Oche & Adamu, 2014) Outpatient	Objective	1. The overall satisfaction was above average (52%) Patients were satisfied (actual time of registration and clinic waiting time was measured). 2. Patients expressed their above average (65%) satisfaction with explanations provided by doctors, above average (65%) satisfaction with neatness of clinic environment, below average (48.5%) with communication with doctors. 3. Patients were dissatisfied with registration time, waiting time, and condition of consultation room. 4. Determinate satisfaction was felt according to total clinic waiting time, clinic waiting time, and age.
(Al-Borie & Sheikh Damanhouri, 2013) Inpatient	subjective	1. SERVQUAL proved to be reliable, valid and appropriate. 2. The results showed that sex, education, and occupation were significant in influencing inpatients' satisfaction. Only age was not significant.

Appendix 2.3: Socio-demographic factors included – support from different writers

Question	Reference	Comments
Q1. Gender	(Al-Borie & Sheikh Damanhouri, 2013; Barlow, 2002; Hurst, 1992)	
Q2. Age	(Adamu & Oche, 2014; Boss & Thompson, 2012; Chaker & Al-Azzab, 2011; Hurst, 1992)	In our questionnaire we used the same categories as were used by Anderson. et al. (2007).
Q3. Educational level	(Al-Borie & Sheikh Damanhouri, 2013).	
Q4. Occupation	(Adamu & Oche, 2014; Al-Borie & Sheikh Damanhouri, 2013)	
Q5. Nationality		The nationality was added in our questionnaire because most UAE residents are non-local
Q8. City		
Q53. Income	(Al-Borie & Sheikh Damanhouri, 2013; Chaker & Al-Azzab, 2011; Ir et al., 2011)	We used the categories used by Chaker & Al-Azzab, 2011). Other studies provided no details. (Pillay et al., 2011) has indicated that the high satisfaction despite the long waiting time may be due to the provision of an almost free service

Appendix 2.4: Section two questions – support from different literature

Question	Reference	Comments
Q6.Patient's last visit to the hospital	(Hurst, 1992)	
Q7. Hospital name		
Q9. Type of hospital visited (if it is private or public).	(Arasli, Ekiz, & Katircioglu, 2008; Hurst, 1992; Jabnoun & Chaker, 2003)	
Q10. Name of clinic	(Barlow, 2002) in eye clinic and (Bielen & Demoulin, 2007) in Radiology	Different studies were conducted in different clinics
Q11. Patient's last visit (if it was a first time visit or repeated)	(Anderson. et al., 2007; Barlow, 2002)	
Q12. How often the patient visit the same clinic	(Hurst, 1992)	This is to understand the frequency of visits which is related to Q.11. (Hurst, 1992) used previous appointments.
Q13. Waiting time for first appointment	(Hurst, 1992)	He used the waiting time since being referred.
Q14. Waiting time for second appointment	(Hurst, 1992)	He used the waiting time since being referred.
Q15. If the patient came alone to the hospital or accompanied	(Barlow, 2002)	
Q16. Length of waiting time from arrival to registration	(Anderson. et al., 2007) and (Adamu & Oche, 2014)	We used the same categories of length of waiting time as (Anderson. et al., 2007) but he used it only to ask about the perceived waiting time, while in our case we were asking about both perceived and expected. (Adamu & Oche, 2014) also used the categories of time to measure the perceived length of waiting time using different range of time. In this study, we asked about previous experience of the waiting time to see if there was a relationship between the patient's expectation, patient perception and their previous experience

Appendix 2.4: Section two questions – support from different literature (Continued)

Question	Reference	Comments
Q17. Previous experience of waiting time from arrival to registration		
Q18. Length of waiting time from registration until consultation time	(Hurst, 1992)	
Q19. Previous experience of waiting time from arrival to registration		
20. Length of time spent in consultation with the doctor	(Anderson. et al., 2007; Hurst, 1992)	When asking about the patient's perception and expectation of time spent in consultation with the doctor, we used the same category or range of time used by Anderson. et al. (2007) in his study of perceived waiting time.
Q21. specify the exact time you have spent with the doctor	(Anderson. et al., 2007; Hurst, 1992)	
Q22. Length of time for taking medicine from the pharmacy	(Brahmbhatt et al., 2011)	
Q23. Waiting time experience	(Bielen & Demoulin, 2007; Smidts & Pruyn, 1998)	
Q24. Patient's feelings about waiting time	(Bielen & Demoulin, 2007; Ir et al., 2011; Pitrou et al., 2009; Smidts & Pruyn, 1998)	
Q25. Causes of long waiting time		
1. Doctors starts clinic late	(Ir et al. (2011); Rohleder et al., 2011)	
2. Doctors are slow	(Rohleder et al., 2011)	
3. Patient unpunctuality.	(Fetter & Thompson, 1966); Reid, 1976)	
4. Understaffing/lack of staff including doctors	(Rohleder et al., 2011); (Clague et al., 1997); Potisek et al., 2007)	
5. Staff having rest hour at the same time.	(Pillay et al., 2011)	
6. Lack of supervision	Pillay et al. (2011)	

Appendix 2.4: Section two questions – support from different literature (Continued)

Question	Reference	Comments
7. Double booking	Santibáñez et al. (2009)	
8. Full attendance of the patient	Clague et al. (1997)	
9. Using computer systems	Pillay et al. (2011)	
10. Inefficient work process.	Ir et al. (2011)	
11. Too many forms to fill	Ir et al. (2011)	
12. Inappropriate design of clinic workflow and patient flow	Potisek et al. (2007); Racine and Davidson (2002); Reid (1976)	
13. Late start of clinic sessions	Harper and Gamlin (2003); Johnson and Rosenfeld (1968); Santibáñez et al. (2009); Zhu et al. (2012)	
14. Long consultation time	Clague et al. (1997)	
15. Inadequate facilities (number of examination/consult-ing rooms)	Ir et al. (2011)	
16. Crowded waiting lounge/room.	Pillay et al. (2011)	

Appendix 2.5: Section three questions and dimensions – support from different authors

	Tangibles (7 items)	Reference
Q26	Appearance	(Parasuraman et al., 1988)
Q31	Up-to date equipment	(Parasuraman et al., 1988)
Q32	Materials are visually appealing	(Parasuraman et al., 1988)
Q39	Best physical environment	(Babakus & Mangold, 1992; Brady & Cronin Jr, 2001; Cronin, Brady, & Hult, 2000; Elleuch, 2008)
Q41	Clean and comfortable environment & directional sign	(Al-Borie & Sheikh Damanhouri, 2013; Lim & Tang, 2000)
Q42	Clean, comfortable & attractive waiting room	(Al-Borie & Sheikh Damanhouri, 2013; Elleuch, 2008)
Q50	Excellent quality of facility	(Al-Borie & Sheikh Damanhouri, 2013; Cronin et al., 2000)
	Assurance (4 items)	
Q35	Environment free from danger, risk or doubt	(Cronin et al., 2000; Parasuraman et al., 1988)
Q46	Staff help patients by curing them, relieving their suffering	(Brady & Cronin Jr, 2001; Mangelsdorff, 1991; Sower et al., 2001)
Q47	Enough time with physician	(Arasli et al., 2008; Boss & Thompson, 2012)
Q48	Explain the diagnosis in language patient can understand	(Arasli et al., 2008; Boss & Thompson, 2012)
	Responsiveness (6 items)	
Q28	Not too busy to respond	(Parasuraman et al., 1988)
Q34	Employees knowledgeable	(Brady & Cronin Jr, 2001; Cronin et al., 2000; Elleuch, 2008; Parasuraman et al., 1988)
Q38	Inform patients about expected time of waiting	(Brady & Cronin Jr, 2001)
Q40	Layout should serve patients' needs	(Brady & Cronin Jr, 2001)
Q43	Enough physicians, nurses and staff	(Mangelsdorff, 1991; Sower et al., 2001)
Q49	Physician and staff friendly with patients	(Al-Borie & Sheikh Damanhouri, 2013; Brady & Cronin Jr, 2001; Lim & Tang, 2000)
	Empathy (4 items)	
Q27	Attend when patients have problems	(Parasuraman et al., 1988)
Q29	Have patient's best interest at heart	(Parasuraman et al., 1988)
Q30	Understand specific need of the patients	(Parasuraman et al., 1988)
Q37	Operate at times convenient to patients	(Parasuraman et al., 1988)
	Reliability (4 items)	
Q33	Diagnose care right first time	(Parasuraman et al., 1988)
Q36	Promise to do something at a certain time	(Parasuraman et al., 1988)
Q44	Seeing the same physician/the doctor of their choice	(Mangelsdorff, 1991)
Q45	Medical files and records are accurate and error free	(Al-Borie & Sheikh Damanhouri, 2013)
	Overall satisfaction	
Q51	I recommend this hospital to my family and friend	(Prentice, Davies, & Pizer, 2014; Zeithaml et al., 1996)
Q52	I am satisfied about the quality of the services provided to me	(Elleuch, 2008; Mangelsdorff, 1991)

Appendix 2.6: The questionnaire form

• تهدف هذه الدراسة إلى استقصاء آرائكم عن مدة رضاكم عن الخدمات المقدمة لكم في قطاع الخدمات الصحية، وذلك بهدف تحسين كفاءة الخدمات المقدمة وأوقات الإنتظار • Patient satisfaction survey is used to lend some exceptional insight into how to improve quality, care, and waiting time. Your opinion is essential for improving the efficiency of service provided and waiting time
• يرجى قراءة المعلومات المرفقة والخاصة بالدراسة و أيضاً المعلومات التي قد تهمكم بخصوص مشاركتكم في هذه الدراسة. • Please read the Participant information sheet for more information and clarification about the survey

Section 1: Socio-demographics	**القسم الأول: المعلومات الإجتماعية- الديموغرافية**
Please answer the following general questions about yourself.	الرجاء الإجابة على الأسئلة العامة التالية للتعريف بكم

1	**الجنس** Gender
.1	ذكر
	Male
.2	أنثى
	Female
2	**الفئة العمرية** **Age**
.1	من 18 إلى 24 سنة
	From 18 to 24 years old
.2	من 25 إلى 34 سنة
	From 25 to 34 years old
.3	من 35-44 سنة
	From 35 to 44 years old
.4	من 45 إلى 54 سنة
	From 45 to 54 years old
.5	55 سنة فما فوق
	55 years old and above
3	**المستوى التعليمي** **Educational level**
.1	ابتدائي
	Primary
.2	ثانوي
	Secondary
.3	جامعي
	Graduate
.4	دراسات عليا
	Post graduate
.5	أخرى....................................
	.... Others

4	المهنة **Occupation**	يرجى تحديد المسمة الوظيفي أو السنة الدراسية **Please specify what is your title/grade if applicable**
.1	طالب	
	Student	
.2	موظف حكومي	
	Working for government	
.3	موظف في القطاع الخاص	
	Working in private sector	
.4	رجل/سيدة أعمال	
	Have your own business	
.5	ربة منزل بدوام كامل	
	Full time house wife	
.6	لاتعمل	
	Unemployed	
.7	متقاعد	
	Retired	

5	**الجنسية...**
	....**Nationality**

Section 2: Hospital	**القسم الثاني: المستشفى**
Please provide us with the information about your last visit to the hospital about which you will provide your opinion in the following sections	يرجى تزويدنا بالمعلومات عن المستشفى/العيادة التي قمت بزيارتها و التي سوف تبدي رأيك بها في الأسئلة التالية

6	**متى كانت آخر مرة قمت بزيارة المستشفى** **When was the last time you visited a hospital**
1.	قبل أقل من شهر Less than one month ago
2.	ما بين شهر واحد إلى أقل من 3 أشهر From one month to less than 3 months ago
3.	ما بين 3 أشهر إلى أقل من 6 أشهر From 3 months to less than 6 months ago
4.	أكثر من 6 أشهر More than 6 months

7	**اسم المستشفى :..**
	......................................:Hospital name
8	**المدينة:...**
	....:City

9	**ما هو آخر نوع مستشفى قمت بمراجعته/زيارته** What was the last hospital you went to?	**لماذا إخترت الذهاب إلى المستشفى الحكومي أو الخاص** Why you choose to go to the public or private hospital?
.1	مستشفى حكومي Public hospital	
.2	مستشفى خاص Private hospital	

ما هي العيادة التي قمت بمراجعتها؟... What is the last clinic you visited?..	**10**

هل كانت هذه الزيارة الأولى لك لهذا العيادة Was this your first visit to this clinic?	11
نعم Yes	.1
لا No	.2

إذا كانت الإجابة ب لا، كم مرة قمت بزيارة المستشفى/العيادة خلال هذا العام If not, how often have you visited this department/hospital?	**12**
مرة واحدة على الأقل في الشهر At least once a month	.1
مرة واحدة كل ثلاثة أشهر Once every three months	.2
مرة واحدة كل 6 أشهر Once every 6 months	.3
مرة واحدة كل عام Once every year	.4
اقل مما هو المذكورة أعلاه Less than what is listed above	.5

ما هي المدة التي قضيتها تنتظر من أجل موعدك الأول لرؤية الطبيب How long did you have to wait to get your first appointment?	**13**
من يوم واحد إلى اسبوع **From 1 day to 1 week**	.1
من اسبوع إلى إلى شهر **From 1 week to 1 month**	.2
من شهر إلى شهرين **From 1 month to 2 months**	.3
من شهرين إلى 3 أشهر **From 2 months to 3 months**	.4
أكثر من 3 أشهر **More than 3 months**	.5
لا أذكر **I don’t remember**	.6

ما هي المدة التي قضيتها تنتظر من أجل موعدك التالي لروئية الطبيب How long did you have to wait to get your next appointment?	**14**
من يوم واحد إلى اسبوع **From 1 day to 1 week**	.1
من اسبوع إلى إلى شهر **From 1 week to 1 month**	.2
من شهر إلى شهرين **From 1 month to 2 months**	.3
من شهرين إلى 3 أشهر **From 2 months to 3 months**	.4
أكثر من 3 أشهر **More than 3 months**	.5
لا أذكر **I don’t remember**	.6

هل ذهبت إلى المستشفى لوحدك؟ Did you go to the hospital alone?	15
نعم Yes	.1
لا ، ماهي صلة قرابة المرافق؟.. If no, what is your relationship to this person?...	.2

طول فترة الانتظار من وقت الوصول إلى التسجيل Length of time form arrival until registration			**16**
كم من الوقت قضيت فعلياً منتظراً؟ How long did you have to **wait?**		كم من الوقت توقعت أن تقضي منتظراً؟ How long **did you expect** to wait?	
أكثر من 30 دقيقة More than 30 min	.1	أكثر من 30 دقيقة More than 30 min	.1
من 15 إلى 30 دقيقة From 15 to 30 min	.2	من 15 إلى 30 دقيقة From 15 to 30 min	.2
من 5 إلى 15 دقيقة From 5 to 15 min	.3	من 5 إلى 15 دقيقة From 5 to 15 min	.3
أقل من 5 دقائق Less than 5 min	.4	أقل من 5 دقائق Less than 5 min	.4

في زياراتك السابقة للعيادة ، كان طول فترة الانتظار من وقت الوصول إلى التسجيل In your previous visit (if any) to the clinic, was your waiting time from arrival until registration	17
نفس زيارتك الأخيرة The same as your last visit?	**.1**
أطول من زيارتك الأخيرة Longer than your last visit?	**.2**
أقصر من زيارتك الأخيرة Shorter than your last visit?	**.3**
لا ينطبق Not applicable	.4

طول فترة الانتظار من وقت التسجيل إلىرؤية الطبيب Length of waiting time from registration until seeing the doctor			18
كم من الوقت قضيت فعلياً منتظراً؟ How long did you have **to wait?**		كم من الوقت توقعت أن تقضي منتظراً؟ How long **did you expect** to wait	
أكثر من 60 دقيقة More than 60 min	1	أكثر من 60 دقيقة More than 60 min?	1
من 30 إلى 60 دقيقة From 30 to 60 min	2	من 30 إلى 60 دقيقة From 30 to 60 min?	2
من 15 إلى 30 دقيقة From 15 to 30 min	2	من 15 إلى 30 دقيقة From 15 to 30 min?	3
أقل من 15 دقيقة Less than 15 min	3	أقل من 15 دقيقة Less than 15 min?	4

19	**في زياراتك السابقة للعيادة ، كان طول فترة الانتظار من وقت التسجيل إلى رؤية الطبيب** In your previous visit (if any) to the clinic, was your waiting time from arrival until registration
1.	نفس زيارتك الأخيرة The same as your last visit?
2.	أطول من زيارتك الأخيرة Longer than your last visit?
3.	أقصر من زيارتك الأخيرة Shorter than your last visit?
4.	لا ينطبق Not applicable

20	**المدة التي قضيتها مع الطبيب** Length of time spent in consultation with the doctor		
	كم من الوقت **<u>توقعت أن تقضي</u>** مع الطبيب How long **<u>did you expect</u>** to spend with the doctor		كم من الوقت **<u>قضيت فعلياً</u>** مع الطبيب How long did **<u>you spend</u>** with the doctor
1.	أقل من 5 دقائق Less than 5 min?		أقل من 5 دقائق Less than 5 min?
2.	من 5 إلى 10 دقائق From 5 to 10 min?		من 5 إلى 10 دقائق From 5 to 10 min?
3.	أكثر من 10 دقائق More than 10 min?		أكثر من 10 دقائق More than 10 min?

21	**هل من الممكن أن تحدد الوقت الذي قضيته مع الطبيب في المرة السابقة؟... دقيقة**
	Can you specify the exact time you spent with the doctor?.................................. Minutes

22	**طول فترة الانتظار لإستلام الأدوية من الصيدلية** **Time spent on taking the medicine from the pharmacy**		
	كم من الوقت توقعت أن تقضي منتظراً؟ How long **<u>did you expect</u>** to wait		كم من الوقت قضيت فعلياً منتظراً؟ How long did you have to **<u>wait</u>**
1.	أكثر من 30 دقيقة More than 30 min?		أكثر من 30 دقيقة More than 30 min?
2.	من 15 إلى 30 دقيقة From 15 to 30 min?		من 15 إلى 30 دقيقة From 15 to 30 min?
3.	من 5 إلى 15 دقيقة From 5 to 15 min?		من 5 إلى 15 دقيقة From 5 to 15 min?
4.	أقل من 5 دقائق Less than 5 min?		أقل من 5 دقائق Less than 5 min?
5.	لا ينطبق Not applicable		

23	هل تعتبر فترة الإنتظار **Do you classify your waiting time experience as**
.1	**طويلة** Long
.2	**مقبولة** Acceptable
.3	**قصيرة** Short

24	هل من الممكن أت تصف لنا شعورك خلال فترة الإنتظار، هل هي **What was your feeling during the waiting time**
.1	**ضجر** Bored
.2	**متضايق** Stressed
.3	**راض** Satisfied

لا أعرف I don't know	غير موافق تماماً Strongly Don't Agree	غير موافق Don't Agree	محايد Neutral	موافق Agree	موافق تماماً Strongly Agree	الأسباب التي تؤدي إلى طول أوقات الأنتظار في المستشفى The causes of long waiting time	25
0	1	2	3	4	5	حضور الأطباء متأخرون عن ساعات عمل العيادة Doctors come to the clinic late	.1
0	1	2	3	4	5	بطىء الأطباء Doctors are slow	.2
0	1	2	3	4	5	عدم إلتزام المرضى بالمواعيد Patient don't adhere to their appointment time	.3
0	1	2	3	4	5	يذهب الموظفون للراحة في نفس الوقت Staff have their rest hour at the same time	.4
0	1	2	3	4	5	قلة عدد الموظفين بما فيهم الأطباء Understaffing including doctors	.5
0	1	2	3	4	5	نقص الإشراف Lack of supervision	.6
0	1	2	3	4	5	حجز موعد واحد لأكثر من مريض في نفس الوقت للمتابعة عند نفس الطبيب Double booking	.7
0	1	2	3	4	5	حضور جميع المرضى لمواعيدهم Full attendance of patients	.8
0	1	2	3	4	5	استخدام الكمبيوتر Using computer systems	.9
0	1	2	3	4	5	عدم كفاءة طريقة أداء العمل Inefficient work processing	.10
0	1	2	3	4	5	وجود نماذج كثيرة تحتاج لملئها Too many forms to fill	.11
0	1	2	3	4	5	عدم ملائمة تصميم العيادة/المستشفى لتدفق العمل في العيادة والمرضى Inappropriate design of clinic workflow and patient flow	.12
0	1	2	3	4	5	التأخير في بدء عمل العيادات Late start of clinic sessions	.13
0	1	2	3	4	5	طول الوقت الذي يقضيه المريض مع الطبيب الإستشارة Long consultation time	.14
0	1	2	3	4	5	عدد غرف الفحص وغرف الأستشارات غير كافي Inadequate number of examination/consultation rooms	.15
0	1	2	3	4	5	إزدحام غرف وقاعات الإنتظار Crowded waiting lounge/room.	.16

Section 3: Service Quality	**القسم الثالث**: جودة الخدمات
Please express your opinion by using a number that best shows your expectations and opinion about institutions offering healthcare services. Each question in this section is measured by your expectation and your actual opinion.	**يرجى التعبير عن رأيك عن أفضل توقعاتك ومطابقة الوضع الحالي لتوقعاتك باستخدام الرقم الذي يظهر حول خدمات الرعاية الصحية. كل سؤال في هذا القسم يقاس بتوقعاتك ورأيك بالنسبة للوضع الحالي**

العناية والإهتمام Art of Care									
الوضع الحالي Perceived/Actual					**المتوقع Expected**				
غير موافق تماماً	غيرموافق	محايد	موافق	موافق تماماً	غير موافق تماماً	غيرموافق	محايد	موافق	موافق تماماً
Strongly Don't Agree	**Don't Agree**	**Neutral**	**Agree**	**Strongly Agree**	**Strongly Don't Agree**	**Don't Agree**	**Neutral**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
المظهر الخارجي لموظفي المستشفى مرتب و أنيق					يجب أن يكون المظهر الخارجي لموظفي المستشفى مرتب و أنيق				
Hospital employees appear well-groomed and neat					The hospital employees should appear well-groomed and neat				
1	2	3	4	5	1	2	3	4	5
يتعامل موظفي المستشفى بتعاطف و طمأنينة مع المرضى الذين لديهم مشاكل وهم على استعداد تام لمساعدة المرضى					يجب أن يعامل موظفي المستشفى المرضى الذين لديهم مشاكل بتعاطف و طمأنينة وأن يكونوا على استعداد تام لمساعدتهم				
When patients have problems, the hospital's employees are sympathetic, reassuring and willing to help					When patients have problems, hospital employees should be sympathetic, reassuring and willing to help				
1	2	3	4	5	1	2	3	4	5
العاملون في المستشفى على استعداد تام للرد على طلبات المرضى حتى في حال انشغالهم و دائما ما يولونهم الاهتمام بشكل شخصي.					يجب على موظفي المستشفى الإستجابة للمرضى حتى في حال انشغالهم وأن يولونهم الإهتمام بشكل شخصي				
Hospital Employees are never too busy to respond to your requests and always give them personal attention.					The hospitals' employee will never be too busy to respond to patients' requests and will give patients personal attention				
1	2	3	4	5	1	2	3	4	5
يضع المستشفى مصلحة المرضى فوق جميع الأولويات					يجب على المستشفيات وضع مصلحة مرضاهم نصب أعينهم				
The hospital has patients' best interests at heart.					It is realistic to expect hospitals to have their patients' best interests at heart.				
1	2	3	4	5	1	2	3	4	5
لدى موظفي المستشفى القدرة على فهم احتياجات المرضى الخاصة					يجب على موظفي المستشفى فهم احتياجات المرضى الخاصة				
The employees of the hospital understand my specific needs					The employees of an excellent hospital will understand the specific needs of their patients				
1	2	3	4	5	1	2	3	4	5

										الجانب الفني **Technical Aspect**
الوضع الحالي Perceived/Actual					**المتوقع** Expected					
يتوفر في المستشفى أحدث المعدات الطبية The hospital has up-do-date equipment					يجب أن يتوفر في المستشفى أحدث المعدات الطبية Hospitals should have up-to-date equipment					**.31**
1	2	3	4	5	1	2	3	4	5	
الكتيبات التوعوية و المستندات المقدمة للمرضى واضحة و مقبولة شكلياً Materials associated with the service (such as pamphlets or statements) are visually appealing at the hospital					يجب أن تكون الكتيبات التوعوية و المستندات المقدمة للمرضى واضحة و مقبولة شكلياً Materials associated with the service (such as pamphlets or statements) will be visually appealing at an excellent hospital					**.32**
1	2	3	4	5	1	2	3	4	5	
يتم بتشخيص حالات المرضى بشكل صحيح من المرة الأولى The hospital diagnoses my case right the first time					يجب أن يتم تشخيص حالة المريض بشكل صحيح من المرة الأولى. Excellent hospitals will diagnose cases right the first time					**.33**
1	2	3	4	5	1	2	3	4	5	
يمكنني الاعتماد على موظفي المستشفى في معرفة وظائفهم I can rely on the hospital's employees knowing their jobs					يجب أن يكون موظف المستشفى ملماً بوظيفته Hospital employees should be reliable and know their job					**.34**
1	2	3	4	5	1	2	3	4	5	
يقدم هذا المستشفى بيئة خالية من المخاطر This hospital provides an environment that is free from danger, risk, or doubt.					يجب أن تكون المستشفيات بيئة خالية من المخاطر Hospitals should have an environment which is free from danger, risk or doubt.					**.35**
1	2	3	4	5	1	2	3	4	5	
										امكانية الوصول/الملائمة **Accessibility/convenience**
الوضع الحالي Perceived/Actual					**المتوقع** Expected					
يقدم المستشفى جميع الخدمات في الأوقات التي يتم الوعد بها The hospital provides its service at the time it promises to do so.					يجب على المستشفى تقديم جميع الخدمات في الأوقات التي يتم الوعد بها Excellent hospitals will provide the service at the time they promise to do so.					**.36**
1	2	3	4	5	1	2	3	4	5	
ساعات عمل المستشفيات مناسبة لجميع المرضى The hospital has operating hours convenient to all its patients					يجب أن تكون ساعات عمل المستشفيات مناسبة لجميع المرضى Excellent hospitals will have operating hours convenient to all their patients.					**.37**
1	2	3	4	5	1	2	3	4	5	

الجانب الفني **Technical Aspect**										
الوضع الحالي Perceived/Actual					**المتوقع** Expected					
تم ابلاغي بالفترة الزمنية المتوقعة للانتظار I was informed about the expected waiting time					يجب على المستشفيات إبلاغ المرضى حول المدة المتوقعة للانتظار Excellent hospitals should inform patients about their expected time of waiting					**38.**
1	2	3	4	5	1	2	3	4	5	
بيئة المستشفى **Physical environment**										
الوضع الحالي Perceived/Actual					**المتوقع** Expected					
إن بيئة المستشفى هي واحدة من أفضل البيئات بين المستشفيات The hospital's physical environment is one of the best in its industry					يجب أن تكون بيئة المستشفى (physical environment) واحدة من أفضل البيئات بين المستشفيات The physical environment of an excellent hospital should be one of the best in its industry					**39.**
1	2	3	4	5	1	2	3	4	5	
تصميم المستشفى يخدم احتياجاتي The hospital's layout serves my purposes.					يجب أن يخدم تصميم المستشفى احتياجات المرضى Excellent hospital layout should serve patients' needs					**40.**
1	2	3	4	5	1	2	3	4	5	
هذا المستشفى لديه بيئة نظيفة ومريحة مع وضوح اللوحات الإرشادية This hospital has a clean and comfortable environment with good directional signs					يجب أن تكون بيئة المستشفى نظيفة ومريحة مع وضوح اللوحات الإرشادية The hospital should have a clean and comfortable environment with good directional signs					**41.**
1	2	3	4	5	1	2	3	4	5	
غرف الانتظار في المستشفى نظيفة ومريحة و جذابة وسهل الوصول إليها The hospital waiting rooms are clean, comfortable, reachable and attractive					يجب أن تكون غرفة الانتظار في المستشفى نظيفة ومريحة و جذابة وسهل الوصول إليها The excellent hospitals should have a clean, comfortable, attractive and reachable waiting room					**42.**
1	2	3	4	5	1	2	3	4	5	

										التوفر والإتاحة **Availability**
الوضع الحالي Perceived/Actual					**المتوقع** Expected					
هناك ما يكفي من الأطباء والممرضين و غيرهم من الموظفين في المستشفى There are enough doctors, nurses, and other staff					يجب أن يكون في المستشفى عدداً كافياً من الأطباء والممرضين و غيرهم من الموظفين Hospitals should have enough doctors, nurses and other staff					**.43**
1	2	3	4	5	1	2	3	4	5	

										استمرارية العلاج **Continuity of care**
الوضع الحالي Perceived/Actual					**المتوقع** Expected					
أقابل نفس الطبيب في كل مرة عند زيارتي لنفس العيادة أو تكون لي حرية إختيار الطبيب I always receive care from the same doctors when I visit the same clinic or I can choose a doctor					يجب أن يعاين المريض نفس الطبيب في كل مرة يأتي فيها إلى العيادة أو تكون له حرية إختيار الطبيب The patient should be seen by the same doctors every time he comes to the same clinic or should be able to choose the doctor					**.44**
1	2	3	4	5	1	2	3	4	5	
في جميع الأوقات التي زرت فيها العيادة، كانت كل السجلات و نتائج الفحوصات في الملف الطبي الخاص بي Every time I visited the clinic, all my records and examination results were in my medical file					يجب على المستشفى الإحتفاظ بجميع سجلات المرضى و نتائج الفحوصات في الملف الطبي للمريض The hospitals should maintain all patient records and examination results in the patient's medical file					**.45**
1	2	3	4	5	1	2	3	4	5	
										فعالية العلاج **Efficacy/outcome of care**
الوضع الحالي Perceived/Actual					**المتوقع** Expected					
في جميع الأوقات التي زرت فيها الطبيب ، ساعدني على أن أشفى من مرضي وخفف من آلامي وساعدني على الوقاية من الأمراض Every time I visited the doctor, he helped me to be cured and relieved my suffering					يجب على الأطباء مساعدة المرضى عن طريق علاجهم ، والتخفيف من معاناتهم و وقايتهم من الأمراض Doctors should help patients by curing them, relieving their suffering and preventing diseases					**.46**
1	2	3	4	5	1	2	3	4	5	

										العلاقة اشخصية **Interpersonal Components**
الوضع الحالي					**المتوقع**					
Perceived/Actual					Expected					
أنا دائما أقضي وقتاً كافياً مع الطبيب I always spend enough time with the doctors					يجب أن يقضي المريض الوقت الكافي مع الطبيب Patient should have enough time with the doctors					**.47**
1	2	3	4	5	1	2	3	4	5	
يشرح الطبيب لي دائما التشخيص والعلاج والرعاية المناسبة لي بلغة وطريقة أفهمها My doctors always explain the diagnosis, treatment and care in a language that I can understand					يجب أن يشرح الطبيب التشخيص والعلاج والرعاية المناسبة بلغة و طريقة يفهمها المريض Doctors should explain the diagnosis, treatment and care in language that patients can understand					**.48**
1	2	3	4	5	1	2	3	4	5	
الأطباء و الموظفون يعاملوني بطريقة ودية The doctors and staff are always friendly with me					يجب أن يعامل الأطباء و الموظفون المرضى بطريقة ودية The doctors and staff should be friendly with patients					**.49**
1	2	3	4	5	1	2	3	4	5	

										المرافق ووسائل الراحة **(Amenities (facility appeal and comfort**
الوضع الحالي					**المتوقع**					
Perceived/Actual					Expected					
مرافق المستشفى ممتازة The quality of the hospital is excellent					يجب أن تكون مرافق المستشفى ممتازة Excellent hospitals should have excellent facilities					**.50**
1	2	3	4	5	1	2	3	4	5	

						الرضى العام **Overall service satisfaction**
	أوصي أقاربي وأصدقائي بزيارة هذا المستشفى I would recommend this hospital to my family and friends					**.51**
	1	2	3	4	5	
	نوعية الخدمات المقدمة لي في المستشفى ممتازة I am satisfied with the quality of the services provided to me					**.52**
	1	2	3	4	5	

.53	الراتب الشهري **Monthly Salary Range**
1.	أقل من 5,000 less than 5000,
2.	من 5,000 – 25,000 from 5000 – 25,000,
3.	من 25,000 – 50,000 from 2500 – 50,000,
4.	أكثر من 50,000 more than 50,000

معلومات عن المشارك

Participant's information details

إسم المشارك **Name of participant**		التاريخ **Date**		التوقيع **Signature**	
تفاصيل الإتصال **Participant's Contact number**	الهاتف المتحرك Mobile		الهاتف الثابت Landline		
البريد الإلكتروني					

Appendix 2.7: Healthcare service dimensions – average gap score calculation

Healthcare Service Dimensions				
	Art of Care			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q26	Hospital employee appearance (well-groomed and neat)	4.65	4.09	-0.56
Q27	When patients have problems, employees should be sympathetic, reassuring, and willing to help	4.61	3.79	-0.82
Q28	Employees will never be too busy to respond to patients' requests and will give patients personal attention	4.45	3.61	-0.84
Q29	The hospital has the patient's best interest at heart	4.65	3.66	-0.99
Q30	The employees of an excellent hospital will understand the specific needs of the patients	4.56	3.61	-0.95
	Total	22.92	18.76	-4.16
	Average			-.83
	Technical Aspects			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q31	Up-to-date equipment	4.97	4.80	-0.17
Q32	Materials are visually appealing	4.67	4.66	-0.01
Q33	The right care is diagnosed first time	4.66	3.61	-1.05
Q34	Employees are knowledgeable	4.76	3.77	-0.99
Q35	Environment free from danger, risk or doubt	4.74	4.03	-0.71
	Total	23.8	20.87	-2.93
	Average			-0.59
	Accessibility/convenience			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q36	Staff will promise to do something at a certain time	4.77	3.81	-0.96
Q37	- will arrange operating hours convenient to patients	4.73	3.84	-0.89
Q38	- inform patients about the expected time of waiting	4.69	3.37	-1.32
	Total	14.19	11.02	-3.76
	Average			-0.94

	Physical Environment			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q39	The best physical environment	4.78	4.77	-0.01
Q40	- layout should serve patient's needs	4.81	3.92	-0.89
Q41	- clean and comfortable environment & directional signs	4.79	4.77	-0.02
Q42	- clean, comfortable & attractive waiting room	4.8	4.78	-0.02
	Total	19.18	18.24	-0.94
	Average			-0.24
	Availability			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q43	enough physicians, nurses and staff (expectation)	4.76	3.68	-1.08
	Total	4.76	3.68	-1.08
	Average			-1.08
	Continuity of care			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q44	seeing the same physician/the doctor of their choice	4.65	3.82	-0.83
Q45	- medical files and records are accurate and error free	4.80	4.29	-0.51
	Total	14.21	11.79	-1.34
	Average			-0.67
	Efficacy/outcome of care			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q46	help patient by curing them, relieving their sufferings	4.8	4.04	-0.76
	Total	4.8	4.04	-0.76
	Average			-0.76
	Interpersonal Components			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q47	enough time with physician	4.79	3.96	-0.83
Q48	- explain the diagnosis in language patient understand	4.94	4.12	-0.82
Q49	- physician and staff friendly with patients (expectation)	4.8	4.06	-0.74
	Total	14.53	12.14	-2.39
	Average			-0.80

	Amenities/facility appeal and comfort			
		Qa(Expectation)	Qb (Perception)	Qb-Qa
Q50	Excellent quality of facility (expectation)	4.84	4.82	-0.02
	Total	4.84	4.82	-0.02
	Average			-0.02

	Dimensions	Average	Largest Gap Order
	Art of Care	-0.83	3
	Technical Aspects	-0.59	7
	Accessibility/convenience	-0.94	2
	Physical Environment	-0.24	8
	Availability	-1.08	1
	Continuity of care	-0.67	6
	Efficacy/outcome of care	-0.76	5
	Interpersonal Components	-0.80	4
	Amenities/facility appeal and comfort	-0.02	9
	Average	-0.66	

Appendix 2.8: SERVQUAL dimensions – average gap score calculation

UNWEIGHTED SERVQUAL SCORE				
Average Gap Score for Dimensions Obtain an average Gap Score for each dimension by assessing the Gap Scores for each of the statements that constitute the dimension and dividing the sum by the number of statements making up the dimension.				
	Tangibles (7 Items)	Qa (Expectation)	Qb (Perception)	Qb-Qa
Q26	Appearance	4.65	4.09	-0.56
Q31	up-to date equipment	4.97	4.8	-0.17
Q32	materials are visually appealing	4.67	4.66	-0.01
Q39	physical environment the best	4.78	4.77	-0.01
Q41	clean and comfortable environment & directional sign	4.79	4.77	-0.02
Q42	clean, comfortable & attractive waiting room	4.8	4.78	-0.02
Q50	excellent quality of facility	4.84	4.82	-0.02
	Gap Score - Tangibles	33.2	33.33	-0.81
	Average Tangibles SERVQUAL score			-0.12
	Assurance (4 Items)	Qa (Expectation)	Qb (Perception)	Qb-Qa
Q35	Environment free from danger, risk or doubt	4.74	4.03	-0.71
Q46	help patient by curing them, relieving their suffering	4.8	4.04	-0.76
Q47	enough time with physicians	4.79	3.96	-0.83
Q48	explain the diagnosis in language patients can understand	4.94	4.12	-0.82
	Gap Score - Assurance	19.28	16.15	-3.12
	Average Assurance SERVQUAL score			-0.78
	Responsiveness (6 Items)	Qa (Expectation)	Qb (Perception)	Qb-Qa
Q28	Not too busy to respond	4.45	3.61	-0.84
Q34	employee knowledgeable	4.76	3.77	-0.99
Q38	inform patients about expected time of waiting	4.69	3.37	-1.32
Q40	layout should serve patient's needs	4.81	3.92	-0.89
Q43	enough physicians, nurses and staff	4.76	3.68	-1.08
Q49	physician and staff friendly with patients	4.8	4.06	-0.74
	Gap Score - Responsiveness	28.26	22.39	-5.87
	Average Responsiveness SERVQUAL score			-0.98

	Empathy (4 Items)	Qa (Expectation)	Qb (Perception)	Qb-Qa
Q27	When patients have problems	4.61	3.79	-0.82
Q29	patient's best interest at heart	4.65	3.66	-0.99
Q30	understand specific need of the patients	4.56	3.61	-0.95
Q37	operating hours convenient to patients	4.73	3.84	-0.89
	Gap Score - Empathy	18.56	14.91	-3.65
	Average Empathy SERVQUAL score			-0.91
	Reliability (4 Items)	Qa (Expectation)	Qb (Perception)	Qb-Qa
Q33	Diagnose care right first time	4.66	3.61	-1.04
Q36	promise to do something at a certain time	4.77	3.81	-0.96
Q44	seeing the same physician/the doctor of their choice	4.65	3.82	-0.83
Q45	medical files and records are accurate and error free	4.8	4.29	-0.51
	Gap Score - Reliability	18.88	15.54	-3.35
	Average Empathy SERVQUAL score			-0.84

<u>CALCULATIONS TO OBTAIN UNWEIGHTED SERVQUAL SCORE :</u>
Transfer the average dimension SERVQUAL scores (for all five dimensions) from the SERVQUAL instrument. Sum up the scores and divide them by five to obtain the unweighted measure of service quality.

		Average score	Largest gap order
	Average Tangible SERVQUAL score	-0.12	5
	Average Assurance SERVQUAL score	-0.78	4
	Average Responsiveness SERVQUAL score	-0.98	1
	Average Empathy SERVQUAL score	-0.91	2
	Average Reliability SERVQUAL score	-0.84	3
	AVERAGE UNWEIGHTED SERVQUAL SCORE	-0.72	

Appendix 2.9: Testing the assumptions of the multiple linear regression

Multiple regression was chosen as the preferred method to model the relationship between the dependent and IVs because it not only accommodates multiple IVs but also has more than three measurement variables where two are dependent (Y) variables and the remainder are independent (X) variables. The multiple regression technique evaluated whether the model provided a reasonable fit to the data and the contribution of each of the IVs to the DVs (Tabachnick & Fidell, 2007)

1. Considerations for Multiple Regression

The following is a summary checklist of the data analysis plans for the standard multiple regression of the study (Tabachnick & Fidell, 2007)
Issues

- 1.1. Ratio of cases to IVs
- 1.2. Normality, linearity, and homoscedasticity of residuals
- 1.3. Outliers

1.1 Ratio of Cases to IVs

Green (1991) makes two rules of thumb for the minimum acceptable sample size,

1. First on the basis of the test the overall fit of regression model (i.e. testing the R2), and
2. Second on the basis of the test of the individual predictors within the model (i.e. testing the b-values of the model).

- For the overall test of the model, a minimum sample size of 50 + 8k, where k is the number of predictors. So, with five predictors, a sample size of 50 + 40 = 90 is needed.
- For testing individual predictors he suggests a minimum sample size of 104 + k, so again taking the example of 5 predictors a sample size of 104 + 5 = 109 is needed.

With a 552 respondents and 33 IVs, the number of cases were well above the minimum requirement of 137 (104 + 33) for testing individual predictors in standard multiple regression.

Moreover, we followed the rule of five subjects for one variable to determine the sample size, as suggested by Alquraini (2003). In this study we identified 42 attributes, so the ideal sample size should be 210 (42 X 5= 210). The sample of this study was n = 552, which exceeded the required number by a margin of 342 samples. At the same time, if the SERVQUAL attributes which total 25 had a required sample size of 125 (=25 X 5) the sample size of this study exceeds this also.

1.2 Normality, Linearity, and Homoscedasticity of Residuals

a) The normality of the variables was assessed through two components, skewness and kurtosis. This was achieved with statistical and graphical methods (Tabachnick & Fidell, 2007).

b) Linearity was considered since the Pearson's r captured the linear relationships among the variables (Tabachnick & Fidell, 2007) and was assessed through scatterplots inspection.
c) The homoscedasticity or the assumption of homogeneity data of variance was considered since one of the variables was discrete (service quality and waiting time satisfaction) and the other was continuous (Tabachnick & Fidell, 2007).

1.3 Outliers

Outliers in the dependent and IVs were examined using output from the Mahalanobis distance in SPSS, which is a commonly used procedure identifying outliers and calculating the distance of specific scores on the basis of the remaining cases within the centre cluster (Tabachnick & Fidell, 2007).

Appendix 2.10: Summary of hypotheses testing –multiple regression analysis

H1.1: satisfaction about waiting time affects patient satisfaction	*Delta Q16: satisfaction (waiting from arrival to registration)* *Delta Q18: Satisfaction (waiting from registration to consultation)* *Delta Q22: Satisfaction (waiting at pharmacy)* *Q23: Do you classify your waiting time experience as (long, acceptable, short)* *Q24: what was your feeling about the waiting time (not satisfied, satisfied)* *+* *Delta Q 26 – 50 (average): satisfaction (Average SERVQUAL)*	*1. The results indicate a statistically significant (p=.009) positive (β=.099) relationship with the satisfaction from arrival to registration.* *2. The results indicate a statistically significant (p=.002) positive (β=.169) relationship with the waiting time experience*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.246a	.060	.051	.761	1.464

a. Predictors: (Constant), Q22_b_a_R, Q24_R, Q18_b_a_R, Q23_R, Q16_b_a_R

b. Dependent Variable: Delta_SERVQUAL

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.223	5	3.845	6.633	.000[b]
	Residual	299.066	516	.580		
	Total	318.289	521			

a. Dependent Variable: Delta_SERVQUAL
b. Predictors: (Constant), Q22_b_a_R, Q24_R, Q18_b_a_R, Q23_R, Q16_b_a_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.191	.120		-9.944	.000					
	Q23_R	.169	.054	.142	3.117	.002	.182	.136	.133	.874	1.145
	Q24_R	.057	.042	.062	1.357	.175	.130	.060	.058	.871	1.148
	Q16_b_a_R	.099	.038	.124	2.614	.009	.166	.114	.112	.806	1.241
	Q18_b_a_R	.040	.039	.048	1.027	.305	.118	.045	.044	.823	1.215
	Q22_b_a_R	.001	.036	.001	.025	.980	.078	.001	.001	.877	1.141

a. Dependent Variable: Delta_SERVQUAL

H1.1 – Re-Run with significant variables Q16 and Q23

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.219a	.048	.044	.787	1.433

a. Predictors: (Constant), Q16_b_a_R, Q23_R

b. Dependent Variable: Delta_SERVQUAL

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.028	2	8.514	13.764	.000b
	Residual	339.607	549	.619		
	Total	356.635	551			

a. Dependent Variable: Delta_SERVQUAL

b. Predictors: (Constant), Q16_b_a_R, Q23_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.081	.102		-10.591	.000					
	Q23_R	.179	.051	.146	3.478	.001	.163	.147	.145	.986	1.014
	Q16_b_a_R	.124	.035	.146	3.493	.001	.164	.147	.145	.986	1.014

a. Dependent Variable: Delta_SERVQUAL

H1.2: satisfaction about waiting time affects patient satisfaction	*Delta Q16: satisfaction (waiting from arrival to registration)* *Delta Q18: Satisfaction (waiting from registration to consultation)* *Delta Q22: Satisfaction (waiting at pharmacy)* *Q23: Do you classify your waiting time experience as (long, acceptable, short)* *Q24: what was your feeling about the waiting time (not satisfied, satisfied)* *+* *Q51: I would recommend this hospital to my family and relatives*	*The results indicate:* *1. A statistically significant (p=.010) positive relationship (β=.123) between waiting from arrival to registration and patients' recommending the hospital to others* *2. A significantly (p=.000) positive correlation (β=.211) between waiting feeling and patients' recommending the hospital to others*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.233a	.055	.045	.923	1.851

a. Predictors: (Constant), Q22b_a_R, Q24_R, Q18b_a_R, Q23_R, Q16b_a_R

b. Dependent Variable: Q51

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.441	5	4.888	5.742	.000b
	Residual	423.932	498	.851		
	Total	448.373	503			

a. Dependent Variable: Q51

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.356	.149		22.597	.000					
	Q23_R	.044	.067	.031	.656	.512	.096	.029	.029	.876	1.142
	Q24_R	.211	.052	.190	4.058	.000	.199	.179	.177	.870	1.150
	Q16b_a_R	.123	.047	.124	2.600	.010	.117	.116	.113	.835	1.198
	Q18b_a_R	-.066	.048	-.064	-1.356	.176	.003	-.061	-.059	.851	1.175
	Q22_b_a_R	-.037	.045	-.038	-.824	.410	.013	-.037	-.036	.892	1.121

a. Dependent Variable: Q51

H1.2 – Re-Run the model after removing the non-significant variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.220a	.049	.045	.923	1.846

a. Predictors: (Constant), Q24_R, Q16b_a_R

b. Dependent Variable: Q51

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.761	2	10.880	12.778	.000b
	Residual	426.612	501	.852		
	Total	448.373	503			

a. Dependent Variable: Q51

b. Predictors: (Constant), Q24_R, Q16b_a_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.473	.111		31.206	.000		
	Q16b_a_R	.094	.043	.095	2.167	.031	.987	1.014
	Q24_R	.210	.049	.188	4.285	.000	.987	1.014

a. Dependent Variable: Q51

H2.1: patient's waiting time perception affects patient's waiting time satisfaction	*Q16.b: How long did you wait from arrival to registration?* *Q18.b: How long did you have to wait from registration to consultation time* *Q22.b: How long did you have to wait at the pharmacy to get your medicine* *+* *Delta/average Q(16, 18,22)*	1. *The result indicates a significant (p=.000) positive relationship (β=.172) between perceived waited time from arrival to registration with satisfaction of waiting time* 2. *The result indicates a significant (p=.000) positive relationship (β=.159) between perceived time waited from registration to consultation time and satisfaction with waiting time* 3. *The result indicates a significant (p=.000) positive relationship (β=.148) between perceived wait at the pharmacy and satisfaction with waiting time*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.564[a]	.318	.315	.576	1.704

a. Predictors: (Constant), Q22b_R, Q18b_R, Q16b_R
b. Dependent Variable: Delta_Q16_Q18_Q22

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85.026	3	28.342	85.331	.000[b]
	Residual	182.014	548	.332		
	Total	267.040	551			

a. Dependent Variable: Delta_Q16_Q18_Q22
b. Predictors: (Constant), Q22b_R, Q18b_R, Q16b_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1.596	.082		-19.520	.000					
	Q16b_R	.172	.026	.269	6.593	.000	.458	.271	.233	.747	1.340
	Q18b_R	.159	.028	.232	5.731	.000	.434	.238	.202	.756	1.322
	Q22b_R	.148	.025	.232	6.019	.000	.407	.249	.212	.835	1.198

a. Dependent Variable: Delta_Q16_Q18_Q22

H2.2: patient's waiting time perception affects patient's waiting time satisfaction	*Q16.b: How long did you have to wait from Arrival to registration?* *Q18.b: How long did you have to wait from registration to consultation* *Q22.b: How long did you have to wait at the pharmacy to get your medicine* *+* *Q23: Do you classify your waiting time experience as (long, acceptable, short)*	*1. The result indicates a significantly (p=.004) positive relationship (β=.080) between perceived waited time from arrival to registration with waiting time experience* *2. The result indicates a significant (p=.013) positive relationship (β=.073) between perceived wait from registration to consultation time and waiting time experience* *3. The result indicates a significantly (p=.000) positive relationship (β=.140) between perceived time spent waiting at the pharmacy and waiting time experience*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.372[a]	.138	.134	.610	1.916

a. Predictors: (Constant), Q22b_R, Q18b_R, Q16b_R
b. Dependent Variable: Q23_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32.749	3	10.916	29.338	.000b
	Residual	203.902	548	.372		
	Total	236.650	551			

a. Dependent Variable: Q23_R
b. Predictors: (Constant), Q22b_R, Q18b_R, Q16b_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.093	.087		12.626	.000					
	Q16b_R	.080	.028	.134	2.909	.004	.268	.123	.115	.747	1.340
	Q18b_R	.073	.029	.113	2.486	.013	.253	.106	.099	.756	1.322
	Q22b_R	.140	.026	.232	5.356	.000	.318	.223	.212	.835	1.198

a. Dependent Variable: Q23_R

H2.3: patient's waiting time perception affects patient's waiting time satisfaction	*Q16.b: How long did you have to wait from Arrival to registration?* *Q18.b: How long did you have to wait from registration to consultation time* *Q22.b: How long did you have to wait at the pharmacy to get your medicine* + *Q24: what was your feeling about the waiting time (not satisfied, satisfied)*	1. *The result indicates a significantly (p=.015) positive relationship (β=.099) between perceived waited from registration to consultation time and feeling about waiting time* 2. *The result indicates a significantly (p=.008) positive relationship (β=.096) between perceived wait at the pharmacy and feeling about waiting time* 3. *The result indicates <u>no significant (p=.124) relationship</u> between perceived wait from arrival to registration and feeling about waiting time*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.236[a]	.056	.050	.822	1.867

a. Predictors: (Constant), Q22b_R, Q18b_R, Q16b_R
b. Dependent Variable: Q24_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.645	3	6.882	10.184	.000[b]
	Residual	350.009	518	.676		
	Total	370.653	521			

a. Dependent Variable: Q24_R
b. Predictors: (Constant), Q22b_R, Q18b_R, Q16b_R

Coefficients[a]											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.058	.038	.074	1.541	.124	-.016	.133	.785	1.274	.058
	Q16b_R	.099	.041	.116	2.438	.015	.019	.179	.800	1.249	.099
	Q18b_R	.096	.036	.123	2.671	.008	.025	.166	.862	1.160	.096
	Q22b_R	.058	.038	.074	1.541	.124	-.016	.133	.785	1.274	.058

a. Dependent Variable: Q24R

H2.3– Re-run the model after removing the non-significant variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.227[a]	.051	.048	.823	1.874

a. Predictors: (Constant), Q22b_R, Q18b_R
b. Dependent Variable: Q24_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.040	2	9.520	14.052	.000[b]
	Residual	351.613	519	.677		
	Total	370.653	521			

a. Dependent Variable: Q24_R
b. Predictors: (Constant), Q22b_R, Q18b_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.451	.123		11.844	.000					
	Q18b_R	.121	.038	.142	3.171	.002	.183	.138	.136	.911	1.097
	Q22b_R	.109	.035	.139	3.112	.002	.182	.135	.133	.911	1.097

a. Dependent Variable: Q24_R

H3.1: Expected waiting time affects waiting time satisfaction	*Q16.a: How long did you expect to wait from arrival to registration* *Q18.a: How long did you expect to wait from registration to consultation* *Q22.a: How long did you expect to wait at the pharmacy* *+* *Delta (Q16, 18, 22)*	*1. The results indicate a statistically significant (p=.010) negative (-.091)relationship between the expected waiting time from arrival to registration and the satisfaction of waiting time* *2. The results indicate a statistically significant (p=.002) negative relationship (β=-.117) between the expected waiting time from registration to consultation and the satisfaction of waiting time* *3. The results indicate a statistically significant (p=.000) negative (-.110) relationship between the expected waiting time at pharmacy and the satisfaction with waiting time*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.329[a]	.108	.103	.659	1.855

a. Predictors: (Constant), Q22a_R, Q16a_R, Q18a_R
b. Dependent Variable: Delta_Q16_Q18_Q22

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.835	3	9.612	22.112	.000[b]
	Residual	238.205	548	.435		
	Total	267.040	551			

a. Dependent Variable: Delta_Q16_Q18_Q22
b. Predictors: (Constant), Q22a_R, Q16a_R, Q18a_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.574	.119		4.804	.000					
	Q16a_R	-.091	.035	-.122	-2.596	.010	-.241	-.110	-.105	.740	1.351
	Q18a_R	-.117	.038	-.150	-3.121	.002	-.265	-.132	-.126	.707	1.414
	Q22a_R	-.110	.030	-.158	-3.642	.000	-.246	-.154	-.147	.861	1.162

a. Dependent Variable: Delta_Q16_Q18_Q22

H3.2: Expected waiting time effects waiting time satisfaction	*Q16.a: How long did you expect to wait from arrival to registration* *Q18.a: How long did you expect to wait from registration to consultation* *Q22.a: How long did you expect to wait at the pharmacy* *+* *Q23: Do you classify your waiting time experience as (long, acceptable, short) – Affective aspect of waiting time*	*1. The results indicate a significantly (p=.029) positive relationship (β=.074) between the expected waiting time from arrival to registration and the waiting time experience cognitive aspect of waiting time* *2. The results indicate a significantly (p=.036) positive relationship (β=.076) between the expected waiting time from registration to consultation and waiting time experience* *3. The results indicate a significantly (p=.003) positive relationship (β=.088) between the expected waiting time at pharmacy and waiting time experience-*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.260[a]	.068	.063	.634	1.918

a. Predictors: (Constant), Q22a_R, Q16a_R, Q18a_R
b. Dependent Variable: Q23_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.046	3	5.349	13.287	.000[b]
	Residual	220.604	548	.403		
	Total	236.650	551			

a. Dependent Variable: Q23_R
b. Predictors: (Constant), Q22a_R, Q16a_R, Q18a_R

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.142	.115		9.938	.000					
	Q16a_R	.074	.034	.105	2.183	.029	.194	.093	.090	.740	1.351
	Q18a_R	.076	.036	.103	2.102	.036	.202	.089	.087	.707	1.414
	Q22a_R	.088	.029	.134	3.010	.003	.200	.128	.124	.861	1.162

a. Dependent Variable: Q23_R

H3.3: Expected waiting time affects waiting time satisfaction	*Q16.a: How long did you expect to wait from arrival to registration* *Q18.a: How long did you expect to wait from registration to consultation* *Q22.a: How long did you expect to wait at the pharmacy* *+* *Q24: what was your feeling about waiting time (not satisfied, satisfied) cognitive aspect of waiting time*	*The model is not statistically significant (p=.177)* *The results indicate that there is no relationship between the expected waiting time and the feeling about waiting time (affective aspect of waiting time).*

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.507	3	1.169	1.649	.177[b]
	Residual	367.146	518	.709		
	Total	370.653	521			

a. Dependent Variable: Q24_r
b. Predictors: (Constant), Q22a_R, Q16a_R, Q18a_R

H4.1: the perceived attractiveness of waiting environment affects positively the patients' waiting time satisfaction. – (occupied waiting time)	*Q32b: materials are visually appealing* *Q39b: the best physical environment* *Q41b: clean and comfortable environment & directional sign* *Q42b: The hospital waiting rooms are clean, comfortable, reachable and attractive* *+* *Delta (Q16, 18, 22)*	*The results indicate a statistically significant (p=.031) positive (B=.089)relationship between waiting time satisfaction and the perceived s cleanness, comfortableness, accessibility and attractiveness of the waiting room*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.154[a]	.024	.016	.666	1.933

a. Predictors: (Constant), Q42b, Q32b, Q39b, Q41b
b. Dependent Variable: Delta_Q16_Q18_Q22

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.632	4	1.408	3.173	.014[b]
	Residual	231.241	521	.444		
	Total	236.873	525			

a. Dependent Variable: Delta_Q16_Q18_Q22
b. Predictors: (Constant), Q42b, Q32b, Q39b, Q41b

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.839	.163		-5.137	.000					
	Q32b	-.021	.036	-.028	-.579	.563	.045	-.025	-.025	.795	1.258
	Q39b	.037	.043	.048	.868	.386	.109	.038	.038	.625	1.600
	Q41b	.021	.040	.029	.525	.600	.107	.023	.023	.598	1.672
	Q42b	.089	.041	.116	2.162	.031	.144	.094	.094	.647	1.547

a. Dependent Variable: Delta_Q16_Q18_Q22

H4.1– Re-run the model after removing the non-significant variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.116[a]	.013	.012	.686	1.927

a. Predictors: (Constant), Q42b
b. Dependent Variable: Delta_Q16_Q18_Q22

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.434	1	3.434	7.303	.007[b]
	Residual	251.102	534	.470		
	Total	254.536	535			

a. Dependent Variable: Delta_Q16_Q18_Q22
b. Predictors: (Constant), Q42b

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.710	.131		-5.439	.000					
	Q42b	.091	.034	.116	2.702	.007	.116	.116	.116	1.000	1.000

a. Dependent Variable: Delta_Q16_Q18_Q22

H4.2: the perceived attractiveness of the waiting environment affects patients' waiting time satisfaction (occupied waiting time.)	*Q32b: materials are visually appealing* *Q39b: the best physical environment* *Q41b: clean and comfortable environment & directional signs* *Q42.b: The hospital waiting rooms are clean, comfortable, accessible and attractive* *+* *Q23: Do you classify your waiting time experience as (long, acceptable, short)*	*The results indicate no statistical significant relationship*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.121[a]	.015	.007	.650	1.878

a. Predictors: (Constant), Q42b, Q32b, Q39b, Q41b
b. Dependent Variable: Q23_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.280	4	.820	1.942	.102[b]
	Residual	219.997	521	.422		
	Total	223.278	525			

a. Dependent Variable: Q23_R
b. Predictors: (Constant), Q42b, Q32b, Q39b, Q41b

H4.3: the perceived attractiveness of the waiting environment affects positively the patients' waiting time satisfaction. – (occupied waiting time)	*Q32b: materials are visually appealing* *Q39b: the best physical environment* *Q41b: clean and comfortable environment & directional signs* *Q42.b: The hospital waiting rooms are clean, comfortable, reachable and attractive* + *Q24: what was your feeling about waiting time (not satisfied, satisfied) cognitive aspect of waiting time*	The results indicate a statistically significant (p=.001) positive relationship (β=+.178) between the physical environment and the affective aspect of waiting time satisfaction

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.201[a]	.040	.032	.836	1.929

a. Predictors: (Constant), Q42b, Q32b, Q39b, Q41b
b. Dependent Variable: Q24_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.471	4	3.618	5.173	.000[b]
	Residual	345.476	494	.699		
	Total	359.948	498			

a. Dependent Variable: Q24_R
b. Predictors: (Constant), Q42b, Q32b, Q39b, Q41b

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.288	.208		6.200	.000					
	Q32b	.065	.046	.070	1.420	.156	.125	.064	.063	.796	1.256
	Q39b	.178	.054	.183	3.284	.001	.185	.146	.145	.628	1.592
	Q41b	-.056	.051	-.063	-1.103	.271	.074	-.050	-.049	.594	1.683
	Q42b	.022	.053	.023	.410	.682	.105	.018	.018	.630	1.588

a. Dependent Variable: Q24_R

H4.3_ Re-run after removing all non- significant variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.189[a]	.036	.034	.831	1.925

a. Predictors: (Constant), Q39b
b. Dependent Variable: Q24_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.002	1	13.002	18.822	.000[b]
	Residual	351.601	509	.691		
	Total	364.603	510			

a. Dependent Variable: Q24_R
b. Predictors: (Constant), Q39b

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.383	.162		8.519	.000					
	Q39b	.183	.042	.189	4.338	.000	.189	.189	.189	1.000	1.000

a. Dependent Variable: Q24_R

H5.1: Uncertain waiting time affects a patient's waiting time satisfaction	*Q38.b: I was informed about the expected waiting time* + *Delta Q16+18+22*	There is a statistically significant (p=.000) positive correlation (β=.107) between the information provided about the expected waiting time (certainty of waiting time) and waiting time satisfaction

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.178[a]	.032	.030	.672	1.902

a. Predictors: (Constant), Q38b
b. Dependent Variable: Delta_Q16_Q18_Q22

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.863	1	7.863	17.417	.000[b]
	Residual	240.635	533	.451		
	Total	248.498	534			

a. Dependent Variable: Delta_Q16_Q18_Q22
b. Predictors: (Constant), Q38b

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.721	.088		-8.180	.000					
	Q38b	.107	.026	.178	4.173	.000	.178	.178	.178	1.000	1.000

a. Dependent Variable: Delta_Q16_Q18_Q22

H5.2: Uncertain waiting time affects a patient's waiting time satisfaction	*Q38.b: I was informed about the expected waiting time* + *Q23: how do you classify your waiting time experience (long, acceptable, short)* - *affective aspect of waiting time*	There is a statistically significant (p=.000) positive relationship (β=.091) between the information provided about the expected waiting time (certainty of waiting time) and waiting time satisfaction, the cognitive aspect of waiting time as being short, acceptable, long.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.158[a]	.025	.023	.646	1.890

a. Predictors: (Constant), Q38b
b. Dependent Variable: Q23_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.719	1	5.719	13.701	.000[b]
	Residual	222.461	533	.417		
	Total	228.179	534			

a. Dependent Variable: Q23_R
b. Predictors: (Constant), Q38b

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.532	.085		18.079	.000					
	Q38b	.091	.025	.158	3.702	.000	.158	.158	.158	1.000	1.000

a. Dependent Variable: Q23_R

H5.3: Uncertain waiting time affects a patient's waiting time satisfaction	*Q38.b: I was informed about the expected waiting time* + *Q24: what was your feeling about waiting time*	There is a statistically significant (p=.002) Positive relationship (β= +.101) between the information provided about the expected waiting time (certainty of waiting time) and waiting time satisfaction, the affective aspect of waiting time

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.137[a]	.019	.017	.839	1.901

a. Predictors: (Constant), Q38b
b. Dependent Variable: Q24_R

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.805	1	6.805	9.672	.002[b]
	Residual	356.051	506	.704		
	Total	362.856	507			

a. Dependent Variable: Q24_R
b. Predictors: (Constant), Q38b

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.737	.112		15.545	.000					
	Q38b	.101	.033	.137	3.110	.002	.137	.137	.137	1.000	1.000

a. Dependent Variable: Q24_R

H6.1: Patients who are accompanied are more satisfied with the waiting time than the unaccompanied patients	*Q15: Did you go to the hospital alone/accompanied* + *Delta Q16+18+22*	The results indicate a statistically significant (p=.046) positive relationship (b=.104) between patients coming accompanied and waiting time satisfaction

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.086[a]	.007	.005	.693	1.889

a. Predictors: (Constant), Q15

b. Dependent Variable: Delta_Q16_Q18_Q22

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.913	1	1.913	3.986	.046[b]
	Residual	259.104	540	.480		
	Total	261.017	541			

a. Dependent Variable: Delta_Q16_Q18_Q22

b. Predictors: (Constant), Q15

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.503	.075		-6.684	.000					
	Q15	.104	.052	.086	1.997	.046	.086	.086	.086	1.000	1.000

a. Dependent Variable: Delta_Q16_Q18_Q22

H6.2: Patients who are accompanied are more satisfied with the waiting time than the unaccompanied patients	*Q15: Did you go to the hospital alone/accompanied* + *Q23: how do you classify your waiting time experience (long, acceptable, short) (the affective aspect of waiting time).*	There is no statistically significant (p=.229) relationship between patients coming alone or accompanied and waiting time experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.630	1	.630	1.450	.229[b]
	Residual	234.406	540	.434		
	Total	235.035	541			

a. Dependent Variable: Q23_R
b. Predictors: (Constant), Alone_or_Accompanied

H6.3: Patients who are accompanied are more satisfied with the waiting time than the unaccompanied patients	*Q15: Did you go to the hospital alone/accompanied* + *Q24: what was your feeling about waiting time*	There is no statistically significant (p=.743) relationship between patients coming alone or accompanied and waiting time feeling

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.077	1	.077	.108	.743b
	Residual	366.281	516	.710		
	Total	366.357	517			

a. Dependent Variable: Q24_R

b. Predictors: (Constant), Alone_or_Accompanied

H7.1: first time visit of patients are more satisfied with the waiting time than repeated visit	*Q11: Was this your first visit to this clinic first/repeated* *Q6: Last visited* *Q12: Frequency of visits* + *Delta Q16+18+22*	There is no statistically significant (p=.744) relationship between the frequency of patients' visits and waiting time satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.588	3	.196	.413	.744[b]
	Residual	219.330	462	.475		
	Total	219.918	465			

a. Dependent Variable: WT_Satisfaction
b. Predictors: (Constant), Frequency of_ Visits, First or Repeated visit, date of last visit

H7.2: patients visiting for the first time are more satisfied with the waiting time than those making a repeated visit	*Q11: Was this your first visit to this clinic first/repeated* *Q6: Last visited* *Q12: Frequency of visit* + *Q23: do you classify your waiting time experience(long, acceptable, short)*	There is no statistically significant (p=.280) relationship between the cognitive aspect of patients' waiting time satisfaction and the frequency of visits

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.692	3	.564	1.283	.280[b]
	Residual	203.183	462	.440		
	Total	204.876	465			

a. Dependent Variable: WT_Experience
b. Predictors: (Constant), Frequency of Visits, First Repeat visit, date of last visit

H7.3: first time visit of patients are more satisfied with the waiting time than repeated visit	*Q6: Last visited* *Q11: Was this your first visit to this clinic first/repeated* *Q12: Frequency of visit* + *Q24: what was your feeling about the waiting time*	There is a significant (p=.017) negative correlation between last time patient visited the hospital/clinic (β=-.094) and their affective aspect of waiting time. The more recent visit has a relationship with patients being more satisfied

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.137[a]	.019	.012	.840	1.827

a. Predictors: (Constant), Frequency of_ Visit, First_or_Repeated_visit, last_visited
b. Dependent Variable: Waiting_Feeling

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.906	3	1.969	2.787	.040[b]
	Residual	310.797	440	.706		
	Total	316.703	443			

a. Dependent Variable: Waiting_Feeling
b. Predictors: (Constant), Frequency of Visits, First or Repeated visit, last visited

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.033	.156		13.021	.000					
	Last visited	-.094	.039	-.122	-2.402	.017	-.107	-.114	-.113	.860	1.163
	First or Repeated visit	.073	.067	.053	1.088	.277	.074	.052	.051	.953	1.049
	Frequency of visits	.040	.033	.062	1.203	.230	.027	.057	.057	.851	1.175

a. Dependent Variable: Waiting_Feeling

H7.3 –Re-run after removing all non-significant variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.113[a]	.013	.011	.844	1.936

a. Predictors: (Constant), last visited
b. Dependent Variable: WT Feelings

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.632	1	4.632	6.501	.011[b]
	Residual	359.084	504	.712		
	Total	363.715	505			

a. Dependent Variable: WT Feelings
b. Predictors: (Constant), last visited

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.257	.083		27.087	.000					
	Last visited	-.087	.034	-.113	-2.550	.011	-.113	-.113	-.113	1.000	1.000

a. Dependent Variable: WT Feelings

H8.1: time spent with doctors affects overall satisfaction with the waiting time	*Q20a: how long did you expect to spend with doctor* *+ Q20b: how long did you spend with the doctor* *+ Q47a: patients should always spend enough time with the doctor* *+ Q47a: I always spend enough time with the doctors* *+* *Delta Q16+18+22*	*1. There is a statistically significant (p=0.001) negative relationship (β=-.139) between patients' waiting time satisfaction and patients' expectation that they will spend enough time with doctors in consultation* *2. There is a statistically significant (p=0.001) positive relationship (β=.119) between patients' waiting time satisfaction and patients' perceived spending of enough time with the doctors in consultation*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.210[a]	.044	.036	.607	2.013

a. Predictors: (Constant), Always_Enough_Time_With_Dr (Perceived), Consultation_Time(Expected), Always_Enough_Time_With_Dr (Expected), Consultation_Time(Perceived)
b. Dependent Variable: WT_Satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.211	4	2.053	5.574	.000[b]
	Residual	177.139	481	.368		
	Total	185.350	485			

a. Dependent Variable: WT_Satisfaction
b. Predictors: (Constant), Always_Enough_Time_With_Dr (Perceived), Consultation_Time (Expected), Always_Enough_Time_With_Dr (Expected), Consultation_Time (Perceived)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.147	.224		-.654	.513					
	Consultation_Time (Expected)	.047	.053	.048	.889	.375	.014	.040	.040	.682	1.466
	Consultation_Time (Perceived)	-.036	.050	-.039	-.717	.474	-.021	-.033	-.032	.673	1.486
	Always_Enough_Time_ With_Dr (Expected)	-.139	.041	-.154	-3.363	.001	-.122	-.152	-.150	.947	1.056
	Always_Enough_Time_ With_Dr (Perceived)	.119	.031	.172	3.780	.000	.140	.170	.168	.958	1.043

a. Dependent Variable: WT_Satisfaction

H8.1- Re-Run after removing all non-significant variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.168[a]	.028	.025	.673	1.914

a. Predictors: (Constant), Always_Enough_Time_With_D r (Perceived), Always_Enough_Time_With_Dr (Expected)
b. Dependent Variable: WT_Satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.916	2	3.458	7.646	.001[b]
	Residual	237.891	526	.452		
	Total	244.807	528			

a. Dependent Variable: WT_Satisfaction
b. Predictors: (Constant), Always_Enough_Time_With_Dr (Perceived), Always_Enough_Time_With_Dr (Expected)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.429	.206		-2.080	.038					
	Always_Enough_Time_With_Dr (Expected)	-.089	.042	-.093	-2.110	.035	-.055	-.092	-.091	.946	1.057
	Always_Enough_Time_With_Dr (Perceived)	.122	.033	.163	3.693	.000	.142	.159	.159	.946	1.057

b. Dependent Variable: WT_Satisfaction

H8:.2 Enough time spent with doctors leads to overall satisfaction with the waiting time	*Q20a: how long did you expect to spend with doctor + Q20b: how long did you spend with the doctor + Q47a: : patient should always spend enough time with the doctor + Q47b: I always spend enough time with the doctors + Q23: how do you classify your waiting time experience (long, acceptable, short) – Affective aspect of waiting time*	*1. There is a statistically significant (p=0.001) negative relationship (β=-.180) between expected time spent with the doctors and the cognitive aspect of waiting time satisfaction 2. There is a statistically significant p=(.037) positive relationship (β=+.069) between perceived always spending enough time in consultation with the doctors and the cognitive aspect of waiting time satisfaction*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.224[a]	.050	.042	.641	1.877

a. Predictors: (Constant), Always_Spending_Enough_Time_With_Dr (perceived), Consultation_Time(Expected), Always_Spending_Enough_Time_With_Dr (expected), Consultation_Time (Perceived)
b. Dependent Variable: WT_Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.480	4	2.620	6.378	.000[b]
	Residual	197.586	481	.411		
	Total	208.066	485			

a. Dependent Variable: WT_Experience
b. Predictors: (Constant), Always_Spending_Enough_Time_With_Dr (perceived), Consultation_Time (Expected), Always_Spending_Enough_Time_With_Dr (expected), Consultation_Time(perceived)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.195	.237		9.258	.000					
	Consultation_Time (Expected)	-.180	.056	-.173	-3.212	.001	-.201	-.145	-.143	.682	1.466
	Consultation_Time (Perceived)	-.047	.053	-.048	-.884	.377	-.142	-.040	-.039	.673	1.486
	Always_Spending_Enough_Time_With_Dr (expected)	-.024	.044	-.025	-.541	.589	-.027	-.025	-.024	.947	1.056
	Always_Spending_Enough_Time_With_Dr (perceived)	.069	.033	.095	2.089	.037	.086	.095	.093	.958	1.043

a. Dependent Variable: WT_Experience

H8.2- Rerun after removing all non-significant variables - Re-run again with Q20a

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.319	.105		22.111	.000					
	Q20a	-.207	.043	-.200	-4.751	.000	-.200	-.200	-.200	1.000	1.000

a. Dependent Variable: WT_Experience

H8.3: enough time spent with doctors leads to overall satisfaction with the waiting time	*Q20a: how long did you expect to spend with doctor* *+ Q20b: how long did you spend with the doctor* *+ Q47a: patients should always spend enough time with the doctor* *+ Q47b: I always spend enough time with the doctors* *+* *Q24: what was your feeling about the waiting time (not satisfied, satisfied)*	*1. There is a statistically significant p=(.000) positive relationship (β=+.159) between the perception of always spending enough time in consultation with the doctors and the affective aspect of waiting time satisfaction*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.179[a]	.032	.024	.832	1.905

a. Predictors: (Constant), Enough_Time_With_Dr (perceived), Consultation_Time(Expected), Enough_Time_With_Dr (expected), Consultation_Time (perceived)
b. Dependent Variable: Waiting_Feeling

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.538	4	2.635	3.802	.005[b]
	Residual	316.642	457	.693		
	Total	327.180	461			

a. Dependent Variable: Waiting_Feeling
b. Predictors: (Constant), Enough_Time_With_Dr (perceived), Consultation_Time(Expected), Enough_Time_With_Dr (expected), Consultation_Time(perceived)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.696	.317		5.346	.000					
	Consultation_Time(Expected)	-.076	.074	-.056	-1.027	.305	-.062	-.048	-.047	.704	1.421
	Consultation_Time(perceived)	-.017	.069	-.014	-.244	.807	-.032	-.011	-.011	.693	1.444
	Enough_Time_With_Dr (expected)	-.006	.060	-.005	-.098	.922	.022	-.005	-.004	.939	1.065
	Enough_Time_With_Dr (perceived)	.159	.044	.170	3.605	.000	.167	.166	.166	.955	1.047

a. Dependent Variable: Waiting_Feeling

H8.3 -Re-run with Q47b

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.147[a]	.022	.020	.838	1.883

a. Predictors: (Constant), Enough_Time_With_Dr (perceived)
b. Dependent Variable: Waiting_Feeling

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.836	1	7.836	11.155	.001[b]
	Residual	354.748	505	.702		
	Total	362.584	506			

a. Dependent Variable: Waiting_Feeling
b. Predictors: (Constant), Enough_Time_With_Dr (perceived)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.558	.157		9.893	.000					
	Enough_Time_With_Dr (perceived)	.134	.040	.147	3.340	.001	.147	.147	.147	1.000	1.000

a. Dependent Variable: Waiting_Feeling

H9.1: The perceived technical and interpersonal skills of the doctors and healthcare provider affect Patient's waiting time satisfaction	*Q27b: Willingness to Help* *Q28b: not too busy to respond* *Q29b: patient's best interest at heart* *Q30b: understand specific need of the patients* *Q33b: diagnose care right first time* *Q34b: Knowledgeable* *Q46b: Every time I visited the doctor, he helped me to be cured and relieved my sufferings* *Q48b: my doctor always explains the diagnosis, treatment and care in language that I can understand* *+* *Delta Q16+18+22*	There is no statistically significant (p=.257) relationship between the perceived technical and interpersonal skills of the doctors and healthcare provider and the patient's waiting time satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.518	8	.565	1.270	.257[b]
	Residual	218.362	491	.445		
	Total	222.880	499			

a. Dependent Variable: WT_Satisfaction
b. Predictors: (Constant), Diagnosis_Lang [MEANING?] (perceived), Not Busy (perceived), Diagnoses_Right (perceived), Curing_Patient (perceived), Understands_Needs (perceived), Knowledgeable (perceived), Willing_to_Help (perceived), Patient's_Interest (perceived)

H9.2: The perceived technical and interpersonal skills of the doctors and healthcare provider affect patient's waiting time satisfaction	*Q27b: Willingness to Help* *Q28b: not too busy to respond* *Q29b: patient's best interest at heart* *Q30b: understand specific need of the patients* *Q33b: diagnose care right first time* *Q34b: Knowledgeable* *Q46b: Every time I visited the doctor, he helped me to be cured and relieved my suffering* *Q48b: my doctor always explained the diagnosis, treatment and care in language that I can understand* *+* *Q23: how do you classify your waiting time experience (long, acceptable, short)*	The results indicate a statistically significant (p=.012) positive (β=+.103) relationship between cognitive aspect of waiting time satisfaction and patients' perception that the doctors diagnose their case right first time

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.201[a]	.040	.025	.655	1.888

a. Predictors: (Constant), Diagnosis_Lang (perceived), Not_Busy (perceived), Diagnose_Right (perceived), Curing_Patient (perceived), Understand_Needs (perceived), Knowledgeable (perceived), Willing_to _Help(perceived), Patient's Interest (perceived)
b. Dependent Variable: WT_Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.863	8	1.108	2.586	.009[b]
	Residual	210.359	491	.428		
	Total	219.222	499			

a. Dependent Variable: WT_Experience
b. Predictors: (Constant), Diagnosis_Lang (perceived), Not_Busy (perceived), Diagnose_Right (perceived), Curing_Patient(perceived), Understand_Needs (perceived), Knowledgeable (perceived), Willing_to_Help (perceived), Patient's_Interest (perceived)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
	(Constant)	1.249	.165		7.589	.000					
	Willing_to_Help (perceived)	.001	.046	.002	.027	.978	.096	.001	.001	.457	2.188
	Not_Busy (perceived)	.006	.045	.009	.136	.892	.097	.006	.006	.462	2.163
	Patient's_Interest (perceived)	.015	.049	.021	.295	.768	.107	.013	.013	.388	2.578
	Understand_Needs (perceived)	.019	.046	.027	.410	.682	.112	.018	.018	.445	2.248
	Diagnose_Right (perceived)	.103	.041	.146	2.512	.012	.166	.113	.111	.576	1.737
	Knowledgeable (perceived)	-.061	.044	-.084	-1.378	.169	.085	-.062	-.061	.527	1.897
	Curing_Patient (perceived)	.084	.044	.111	1.903	.058	.158	.086	.084	.575	1.740
	Diagnosis_Lang (perceived)	-.004	.042	-.005	-.093	.926	.101	-.004	-.004	.635	1.574

a. Dependent Variable: WT_Experience

H9.2- Re-run with Q33b

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.160[a]	.026	.024	.648	1.854

a. Predictors: (Constant), Diagnose_Right(perceived)
b. Dependent Variable: WT_Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.915	1	5.915	14.081	.000[b]
	Residual	224.307	534	.420		
	Total	230.222	535			

a. Dependent Variable: WT_Experience
b. Predictors: (Constant), Diagnose_Right (perceived)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.443	.108		13.375	.000					
	Q33b	.112	.030	.160	3.752	.000	.160	.160	.160	1.000	1.000

a. Dependent Variable: WT_Experience

H.9.3: The perceived technical and interpersonal skills of the doctors and healthcare provider affect patient's waiting time satisfaction	*Q27b: Willingness to Help* *Q28b: not too busy to response* *Q29b: patient's best interest at heart* *Q30b: understand specific need of the patients* *Q33b: diagnose care right first time* *Q34b: Knowledgeable* *Q46b: Every time I visited the doctor, he helped me to be cured and relieved my sufferings* *Q48b: my doctor always explained the diagnosis, treatment and care in language that I can understand* *+* *Q24: what was your feeling about waiting time*	The results indicate no statistically significant (p=.054) relationship between the perceived technical and interpersonal skills of the doctors and healthcare provider and the affective aspect of waiting time satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.019	8	1.377	1.930	.054[b]
	Residual	333.966	468	.714		
	Total	344.985	476			

a. Dependent Variable: WT_Feeling
b. Predictors: (Constant), Diagnosis_Lang (perceived), Not_Busy (perceived), Diagnose_Right (perceived), Curing_Patient (perceived), Understand_Needs (perceived), Knowledgeable (perceived), Willing_to_Help (perceived), Patient's_Interest (perceived)

H10.1: socio-demographics of the outpatients influence their waiting time satisfaction	*Q1:Gender Q2: Age Q3: Educational Level Q53: Monthly Salary Range + Delta Q16+18+22*	*The results indicate no statistically significant (p=.314) relationship between the socio-demographics and waiting tine satisfaction*

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.233	4	.558	1.191	.314[b]
	Residual	232.132	495	.469		
	Total	234.366	499			

a. Dependent Variable: WT_Satisfaction

b. Predictors: (Constant), Income, Gender, Education Level, Age

H10.2: socio-demographics of the outpatients influence their waiting time satisfaction	*Q1:Gender* *Q2: Age* *Q3: Educational Level* *Q53: Monthly Salary Range* + *Q23: how do you classify your waiting time experience (long, acceptable, short)*	1. *There is a statistically significant (p=.018) statistical positive relationship (β= +.146) between gender and waiting time experience (cognitive aspect of waiting time)* 2. *There is a statistically significant (p=.000) negative relationship (β= -.120) between Age and Cognitive aspect of waiting time satisfaction. (the younger they are the shorter they perceive the waiting time to have been)* 3. *There is a statistically significant (p=.027) positive relationship (β=.077) between Income level and the cognitive aspect of waiting time satisfaction (the more they earn the more they are satisfied with WT experience)*

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.265[a]	.070	.062	.643	1.904

a. Predictors: (Constant), Income, Gender, Education Level, Age
b. Dependent Variable: WT_Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.389	4	3.847	9.314	.000[b]
	Residual	204.473	495	.413		
	Total	219.862	499			

a. Dependent Variable: WT_Experience
b. Predictors: (Constant), Income, Gender, Education Level, Age

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.499	.167		8.969	.000					
	Gender	.146	.062	.110	2.363	.018	.177	.106	.102	.861	1.161
	Age	-.120	.028	-.211	-4.224	.000	-.197	-.187	-.183	.756	1.323
	Education Level	.076	.046	.075	1.653	.099	.077	.074	.072	.917	1.090
	Income	.077	.035	.105	2.212	.027	.031	.099	.096	.827	1.210

a. Dependent Variable: WT_Experience

H10.2- Re-run Re-run [not sure if this is what you meant] with Q1_Q2_Q3_Q53

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.252[a]	.064	.058	.645	1.901

a. Predictors: (Constant), Income, Gender, Age
b. Dependent Variable: WT_Experience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.026	3	4.675	11.252	.000[b]
	Residual	206.517	497	.416		
	Total	220.543	500			

a. Dependent Variable: WT_Experience
b. Predictors: (Constant), Income, Gender, Age

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.658	.136		12.214	.000					
	Gender	.160	.061	.120	2.607	.009	.174	.116	.113	.883	1.133
	Age	-.113	.028	-.199	-4.011	.000	-.194	-.177	-.174	.766	1.305
	Income	.090	.034	.123	2.614	.009	.033	.116	.113	.856	1.168

a. Dependent Variable: WT_Experience

H10.3: socio-demographics of the outpatients influence their waiting time satisfaction	*Q1:Gender* *Q2: Age* *Q3: Educational Level* *Q53: Monthly Salary Range* + *Q24: what was your feeling about waiting time*	*The results indicate there is no statistically significant (p=.440) relationship between a patient's socio-demographics and the waiting time feeling.*

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.678	4	.669	.941	.440[b]
	Residual	336.611	473	.712		
	Total	339.289	477			

a. Dependent Variable: WT_Feeling

b. Predictors: (Constant), Income, Gender, Education Level, Age

Appendix 3.1: Additional information

Table 1: Average number of patients seen monthly

Months	Number of Patients seen in this OPD
Jul-16	855
Aug-16	1493
Sep-16	1118
Oct-16	1790
Nov-16	1844
Dec-16	1399
Total	8499
Average Patients/month	1416.17

Table 2: Number of patients per days of the months

	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Total
Saturday	50	83	0	76	55	81	345
Sunday	236	268	156	408	320	175	1563
Monday	196	304	272	319	306	276	1673
Tuesday	133	230	183	294	465	336	1641
Wednesday	130	337	147	363	465	260	1702
Thursday	110	271	360	330	233	271	1575
Total	855.0	1493	1118	1790	1844	1399	8499

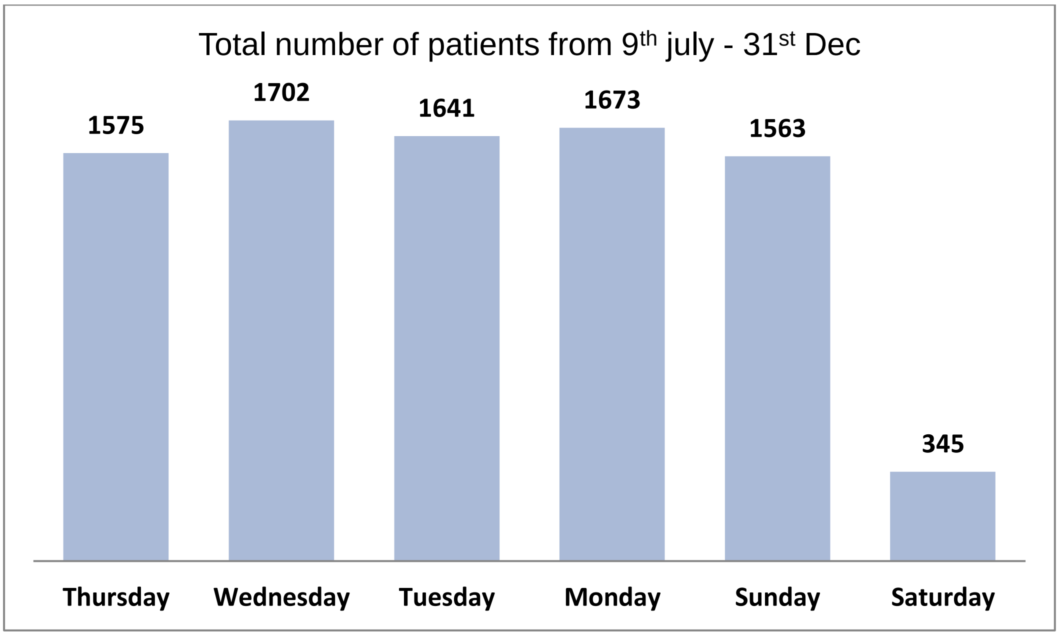

Figure 1: Total number of patients from 9th July - 31th Dec by days

Table 3: Number of patients by shifts and average time between check-ins

Month	Number of patients	Number of Patients AM	Number of patients PM	Average Time between check-ins (hh:mm) AM	Average Time between check-ins (hh:mm) PM	Average time between check-ins (hh:mm)
Jul-16	855	430	425	0:13	0:17	0:13
Aug-16	1493	739	754	0:11	0:15	0:12
Sep-16	1118	615	503	0:07	0:10	0:08
Oct-16	1790	841	949	0:10	0:09	0:09
Nov-16	1844	893	951	0:07	0:10	0:08
Dec-16	1399	704	695	0:09	0:10	0:09

Table 4: Number of working days per month

Months	Number of days off	Missing days	Number of working days
Jul-16	4	8	19
Aug-16	4	0	27
Sep-16	9	5	17
Oct-16	5	1	25
Nov-16	6	0	25
Dec-16	8	1	22

Appendix 3.2: Testing for the type of data for outpatient clinic

3.2.1 Data and distribution summary for the arrival behavior of patients (earliness and lateness against appointment time)

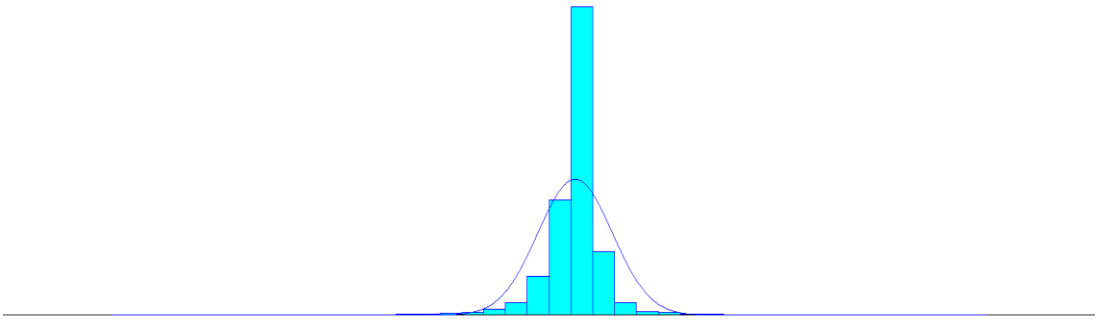

Figure 1: Data distribution for the patients' arrival behavior (earliness and lateness against their appointment time)

Table 1: Summary distribution for patients' arrival behavior (earliness and lateness against their appointment time)

Distribution Summary	
Distribution:	Normal
Expression:	NORM(0, 0)
Square Error:	0.110580
Chi Square Test	
Number of intervals	= 11
Degrees of freedom	= 8
Test Statistic	= 5.32e+003
Corresponding p-value	< 0.005
Data Summary	
Number of Data Points	= 8496
Min Data Value	= -432
Max Data Value	= 373
Sample Mean	= -5.62
Sample Std Dev	= 34.2
Histogram Summary	
Histogram Range	= -432 to 373
Number of Intervals	= 40

3.2.2 Data and distribution summary of patients' inter-arrival times

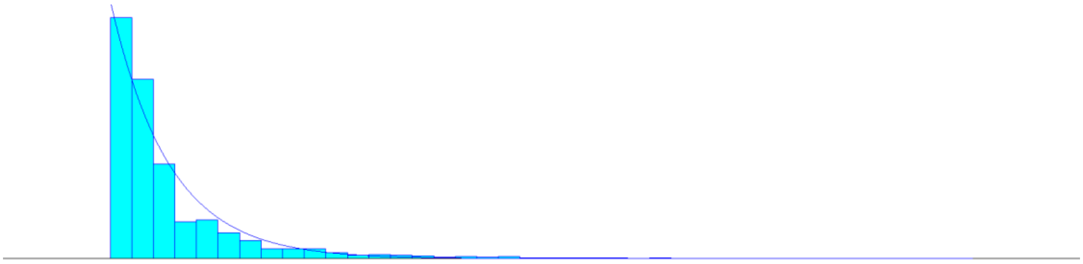

Figure 2: Data distribution of patients' inter-arrival times

Table 2: Summary distribution of patients' inter-arrival times

Distribution Summary	
Distribution:	Exponential
Expression:	-0.001 + EXPO(7.47)
Square Error:	0.006423
Chi Square Test	
Number of intervals	18
Degrees of freedom	16
Test Statistic	2.13e+003
Corresponding p-value	< 0.005
Data Summary	
Number of Data Points	9679
Min Data Value	0
Max Data Value	110
Sample Mean	7.47
Sample Std Dev	10.4
Histogram Summary	
Histogram Range	-0.001 to 110
Number of Intervals	40

3.2.3 Data distribution of checking-in to vital signs and documentations waiting time

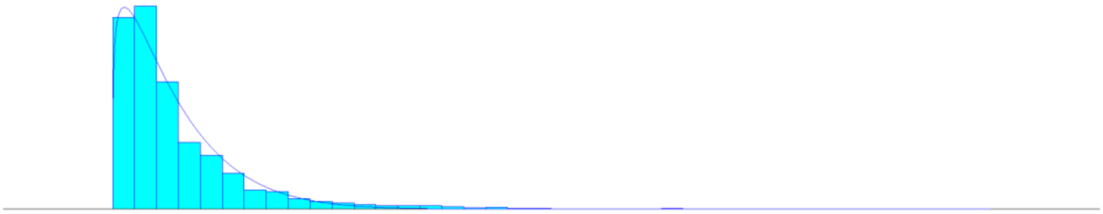

Figure 3: Data distribution of checking-in to vital signs and documentations waiting time

Table 3: Distribution Summary - checking-in to vital signs and documentations waiting time

Distribution Summary	
Distribution:	Beta
Expression:	0.999 + 187 * BETA(1.2, 16.3)
Square Error:	0.003077
Chi Square Test	
Number of intervals	14
Degrees of freedom	11
Test Statistic	1.23e+003
Corresponding p-value	< 0.005
Kolmogorov-Smirnov Test	
Test Statistic	0.0338
Corresponding p-value	< 0.01
Data Summary	
Number of Data Points	5123
Min Data Value	1
Max Data Value	188
Sample Mean	15
Sample Std Dev	15.9
Histogram Summary	
Histogram Range	0.999 to 188
Number of Intervals	40

3.2.4 Data distribution of vital sign and documentation to patient seen waiting time

Figure 4: Data distribution of vital sign and documentation to patient seen waiting time

Table 4: Distribution Summary - vital sign and documentation to patient seen waiting time

Distribution Summary	
Distribution:	Gamma
Expression:	0.999 + GAMM(38.1, 0.687)
Square Error:	0.001377
Chi Square Test	
Number of intervals	19
Degrees of freedom	16
Test Statistic	83.9
Corresponding p-value	< 0.005
Kolmogorov-Smirnov Test	
Test Statistic	0.0842
Corresponding p-value	< 0.01
Data Summary	
Number of Data Points	5123
Min Data Value	1
Max Data Value	391
Sample Mean	27.2
Sample Std Dev	31
Histogram Summary	
Histogram Range	0.999 to 391
Number of Intervals	40