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THE ROLE OF INDIVIDUAL AND GROUP LEVEL VARIABLES IN HEALTHCARE PROFESSIONALS´HAND HYGIENE COMPLIANCE: A MULTI-LEVEL PERSPECTIVE

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RESUMO

A literatura demonstra que a não adesão à higiene das mãos aumenta as infecções hospitalares, contudo a investigação nesta área permanece dispersa. Este trabalho pretende conciliar os contributos da Teoria da Acção Planeada (TAP), modelo Precede-Proceed e abordagem de clima de segurança para analisar esta problemática (1) durante a formação de futuros profissionais de saúde; (2) a higiene das mãos como um comportamento que emerge de micro-sistemas (e.g. equipas de trabalho); (3) as especificidades entre diferentes categorias de profissionais; e (4) o impacto da experiência de trabalho na intenção de aderir. Pretende-se ainda aferir o papel da norma moral enquanto preditora da intenção, sendo testada como inibidora da adesão; e da percepção de vulnerabilidade como moderadora numa relação multi-nível para explorar o seu papel entre o clima de segurança de equipa e a adesão. Para além disso, iremos também avaliar a adesão reportada e observada.

Serão apresentados cinco estudos cujos resultados indicam que (1) os preditores da intenção da TAP funcionam como mediadores transferindo o impacto do clima de segurança de equipa para a intenção; (2) a influência social é um preditor importante reforçando o papel dos "role models"; (3) os profissionais apresentam prerrogativas morais multi-facetadas que inibem a adesão, particularmente os médicos e estudantes de medicina; (4) a adesão reportada parece ser uma medida adequada para avaliar este comportamento devido à sua consistência com a adesão observada.

No final, as variáveis que predispõem, facilitam e reforçam a adesão serão apresentadas relacionando a evidência empírica deste trabalho com a sua dimensão prática pela apresentação de medidas de intervenção.

Palavras-Chave: Multi-nível; influência social; clima segurança equipa; norma moral

Códigos de Classificação (Associação Americana de Psicologia):

3410 Educação e Formação dos Profissionais

3360 Psicologia da Saúde e Medicina

3670 Condições de Trabalho e Segurança Industrial

ABSTRACT

Literature shows that non-compliance with hand hygiene increases hospital-acquired infections and research in this area is far from synthesized. This work aims to conciliate the contributions of the Theory of Planned Behavior (TPB), the Precede-Proceed model and the safety climate approach to analyse (1) this problematic during the education of future healthcare professionals; (2) hand hygiene as arising from micro-systems (e.g. care-delivery teams); (3) the specificities of compliance between different categories of professionals; and (4) the importance of work experience in constraining intention to comply.

We also intend to analyse the impact of the moral norm and the vulnerability perception. The former as a behavioural intention predictor will be tested as an inhibitor of compliance; the latter, will be used as a multi-level moderator to explore its role in the relationship between team safety climate and compliance. Furthermore, we will also analyse self-reported and observed compliance.

We present five studies whose results indicate that (1) TPB behavioural intention predictors function as significant mediators in transferring the impact of team safety climate to intention; (2) social influence is an important predictor enhancing the relevance of role models; (3) professionals present multi-faceted moral prerogatives that inhibit compliance, particularly physicians and medical students; 4) reported compliance appears to be an adequate way to measure hand hygiene due to its consistency with observed compliance.

In the end, predisposing, enabling and reinforcing variables are presented to link the empirical evidence of this work with its practical dimension by defining measures to design future interventions.

Key-words: Multi-level; social influence; team safety climate; moral norm

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"It was not enough to produce satisfactory soap,

it was also necessary to induce people to wash."

Joseph Schumpeter (1939)

GENERAL INTRODUCTION

The science of medicine has greatly advanced during the past century (Shanley, 1930) however, advances in medicine also brought the proliferation of healthcare-acquired infections (HAIs) (World Health Organization [WHO], 1996). Generally speaking, hundreds of millions of patients suffer every year from these infections which contribute to several negative outcomes to patients, professionals and healthcare facilities. From unnecessary patient deaths to a high financial burden for patients, families and hospitals, HAIs remain a challenge to high and low-income countries health systems (WHO, 2002).

Infections have a multifaceted provenance related to healthcare provision, political and economic constraints on health systems and countries, as well as human behaviour (WHO, 2005) making them difficult to eliminate entirely. However, up to one third of HAIs can be prevented through the development of simple safety measures (Nettina, 2008). In particular, research findings have suggested, since Semmelweis discovery in the XIXth century, that hand hygiene is the easiest procedure to prevent the spread of HAIs (Pittet, 2004). Unfortunately, several authors have also registered a gap between evidence-based practices and clinical ones, indicating the difficulties that healthcare professionals (HCPs) have to comply with infection control procedures (Lenfant, 2003). Accordingly, because medical practice of HCPs includes a great diversity of factors, ranging from individual to group and organisational facets (Grol & Wensing, 2004), it seems imperative to pursue a better understanding of the dynamics that are used to determine these individuals professional decisions (Grol, Bosch, Hulscher, Eccles & Wensing, 2007).

Although a growing amount of research is directing its attention to the question of how to improve HCPs' compliance with infection control procedures and which intervention approaches should be applied to decrease the burden of these infections (WHO, 2005), research in this area is far from synthesized. Thus, to date, the question of whether and in what way this HCPs' safety behaviour can be predicted to design a robust intervention program, still remains to be answered. The necessity of exploring the specificities of HCPs' compliance goes beyond socio-cognitive models and the need to integrate different levels of

analysis in predicting adherence with infection control practices plays a critical role in increasing awareness that this is a problem with a multi-level nature. Therefore, departing from this state of the art, the role of individual, group and organisational factors will be addressed in order to better understand hand hygiene compliance

It is hoped that this project will make a contribution in explaining the intentions and behaviours associated with HCPs' compliance with hand hygiene, based on a multi-level theoretical model that emphasizes individual and group level variables which, cooperate with each other to explain this behavioural practice. Along with this main objective, other specific tenets are analysed, such as individual level characteristics of HCPs as predictors of their intention. These objectives will be explored in the two parts of this thesis: the first part is devoted to the theoretical approaches developed in the study of HCPs' safety compliance behaviours and to the theoretical model that underlies this thesis where the specific objectives to be explored in the empirical studies will also be presented; while the second part of this project describes the studies, the results achieved and their theoretical and practical contributions.

The first part of the thesis will be integrated into Chapters 1 and 2 both with a focus on a theoretical review and also by Chapter 3 which addresses the theoretical model to be explored. In the first chapter, the problem of HAIs and the impact they have on society in general is presented. In addition, a review was conducted of studies focusing on the difficulties of HCPs complying with hand hygiene and other infection control procedures. Chapter 2 reflects on the theoretical models that tend to be used in studies of HCPs' safety compliance behaviours. First, a general characterization of the models is presented, where some of its key theoretical and methodological limitations are highlighted. Next, the application of those models in the healthcare sector when directed to study HCPs' clinical practice and safety behaviours is described. In addition, a summary is given of the main contributions of these studies. In this chapter the need to develop a multi-level approach of safety climate to study HCPs' hand hygiene compliance is emphasised.[1]

Finally, in Chapter 3 the main limitations that affect the study of HCPs' compliance with hand hygiene are presented and some possible ways to overcome them are suggested. The major contributions of the theoretical model are discussed, plus highlights of

[1] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Using a multi-level approach of safety climate to study healthcare professionals' compliance with infection control practices: a literature review.* (Submitted).

the new variables that are integrated in the model and, in the end, the aims and objectives that the model intends to achieve.

The second part of this thesis consists of Chapters 4 to 8 corresponding to five empirical studies and the final conclusions of this project. Thus, Chapter 4 focuses on trying to develop a bottom-up approach based on the principle of participation. Study I presents an exploratory framework[2] with a qualitative and quantitative methodology which aims to assess the perspectives that HCPs have about the factors that predispose, enable and reinforce their hand hygiene compliance. In addition, we aim to differentiate their personal characteristics from the specificities of other professionals groups to whom hand hygiene is also a relevant infection control technique (e.g. educational and food professionals).

In Chapter 5, two quantitative studies are presented (Study II and III)[3] that also have an underlying exploratory approach. Because doctors are the group with lowest compliance rates both studies are directed at medical students in order to explore how medical training can constrain compliance issues in future medical professionals. Study II focuses on a sample comprising students from 6th year to explore the role of TBP behavioural intention predictors, including the moral norm. In addition, in study III the applicability of the previous study is expanded and focuses on the role of social norms with different referents, and internalized norms with distinct moral emphasis, to analyse the behavioural intention predictors of 1st and 6th year medical students. In this sense, an evaluation is made of how each of the behavioural intention predictors of these students change their relevance according to the socialization stages in which medical students are integrated.

Chapter 6 describes a multi-level approach to study the trans-level mediation and moderation relationships assumed in the theoretical model during the first research goal of Study IV[4]. In particular, the focus is on the mediating role of attitudes, subjective norm and perceived behavioural control between team safety climate and HCPs' intention to comply; as well as the moderating role of perceived vulnerability in the relationship between team safety

[2] Roberto, M., S., Mearns, K. & Silva, S. A. (2010). *Hand hygiene compliance among health, educational and food professionals: a study on social influence and PRECEDE factors.* (Submitted).

[3] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Perceptions of social and moral norms towards hand hygiene compliance from first and sixth year Portuguese medical students.* (Submitted).

[4] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *A multi-level mediation model of safety climate and the Theory of Planned Behavior: exploring hand hygiene intention to comply among healthcare professionals.* (Submitted).

climate and HCPs' hand hygiene compliance. After this first aim of Study IV, there is also an analysis of the specificities of different HCP groups with regard to their behavioural intention predictors[5]. Finally, the third research goal of the Study IV specifically addresses doctors and assesses how the predictors of their intention to comply change depending on their level of personal work experience[6]. This goal of Study IV is expected to complement the findings of studies II and III related to medical students as discussed in chapter 5.

Chapter 7 presents Study V[7] which combines data collection with self-reporting and observational measures. The consistency between these two measures is assessed as well as the level of consensus among team care-delivery members in relation to their perceptions and behaviours, in order to compute hand hygiene compliance rates.

Finally, in Chapter 8 concluding remarks are made presenting an overview of the main findings of this thesis; highlighting some implications and limitations as well as some suggestions for future research.

[5] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *How to comply with hand hygiene? Different behavioural intention predictors among doctors, nurses and cleaners.* (Submitted).

[6] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Does work experience constrain physicians' intention to comply with hand hygiene? An extended application of the Theory of Planned Behavior.* (Submitted).

[7] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Measuring hand hygiene compliance using self-assessment and direct observation methods: analysing consensus in care-delivery teams.* (Submitted).

PART I

THE CHALLENGES OF HEALTHCARE PROFESSIONALS' COMPLIANCE WITH HAND HYGIENE: THE BURDEN OF HOSPITAL-ACQUIRED INFECTIONS

CHAPTER 1

INFECTIOUS PATHOLOGY: AN HISTORICAL CHALLENGE FOR THE HUMANKIND

1.1 Introduction

Infectious diseases are as old as humankind itself and are reappearing to challenge human defenses. The historical idea provided by the development of antibiotics that bacterial infection could be easily cured has been confronted by the emergence of old and new diseases that appear as a result of changes in lifestyle and environment (e.g. Braunwald, Fauci, Kasper, Houser, Longo & Jameson, 2001; Health Media Lab, 2006).

The emergence of infections may appear inexplicable; but, they do become visible because of specific factors anchored in numerous global changes (Morse, 1991). Ecological changes due to agricultural or economic development, human demographics and behaviour are the most frequent reasons identified for infectious diseases outbreaks by favoring the proximity between people and microbes (Institute of Medicine, 1998; United Nations, 2008). Influenza epidemics are a good example of how an infection first appearing in a particular place of the world can overcome geographic boundaries becoming a major public problem felt worldwide (Morse, 1993).

Nonetheless, rapid advances in technology and industry are also seen as an opportunity to introduce new infectious agents. In this particular case, the medical setting is in the front line of exposure to new diseases as a consequence of these industrial and technological movements (Morse, 1993). Modern society, therefore, becomes a means of unintentionally promoting the spread of HAIs that arise inside medical facilities, which constitute one of the leading causes of death worldwide (Centers for Disease Control and Prevention [CDC], 1993).

Altogether, these societal developments have changed the way in which infectious diseases can be defined, constituting new challenges for epidemics and a need to re-examine strategies to protect and promote health (Morse, 1995). Despite the fact that it's important to reunite professional expertise and research capabilities to address these global threats, education is also a vital part of the battle against the spread of infectious diseases (Morse, 1995). Only adequate health behaviours can reduce the risk of infection and both individual and group behaviours play a critical role in preventing and controlling infection (Health Media Lab, 2006). The reappearance of old diseases and the development of new pandemics, inside and outside the medical setting, are a warning that infectious diseases still remain a problem that is far from being eliminated (Morse & Schluederberg, 1990).

1.2 From technological progress to the burden of hospital-acquired infections

Progresses in technology, as it was previously stated, have a dual role in the development of modern medicine, turning hospitals into a place of both medicine's miracles and acquired infections. Several modern diagnostic and therapeutic procedures (e.g. biopsies, catheterization, intubation, ventilation) despite saving patient's lives also contribute to increase the risk of infection holding medicine as a hostage of its own development (WHO, 2002).

In healthcare facilities, the risk of infection to both patients and HCPs' is high. Actually, HAIs encompass almost all clinically evident infections that do not arise from a patient's original admitting diagnosis (WHO, 2002). These infections, also known as *nosocomial infections*, are a result of treatment in a healthcare facility and will appear from 48 to 72 hours after the patient's discharge (WHO, 2002).

Nosocomial infections may be acquired in several ways, being categorized as *endogenous infections* (when bacteria are already present in the patient), *exogenous cross-infections* (when bacteria are transmitted between patients through direct contact, air, objects or via HCPs' who become contaminated carriers) and, finally, *endemic exogenous environmental infections* (when bacteria survive in the hospital environment, such as in water or food), (Lawrie, 1998).

Despite epidemiological progress, HAIs remain a proportionate problem in both high and low income countries and are an important cause of death, contributing to a significant burden for patients, professionals and public health (Pittet, 2004). According to the WHO (2002), an average of 8.7% hospital patients have a nosocomial infection, meaning that at any time, over 1.4 million people worldwide will suffer from infectious complications acquired in hospitals due to an inappropriate treatment. Furthermore, the 2006 British Annual Report of the Department of Health (2007) stated that, solely in the United Kingdom, there are 300,000 HAIs and 5,000 deaths every year. This equates to a patient acquiring an infection every two minutes and a death every two hours (Chief Medical Officer, 2007). Hospital-acquired infections are estimated to more than double the mortality and morbidity risks of any admitted patient and probably the final numbers of life lost are even higher than those statistically stated (National Nosocomial Infections Surveillance [NNIS], 1999b).

Despite the fact that the prevalence of HAIs ranges according to the country's level of development, European and Western regions are also affected with a reported prevalence of

7.7% and 9% respectively against Eastern Mediterranean (11.8%) and South East Asian regions (10%) infection rates (WHO, 2002). For instance, in Portugal where HAIs rates rely on extrapolations from international indicators, it is possible to verify that the incidence of nosocomial infections in several Portuguese hospitals is around 9.7% (Direcção Geral de Saúde, 2005). Furthermore, inside healthcare facilities, literature findings indicate that the most frequent medical units where nosocomial infections have higher prevalence rates are the Intensive Care Unit (ICU), the Neonatal ICU and the Pediatric ICU, (NNIS, 1999a). It is also well documented that the most frequent HAIs are those related to surgical wounds, urinary and respiratory tract affecting mostly patients with high vulnerability (e.g. age, previous medical condition, type of treatment), (CDC, 2006; WHO, 2002).

The consequences of this infectious pathology are a tremendous weight for patients, professionals and health systems with individual, social and organisational repercussions (WHO, 2003). Mortality and morbidity rates are the major human cost that HAIs imply; moreover, this problem also adds functional disability and emotional stress to patients after medical discharge, compromising the quality of their lives, because on average patients who had an HAI take longer to resume normal daily activities (e.g. Coello, Glenister, Fereres, Bartlett, Leigh, Sedgwick, et al., 1993). These infections are also responsible for considerable economic costs. These include costs of additional stay in hospital, drugs, laboratory investigation, loss of work, bed occupancy, delayed discharge, delayed care of other needy patients and more work for HCPs (Wenzel, 1995). For instance, in the United States where the incidence of HAIs is more than 2 million cases per year, this results in an added expenditure in excess of $4.5 billion in medical expenses, without taking into account the human cost of 90,000 deaths (Hand Hygiene Resource Center, 2007).

Hospital-acquired infection costs can, thus, be physical, emotional and financial. To that end, there remains a need to identify and neutralize the agents promoting these infections and to develop estimations regarding the cost of infection to avoid economic funds becoming scarce to support these preventable conditions worldwide (Graves, Tong, Faddy & Whitby, 2008).

1.3 The role of infection control practices to decrease hospital-acquired infections

The importance of infection control practices inside hospital facilities emerged through the discoveries of several scientists during the XIXth century. In 1846, Ignaz Semmelweis found that doctors' hands were responsible for neonatal mortality rates in Vienna General

Hospital, by carrying bacteria on their hands after autopsies (Boyce & Pittet, 2002). Also in 1854 Florence Nightingale, implemented hygiene measures to reduce infections which contributed to a decrease in the number of infections in war amputees (Palmer, 1986). By the end of the XIXth century, Pasteur proved that through sterilization bacteria could be destroyed (Palmer, 1986); while, Lister published the first paper related to infection control *"Antiseptic Principle of the Practice of Surgery"* introducing the concept of aseptic surgery. Lister discovered that bacteria on hands and objects were more important in producing surgical infections than those that were transported by air (Palmer, 1986).

Turning to the XXth century, the 1960's decade saw a growth in infection control literature, which tried to develop and test surveillance methods in hospitals. Based upon these studies, the CDC recommended a routine practice of surveillance to reduce the proliferation of HAIs by showing the importance of epidemiological measures (Wong, 1999). In 1969, the CDC developed a study to assess the magnitude of this problem and analysed 81 American hospitals. Results indicated that hospitals with infection control programs decreased the number of nosocomial infections by 32% when compared to hospitals without infection control programs (Wong, 1999). Finally, in 1987, the CDC published the criteria to prevent the spread of nosocomial infections, which was recognized as a serious public health problem (Boyce & Pittet, 2002). Universal Precautions (UP) guidelines were then presented as routine barrier precautions for anticipated contact with blood-borne pathogens, including human immunodeficiency virus (HIV), hepatitis C virus (HCV), and hepatitis B virus (HBV), (CDC, 1987).

Universal Precautions are work practices designed to be followed by all HCPs for all patients within and entering healthcare organisations. These safety guidelines are designed to reduce the risk of transmission of microorganisms from both recognized sources of infection in the hospital and protect both patients and employees (CDC, 2003). These precautions include treating every patient as a source of infection regardless of their medical status, hand washing before and after patient contact or contact with infectious substances, adequate disposal of needles and other sharps and using appropriate personal protective equipment, namely disposable latex gloves and other equipment (e.g. goggles, masks) (Doebbeling, Vaughn, McCoy, Beekman, Woolson, Ferguson et al., 2003). The ultimate aim of these measures is to reduce the risk of disease transmission in the healthcare setting, both to patients and staff; and, thus, decrease mortality and morbidity rates by limiting HCPs' contact with all

secretions or biological fluids, skin lesions, mucous membranes and blood or body fluids (Garner, 1996).

In 1989, the UP were updated to include more specific recommendations, such as precautions to be used during phlebotomy (CDC, 1989) and they became mandatory in 1991 when the Occupational Safety and Health Administration (OSHA) published the Blood-Borne Pathogens Rule. The last revision of these guidelines occurred in 1996 when the CDC combined UP with body-substance isolation recommendations, achieving the *Standard Precautions* (Garner, 1996). If Standard Precautions are effectively practiced, patients and workers will be protected from infection transmission, whatever procedure is being undertaken and whatever the diagnosis of the patient (CDC, 2003).

Infection control is an integral part of Standard Precautions and all health professionals should be educated regarding the routes and techniques used to prevent infectious agents (CDC, 2003). Health professionals play, then, a determinant role in spreading and reducing the proliferation of infectious microorganisms. Studies indicate that almost every patient-care activity results in transmission of the patient's bacteria to HCPs' hands (e.g. Sanderson & Weissler, 1992). Also, several research findings highlighted that direct patient contact and respiratory-tract care were most likely to contaminate HCPs' hands and that the duration of patient-care activity was strongly associated with the intensity of hand contamination (e.g. Pittet, Dharan, Touveneau, Sauvan & Perneger, 1999). If HCPs' hands function as bacterial recipients contributing to the transmission of microorganisms between patients, then among Standard Precautions, hand hygiene becomes the most simple and effective infection control procedure (CDC, 2003; Korniewicz, 2007).

Hand hygiene can be defined as an action that decreases the colonization of transient flora found on the human skin, which is readily removed with good hand cleansing (Aylife, Lowbury, Geddes & Williams, 1992). In fact, literature findings have concluded that hand antisepsis is an effective way to decrease the prevalence of HAIs (Larson, 1988; 1999). Results strongly indicate that HAI rates were lower when antiseptic handwashing was performed by HCPs' (Maki, 1989). Therefore, in acute-care settings, HCPs' may spread bacteria when performing inadequate behaviours, particularly the inconsistent use of hand hygiene products, and the lack of compliance with a routine of handwashing before, during, and after clinical procedures (CDC, 2003).

The importance of this infection control measure to decrease HAIs has become mandatory, leading to the development, in the last decade, of surveillance programs. The

recognition of hand hygiene as the most effective infection control procedure allowed hospitals throughout the world to have infection control committees trying to focus on HCPs' compliance behaviours in order to assess infection rates and promote hand hygiene compliance (Hospital in Europe Link for infection Control through Surveillance [HELICS], 2004).

1.4 Healthcare professionals' compliance with infection control procedures

The evolution of infection control practices, as well as the recognition of the role of hand antisepsis as a primary measure to decrease nosocomial infections, reinforces the relevance of HCPs' compliance with health and safety behaviours. Several studies have been made to document HCPs' compliance with hand hygiene and other infection control procedures. Findings have indicated that HCPs wash their hands an average of 5 times per shift to as much as 30 times per shift (e.g. Ayliffe, Babb, Davies & Lilly, 1988; Larson & Killien, 1982; Ojajärvi, Mäkelä & Rantasalo, 1977) for an average duration of 6.6 to 24 seconds (e.g. Broughall, Marshman, Jackson & Bird, 1984; Fox, Langner & Wells, 1974; Larson, Friedman, Cohran, Treston-Aurand & Green, 1997; Larson, Norton, Pyrak, Sparks, Cagatay, & Bartkus, 1998), failing to cover all surfaces of their hands required to eliminate bacteria (Taylor, 1978). Overall, compliance with infection control procedures among HCPs' is poor with an average of 40% complying, ranging from 5% to 81% (Bischoff, Reynolds, Sessler, Edmond, & Wenzel, 2000; Lund, Jackson, Leggett, Hales, Dworkin, & Gilbert, 1994; Muto, Sistrom & Farr, 2000; Pittet, Hugonnet, Harbarth, Mourouga, Sauvan, & Touveneau, 2000; Wurtz, Moye & Jovanovic, 1994).

Non-compliance is also a problem in trauma and emergency units, HCPs are likely to be exposed to blood and other body fluids from patients with unidentified medical records (Limbert & Lamb, 2002). For example, Baraff & Talan (1989) investigated HCPs' compliance with safety precautions in an emergency unit. Results demonstrated that for non-critical patients only 52.5% of HCPs wore gloves for taking blood samples or making an invasive procedure. Furthermore, for critical trauma patients, gloves were only used in 64% of occasions. In another study, Adegboye, Roy & Emeka (1997) found that 45% of HCPs' from a trauma unit were non-compliant at least with glove use.

Other studies also reported, for surgery units, compliance rates of 16% among residents (Hammond, Eckes et al., 1990), while Kellen, DiGiovanna, Celentano, Kalainov, Bisson, Junkins et al. (1990) determined that only 44% of nurses from the Emergency Room complied

with infection control practices. These findings are of great concern, due to the unsuspected rate of infectious pathology that prevails in emergency patients (e.g. HIV, Hepatitis). An illustration of this problem is the one presented by Kelen, DiGiovanna, Bisson *et al.* (1989) study, which found more than 7.8% of emergency patients with no known history of HIV infection were HIV-positive. Another important result was the difference in compliance rates between wards and health professionals, with several studies documenting highest compliance rates among pediatrics wards when compared to intensive-care units. In fact, data show that the higher the demand for hand antisepsis, the lower the compliance, particularly for physicians (Boyce, 1999; Pittet, Mourouga & Perneger, 1999; Voss & Widmer, 1997).

Non-compliance with these infection control procedure has also been largely evaluated by quantitative studies (Lymer, Richt & Isaksson, 2004), being associated with factors such as: lack of accessibility or discomfort with the personal protective equipment, HCPs' need to fulfill patients' requirements, peers' social influence, HCPs' perception of control and inappropriate working conditions (e.g. Godin, Naccache, Morel & E 'Bacher, 2000; Kelen, DiGiovanna, et al.,., 1990). Other indicators related to these professionals non-compliance also state inaccessible equipment (Gould & Ream, 1993; Harris, Samore, Nafziger, DiRosario, Roghmann & Carmeli, 2000; Kaplan & McGuckin 1986), lack of time (Bridger 1997; Larson & Killien, 1982), 'busyness' (Gould & Ream 1993), and deleterious effects on skin (Zimakoff, Kjelsberg, Larsen & Holstein, 1992).

In a study conducted by Ferguson, Waitzkin, Beekman & Doebbeling (2004) several reasons related to non-compliance with infection control procedures were identified. Results referred to the possibility of HCPs' putting the patient at risk if the precautions interfere with their ability to provide adequate care to patients, reinforcing the role of personal dilemmas with moral concerns underlying their routine safe practices. On the other hand, Burns & Knussen (2005) determined in their study that nurses may suffer from the False Consensus Effect (Ross, Greene & House, 1977). After presenting beliefs and behaviours inconsistent with safety procedures guidelines and principles, results also indicated that HCPs who do not subscribe to infection control practices are more likely to overestimate the degree to which colleagues undertake the same undesirable practices.

According to Lymer et al. (2003) HCPs' have to face a daily routine where several factors emerge to compromise their safety compliance behaviours. The forces that undermine their compliance appear to be due to the socio-organisational environment which the professional is integrated into. For instance, HCPs' routines contribute to their socialization

with infection control practices, which contributes to reduce the perceived importance of these safety measures. Also stereotypes attributed to HCPs who do comply with infection control practices have a negative impact on compliance. Another relevant point is the perception of the patient's wishes as well as the unavailability of the infection control equipment (Lymer et al. 2003).

Despite these results, several limitations may be pointed out to the way these studies were conducted. Most of the studies have used observations of HCPs' compliance behaviours. However, there remains a lack of information related to how these observations were made, which constrains not only the results achieved and their accuracy, but also the replication of the methods used (CDC, 2003).

Altogether, these factors are a resume of the main explanations provided to clarify HCPs' non-compliance with Standard Precautions. By taking into account this state of the art, it can be seen that the perceived barriers presented by HCPs' in relation to their safety compliance are not only connected with their personal beliefs and attitudes, but also reflect the social and organisational environment of the healthcare organisation. At the organisational level, safety culture and climate perceptions appear to have a contribution in defining a constitution of an environment that may enable, or inhibit, the proliferation of these professionals' good practices. However, literature does not focus on the interconnections among these different groups of variables and most studies do not sustain their research in a theoretical framework that delineates an articulation between theory and practice. To that end, this project intends to explore the need to focus on HCPs' compliance with Standard Precautions by considering the dynamics of three dimensions: the institutional, the social and the individual one, as a way to coordinate the different multi-level roles that underline safety compliance in order to provide a clear identification of how factors of different levels of analysis are contributing to define HCPs' intention to comply with infection control procedures.

Within the infection control literature, it was possible to identify another group of studies particularly focused on interventions directed to increase compliance with Standard Precautions. The need to explore some of the main results related to interventions rely on the importance of analysing how theory is being translated into practice, meaning in what sense research results have been able to contribute to increase and reinforce compliance.

Recognizing that adherence with these procedures is imperative, yet generally inadequate, several health organisations developed intervention measures to enhance

compliance rates. Interventions to improve compliance, such as provision of an educational programme (e.g. Gould & Chamberlain, 1997), a motivational programme (Simmons, Bryant, Neiman, Spence & Arheart, 1990), automated sinks (Larson, Bryan, Adler & Blane, 1997), and patient educational programmes (McCuckin Waterman, Porten, Bello, Caroso, Juzaitis et al., 1999), have been widely implemented. Nevertheless, it appears that there is also a trend to make little improvement after applying an intervention (e.g. Watson & Myers, 2001). Researchers have concluded that HCPs' compliance rates are difficult to change, having found compliance shifts equal to or less than 12% despite best efforts. Schwartz, Jacobs & Juda (1992), evaluated these professionals' compliance with infection control precautions before and after a lecture on safety. The safety measure focused on the use of gloves and the authors reported a 39% rate of compliance before the session compared to 56% afterwards. Similar results were found by Freeman & Chambers (1992) in which behaviour compliance increased only 1% from 44 to 45%. Also, Neves, Tipple, Silva & Souza, Pereira, Melo & Ferreira (2006) developed a study with a permanent health team at a neonatal ICU with a sample composed by 80 professionals. Incentive strategies were maintained for two months (e.g. posters and phrasings about hand hygiene). Results indicated a small impact on compliance with hand hygiene during the implementation phase and a decrease in HCPs' compliance levels once the intervention ended. Compliance rates remained around 60%.

Gould, Chudleigh, Moralejo & Drey (2007) developed a study to assess the short and longer-term success of strategies to improve hand hygiene compliance. Findings determined the existence of little robust evidence to inform the choice of interventions to improve hand hygiene. It appears that single interventions based on short, 'one off' teaching sessions are unlikely to be successful, even in the short-term. Gould et al. (2007) recommended the need to undertake methodologically robust research to explore the effectiveness of soundly designed interventions to increase compliance.

Other studies have also determined the inefficacy of a single intervention able to consistently sustain improved compliance with respect to HCPs' infection control practices (e.g. Larson & Kretzer, 1995). Generally, most of the studies had a short follow-up period to evaluate improved compliance after an intervention program, which constrains whether behavioural improvements are long-lasting (e.g. Larson, Early, Cloonan, Sugrue, & Parides, 2000; Pittet, Hugonet et al., 2000).

So far, routine observation and feedback practices have been documented as the most effective strategies to increase compliance rates (e.g. Graham, 1990). The difficulty in raising

compliance through intervention programs may be due to the absence of key factors associated with both the individual and the social group as well as with the organisation (e.g. Burns & Knussen, 2005; Kretzer & Larson, 1998).

By taking into account the state of the art focused on these examples of interventions directed to increase compliance with Standard Precautions, it is possible to determine that most programs express an inability of sustaining HCPs compliance over time. In this sense, it can be assumed that there remains a lack of articulation between the theoretical framework on infection control and the design and implementation of interventions. To that end, and departing from the state of the art, this thesis aims to provide more awareness on how to solve these inconsistencies between theory and practice contributing to clarify HCPs' intention to comply. In conclusion, this project will, therefore, direct its attention to a multifaceted approach in which compliance is influenced by individual, social and organizational factors rather than looking into a unifaceted approach aiming to provide specific strategies that can be used in order to develop adequate and sustainable intervention programs based on theory evidence.

1.5 Conclusions

This chapter aimed to develop a general overview of the emergence of infectious pathology in the healthcare sector and its main consequence: the proliferation of HAIs affecting millions of patients worldwide and increasing social and financial costs (CDC, 2003).

The relevance of hand hygiene as an infection control procedure appeared at the end of the XIXth century and its contribution to decrease the prevalence of HAIs was documented by the CDC, and hand hygiene became the easiest and simplest infection control technique among Standard Precautions to be applied by HCPs in hospital settings around the world (WHO, 2005).

However, compliance with infection control practices, in particular with hand hygiene, by HCPs, who constitute the main vehicle of bacterial transmission, remains ineffective. The prevailing body of literature determines that non-compliance is segmented by professional categories and wards; still, non-compliance is a phenomenon that occurs in all medical units regardless of the patients being in a critical and/ or a non-critical state (e.g. Pittet et al., 1999).

Numerous factors have been identified as associated with non-compliance with hand hygiene, namely personal beliefs, attitudes, perceptions and social and organisational factors.

All these characteristics interact to explain non-compliance. Several intervention strategies have been implemented in the healthcare sector over the years in an attempt to increase compliance rates; nevertheless, results have shown that behavioural improvements are currently low and unstable, which means there is a need to explore an integrative approach that incorporates multifaceted factors underlying compliance able to better articulate theory evidence and practice (e.g. CDC, 2003; Pittet, 2004; WHO, 2005).

CHAPTER 2

THEORETICAL FRAMEWORK OVERVIEW OF HEALTHCARE PROFESSIONALS' SAFETY COMPLIANCE

2.1 Introduction

For decades, social psychological models were at the front line in predicting and explaining human behaviour, in particular health behaviours (Rutter & Quine, 2002). Among these models it was possible to find the health belief model (Rosenstock, 1966), the protection motivation theory (Rogers, 1975), the theory of reasoned action (Fishbein & Azjen, 1980) the transtheoretical model of behaviour (DiClemente & Prochaska, 1982), and the theory of planned behavior (Ajzen, 1988).

Most of these models are based upon social cognition enhancing the idea that people's behaviour is best understood by examining their beliefs, social perceptions and representations about their behaviour in a social context (Rutter & Quine, 2002) which contributed to understanding and predicting health behaviours.

However, throughout the decades social psychology's attempt to understand health behaviour patterns started to go beyond the individual level of analysis which was highly focused on socio-cognitive models, and directed attention to a macro perspective that enhances community and organisational facets (Pittet, 2004). To that end, approaches such as the Precede-Proceed model which emphasizes the importance of health education amongst the community; or the role of safety culture, which enhances the relevance of rules, policies and other cultural factors inside an organisation, expanded the diversity of theoretical perspectives able to explain compliance behaviours.

In the particular case of HCPs' compliance with Standard Precautions, literature findings present two types of scientific contribution: 1) those concerning the role of *isolated variables*, such as HCPs' beliefs, attitudes (e. g Wissen, Siebers & Fnzimls, 1993) and behaviours (e. g. Ferguson, Waitzkin, et al., 2004); and 2) those focusing the impact of integrative models, namely socio-cognitive (e.g. Theory of Planned, Ajzen, 1988), community (Precede-Proceed Model, Green & Kreuter, 1999) and organisational approaches (e.g. Safety Climate, Zohar, 1980).

The theoretical guidelines underlying this thesis will be framed taking into account the second type of contribution in order to understand how to improve HCPs' compliance with Standard Precautions by determining which factors predict these behaviours. Therefore, the present research will be theoretically underpinned by the Theory of Planned Behavior, the Precede-Proceed model and the Safety Climate approach.

In order to shed some light on the specificities of these models as well as their contributions and limitations to the study of HCPs' compliance with Standard Precautions, an overview is presented of the definitions and applicability of these theoretical frameworks.

2.2 The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) (Ajzen, 1988) is one of the most applied theories in the field of human behaviour (Rutter & Quine, 2002). This model is a socio-cognitive perspective based upon expectancy-value models. The appearance of this theoretical approach came as a result of the Theory of Reasoned Action (TRA) proposed by Fishbein & Ajzen (1980). This first proposal determines how attitudes, subjective norm and intention are combined to predict behaviour. Individual behaviour will be best predicted by the intention that a person has to perform it. Thus, the intention will reflect the personal motivation to perform the behaviour, demonstrating the efforts that an individual is willing to make in order to develop a certain action (Ajzen, 1991).

According to the TRA (Ajzen & Fishbein, 1980), the intention will be determined by two distinct factors: the attitudes that the individual has towards the behaviour and the subjective norm, or perceived social pressure to perform the behaviour (or not). Attitudes will be the product of a set of salient beliefs related to the consequences of performing the behaviour. Each of these beliefs has a specific weight that will be determined by the personal evaluation of the behavioural consequences. On the other hand, the subjective norm will result from the normative beliefs that the individual has, given the social pressure exerted by relevant others, balanced by his or her personal motivation to comply with that perceived pressure (Ajzen & Fishbein, 1980).

One of the problems of the TRA was reported by Ajzen (1988) who determined that this approach only reflected behaviour under volitional control, neglecting that most individual behaviour is not completely volitional. Departing from contributions of self-efficacy literature provided by Bandura (1986), Ajzen (1988) expanded the TRA by adding a new construct, perceived behavioural control (PBC), which refers to the perception that the individual has that he or she can perform the behaviour.

According to Ajzen (1988), PBC predicts intention when the individual perception of control accurately reflects personal control towards behaviour. PBC is determined by control beliefs that will be based on barriers, obstacles, skills, resources and perceived opportunities that may enable, or inhibit, the performance of the behaviour. These factors can be seen as

being external (e.g. time availability) or internal (e.g. skills), (Rutter & Quine, 2002). However, the contribution of PBC will also have an impact on the final desired behaviour by reflecting the current perception of behavioural control that an individual holds (Ajzen & Fishbein, 2005, pp. 194, 195). The TPB model can be seen in Figure 1.

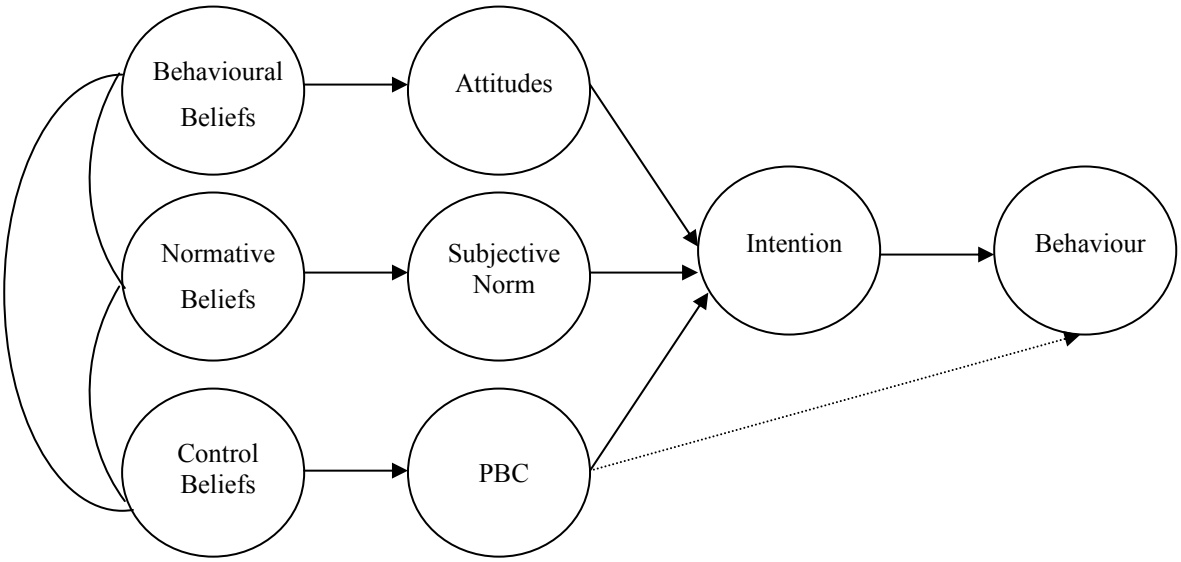


Figure 1.1. Visual representation of the Theory of Planned Behavior (Ajzen, 1991)

In the TPB, Ajzen (1991) considers that it is important to optimize the relationship between attitudes and behaviour and also between intention and behaviour. For instance, general attitudes will tend to fail to predict specific behaviours due to a lack of compatibility in the action, time and context elements (Ajzen & Fishbein, 2005). In this sense, measures of attitude and behaviour need to express the same elements whether defined at a specific or a more general level (Azjen & Fishbein, 2005). Also, incompatibility between intention and overt behaviour occur when performance is not under total volitional control (i.e. when people don't have control over performance of a behaviour they tend to act contrary to their intentions) and when intentions and behaviour are both measured in different periods of time, giving the opportunity to individuals constitute distinct intentions to act towards the same behaviour (Ajzen & Fishbein, 1973; Ajzen & Fishbein, 2005).

Both TRA and TPB theories have been widely applied to a variety of behaviours (e.g. drug and alcohol use, contraceptive use, breast-feeding). In a literature review performed by Sheppard, Hartwick & Warshaw (1988) on the TRA, it was concluded that the model produced an average correlation of 0.66 between beliefs and intention and 0.53 between

intention and behaviour. Eighty-seven papers were reviewed focusing on behaviours such as blood donation, exercise or criminal acts. A similar result was obtained by other literature reviews that assessed the robustness of the TPB (e.g. Ajzen 1991; Conner & Armitage, 1998; Randall & Wolff; 1994). Recently, Armitage & Conner (2001) concluded, in a meta-analysis that for TPB there was an average correlation of 0.63 for attitudes, subjective norm and PBC with the intention and 0.47 between intention and behaviour, with higher correlations when considering self-reported behaviours instead of observed ones.

Turning to the predictive power of the main constructs presented in the TPB, it appears that intentions generally account for approximately 19% to 38% of the variance in behaviour (e.g. Ajzen, 1991; Sheeran & Orbell, 1998), while attitudes and subjective norm explain between 33% to 50% of the variance in intention (e.g. Sheeran & Taylor, 1999). PBC, in turn, tends to increase the explained variance in intention between 5% and 12% (e.g. Conner & Armitage, 1998; Sheeran & Taylor, 1999). Furthermore, it also increases the explained variance in behaviour from 2% to 12% regardless of the predictive power of intention (e.g. Godin & Kok, 1996).

Despite the apparent fit between these models and the analysed behaviours, several considerations were posed in the literature focusing, in particular, on the substantial proportion of variance that is not explained between intentions and behaviour. This amount of unexplained variance suggests that there are other relevant factors that are not included in these models which also have an important role in predicting individual behaviour (Sheeran, 2002).

Actually, several researchers have tried to include new predictors to try to increase TPB predictive robustness (e.g. Eagly & Chaiken, 1993; Manstead & Parker, 1995). In fact, distinct constructs were included to try to explain the variance of behavioural intention, namely, the moral / personal norm or perceived moral obligation (e.g. Beck & Ajzen, 1991; Conner & McMillan, 1999; Sparks, 1994), anticipated regret (e.g. Parker, Manstead & Stradling, 1995), anticipated affect (e.g. Van der Pligt & de Vries 1998), and affective evaluations of behaviour (e.g. Manstead & Parker, 1995).

Recently, studies have also tried to identify factors that may moderate the relationship between intentions and behaviour, such as self-schemas (e.g. Sheeran & Orbell, 2000a), attention control (e.g. Orbell & Sheeran 1998) and implementation intentions (e.g. Gollwitzer & Brandstatter 1997). Nevertheless, results regarding the predictive impact of these new predictors reveal that one of the issues underlying the TPB is the fact that this is a sufficient

model, i.e., in which external variables to the model did not introduce additional explained variance of the intentions or behaviour when the effects of the theory's major predictors have been taken into account (Rutter & Quine, 2002).

Yet, the criticism towards the TPB has also focused upon other conceptual and empirical questions that go beyond the predictive ability of the model. For instance, several authors have questioned the causality that underlies the theoretical path between intention predictors and behaviour. Some researchers reported that the major concern of this theory was the intention, seen as a motivation that causes the behaviour. However, intention is commonly perceived as an indication of what a person is willing to do in order to perform the behaviour (Smith, 2000). In this sense, the individual is an agent that initiates the action. Thus, the beliefs, attitudes and intentions will correspond to each other because they will reflect the evaluation that a given person gives of the action under consideration (Smith, 1999).

Another criticism was proposed by Greve (2001) focusing on the relationship between intention and planned behaviour. This author stated that the concept of behaviour should be perceived as an action due to its intentional nature. Greve (2001) also proposed a new interpretation of intention, defining it as part of the action. Therefore, the components of the TPB would evidence the individual action, rather than causal explanations of the behaviour.

Finally, two other main considerations are made towards the TPB related to the subjective norm and the PBC. Focusing on the subjective norm, this predictor has been seen as the weakest predictor among attitudes and PBC. In a literature review, Ajzen (1991) determined that all reviewed papers presented a significant relationship between attitudes and intention; while only half of them had a significant relationship between the subjective norm and intention. These results expressing the weakness of the subjective norm were also identified by other research (e.g. Armitage & Conner 2001; Conner & Armitage, 1998; Terry & Hogg, 1996). The limitation of this predictive relationship has been attributed to several factors, mostly due to an inadequate conceptualization and measurement of the construct. The former focus a tendency to only address the perceived social pressures placed on the individual; while, the latter is directed to the lack of specificity and also to an insufficient number of the items defined to measure the latent construct (e.g. Rivis & Sheeran, 2003; Sheeran & Orbell, 1999). In this sense, several studies have shown that it would be interesting to include new dimensions to complement the processes of social influence on intention and behaviour (e.g. Fishbein, Chan, O Reilly, Schnell, Wood, Beeker et al, 1992; White, Terry, & Hogg, 1994). To that end, several authors refer to a need to make a distinction between

perceptions of normative influence on the behaviour approved by others, forming an *injunctive norm*; and perceptions of normative influence on behaviour that is typically performed by others, constituting a *descriptive norm* (e.g Cialdini, 2003; Cialdini, Källgren & Reno , 1990).

In the particular case of the subjective norm, it only captures the injunctive nature of the norm by focusing on the perceived individual pressure (Rivis & Sheeran, 2003). By contrast, the descriptive norm has a unique effect on intentions regardless of the predictive power of the injunctive norm, as it relates to perceptions that lead to the behaviour characteristics in a given situation (Cialdini, Kalgrenet al. 1990). Some studies were conducted to try to distinguish between descriptive and injunctive norms. Results achieved determined that the descriptive norm has discriminant validity with a specific weight in predicting intention (e.g. Nucifora, Gallois, & Kasbima. 1993; Sheeran & Orbell, 1999). Nevertheless, despite these results, which indicate that there is an independent weight of each of these constructs on the intention to behave, there are shared conceptual and empirical communalities among them. At the conceptual level, the injunctive and descriptive norms both reflect the pressure or control types of social influence (e.g. Hagger, Chatzisarantis, & Biddle, 2002a; Sheeran, Norman & Orbell, 1999). Turning to the empirical level, both norms are correlated with each other (e.g. Berg, Jonsson, & Conner, 2000, Sheeran & Orbell, 1999). In this sense, it is proposed that this covariance may be explained by a higher order factor by constituting a hierarchical model of normative influence. Thus, a global normative component should include two other sub-components to predict intention: the injunctive norm and the descriptive one.

Although the constructs of subjective and descriptive norms have convergent and discriminant validity, it remains unclear how the descriptive norm predicts the intention (e.g., Grube, Morgan & McGree, 1986; Sheeran & Orbell, 1999; White, Terry, & Hogg, 1994). First, some studies reported medium to strong correlations between descriptive norms and intention, while other studies have found weak correlations or non-significant ones (e.g. Rivis & Sheeran, 2003). Second, literature results have been contradictory when the descriptive norm is included simultaneously in the regression equation with the other TPB main predictors (e.g. Conner, Martin, Silverdale &Grogan, 1996). Third, several studies have evaluated whether the descriptive norm was able to predict intention after controlling the regression effects of attitudes, subjective norm and PBC. Overall, results around this issue remain dubious (e.g. Povey, Conner, Sparks, James & Shepherd, 2000).

Besides the problem concerning the subjective norm, another question was raised towards the PBC, regarding the need to differentiate between control and self-efficacy. In 1991, Ajzen proposed that the conceptualization of PBC should take into account all facets of the behaviour that are not under individual control. Several studies indicate the possibility to distinguish between two sub-components: the extent to which the individual has access to the means to exercise control over the behaviour, which corresponds to *controllability* (Ajzen, 2002a); and, the self-confidence that the individual has to perform the behaviour, corresponding to *self-efficacy* (Armitage & Conner, 1999a; Manstead & van Eekelen, 1998). In the TPB, PBC indicators have focused on the perceived issues that appeal to the subjective evaluation that the individual has over the behaviour; while self-efficacy is measured through the perceived ability to control the behaviour. Studies that enhance the need to perform this distinction have demonstrated the predictive and discriminant validity of both constructs (e.g. Armitage & Conner, 1999a). However, the proposal of a first and second order model in terms of the PBC remains inconclusive due to several ambiguous results of its predictive ability on the intention (Ajzen, 2002a). In fact, Ajzen (2002a) noted that the distinction between first and second order models can be made because there is a commonality shared between the constructs, however, the possibility to distinguish several sub-components that integrate a higher order dimension does not deny its unitary nature.

Given the several criticisms developed towards the TPB, in particular those focusing on the need for new predictors, it is possible to include additional predictors that might capture a significant proportion of the variance of intention or behaviour after the explanatory role of the main theoretical constructs has been assessed (e.g. Ajzen & Fishbein, 2005). Nevertheless, despite that fact that the TPB structure allows the possibility of including new intention predictors, in order to can ensure its parsimony, the introduction of those predictors must be developed with caution and only after solid empirical contributions (Ajzen & Fishbein, 2005, p. 201).

Despite criticism that focuses primarily on the conceptualisation and operationalisation of the theory constructs, its theoretical and practical relevance in a variety of circumstances and problems is unquestionable. However, this theory has rarely been applied in intervention processes. Indeed, the TPB has been mostly used to predict intention or behaviour, failing to transpose the results obtained for the construction of robust intervention programs (Hardeman, Johnston, Johnston, Bonetti, Wareham & Kinmonth, 2002). Actually, in the literature review performed by Hardeman, Johnston et al., (2002) which focused on the

application of this theory to behaviour change interventions, most of the programs that made use of Ajzen's theoretical proposal focused either on the school environment or on the community through programs targeted to decrease the proliferation of risk (e.g. tobacco and other substances, road traffic safety, nutritional problems, prevention of HIV transmission).

Despite the fact that the TPB is rarely applied in the development of intervention programs (e.g. Pittet, 2004; Hardeman et al., 2002) it can be seen as relevant conceptual tool: *first*, it can provide a cognitive orientation for individuals and their ability to make decisions; *second*, it allows the development of guidelines to build effective contingency plans that might reinforce knowledge and increase individuals' propensity to adopt the expected behavioural outcome (Millstein, 1996).

2.2.1 Using the Theory of Planned Behavior to study the healthcare sector

The TPB attempts to understand health behaviours by directing its attention to the individual and interpersonal levels (Pittet, 2004). Usually designated as a socio-cognitive model, the TPB is a specific theoretical framework that can determine the antecedents to comply with health behaviours by revealing the main predictors of an individual's behavioural intention (Conner & Norman, 1995). Despite the existence of other socio-cognitive models to evaluate health behaviour predictors (e.g. Health Belief Model, Protection Motivation Theory) results achieved by the TPB are stronger when compared to those obtained by other theories (Stroebe & Stroebe, 1995). However, in the particular case of infection control and the development of intervention programs for changing the practice between health professionals and patients, little attention has been given to the role of social-cognitive theories (Pittet, 2004) to assess health professionals perceptions about Standard Precautions compliance (e.g. Pittet, 2004).

As the literature demonstrates, these theories of human behaviour that focus on the intention as an immediate predictor of their personal behaviour have been widely applied in non-medical populations with great success (Eccles, Hrisos, Francis, Kaner, Dickinson, Beyer et. al. 2006). Eccles, Hrisos et al. (2006) conducted a literature review in order to explore the relationship between intention and behaviour in a medical population, comparing it with the intention-behaviour relationship that is documented for non-medical populations. The results showed that the explained variance in behaviour has a similar magnitude when compared with the literature that focuses on a non-health professional population, particularly for self-reported behaviours. The results indicate consistency between different samples suggesting

the TPB's suitability for studying health and safety problems in the medical sector (Eccles, Hrisos et al., 2006).

Godin, Bélanger-Gravel, Eccles & Grimshaw (2008) tried to conduct a review focused on health professionals compliance with several sort of behaviours, however results were limited due to the small number of studies developed in this field. Nevertheless, the results indicated that most studies focusing on health professionals have physicians and nurses as samples (Eccles, Grimshaw, Johnston, Steen, Pitts, Thomas et al., 2007; Millstein, 1996; Bernaix, 2000). The most studied behaviours were those that refer to clinical practice (Bernaix, 2000; Eccles, Grimshaw, Johnston, Steen, Pitts, Thomas et al., 2007) and to personal compliance with safety guidelines (Godin, Naccache, Morel & Ébacher, 2000; Maue, Segal, Kimberlin & Lipowski, 2004).

In this regard, the following literature review which focuses on the application of TPB to the health sector will be organised by taking into account the indications collected in the literature focusing the professional group (physicians vs. nurses) and behavioural practices (clinical practice vs. compliance with safety procedures). Results will be presented in such way to determine whether there are differences between intention predictors among samples and the type of behaviour under analysis.

2.2.2 Theory of Planned Behavior predictors of clinical practice

Clinical practice among HCPs' integrates a wide variety of behaviours (e.g. HIV prevention, antibiotics prescription). Theoretically, it can be defined as a systematic set of measures designed to provide guidance to HCPs' and their patients to make decisions about health care in specific situations (Field & Lohr, 1990). Among the first studies conducted in the field of clinical practices are those appearing in the 90s focused on HIV prevention issues.

For instance, in order to identify the psychosocial factors that explained the medical decision-making process towards the need to perform a clinical examination on a patient with HIV, Godin, Boyer, Duval, Fortin & Nadeau (1992) developed a study based on Ajzen's TPB theory. Godin, Boyer et al. (1992) found that the most relevant predictor was the subjective norm, attributing importance to the personal position that other doctors had about the medical conduct in question, which demonstrated the importance of socialization. Also Millstein (1996) attempted to evaluate the usefulness of the TPB by predicting physicians' intention to promote HIV prevention among adolescents. The results determined that physicians' beliefs about their own degree of control in educating adolescent patients were good predictors of

both intention and behaviour. Findings also identified the importance of social norms in influencing physician behaviour. Doctors who were familiar with the beliefs of their professional colleagues towards HIV education for adolescents not only had stronger intentions to deliver these services but were more likely to be able to translate those intentions into actual behaviour (Millstein, 1996).

Another set of studies that focus on medical clinical practice are those concerning physicians' drugs prescription. In this particular case, Gaither, Bagozzi, Ascione & Kirking (1996), tried to analyze the effect of attitudes and subjective norm on the physicians' intention to use multiple sources of information to prescribe medical drugs. In this study there was also the inclusion of two additional predictors to the intention predictor component of the TPB, namely past behaviour and practice characteristics. The results showed that positive attitudes towards the use of various sources of information had the highest impact on intention; while past behaviour directly affected the intention for some types of source (e.g. pharmaceutical literature).

Walker, Grimshaw & Amrstrong (2001) also used the TPB to investigate the strength of intention to prescribe antibiotics for patients with a sore throat and to identify the salient beliefs associated with the intention to prescribe it. The TPB variables explained 48% of doctor's intention to prescribe antibiotics with past behaviour adding a further 15%. In this particular case, attitudes and control beliefs were the most important predictors of intention. Limbert & Lamb (2002) tried to assess the extent to which physicians apply clinical guidelines towards antibiotics prescription. They developed three studies and determined that doctors apply a clinical guideline when they consider it useful and based upon strong empirical evidence. On the negative side, doctors considered that clinical guidelines fail to match patients´ needs as they deny the individuality of the patient, meaning that most patients have a medical history based on multi-factorial problems that go beyond the scope of any guideline. This negative characteristic is seen as a factor that may contribute for non-compliance. Limbert & Lamb (2002) also found that the TPB constructs varied depending on the type of clinical guideline or the physician's social status. Thus, the subjective norm was the best intention predictor for junior doctors who were more influenced by their peers; while attitudes predicted senior doctors' intention to apply clinical guidelines revealing a greater focus on their personal cognitions. Also Liabsuetrakul, Chongsuvivatwong, Lumbiganon & Lindmark's (2003) study identified the importance of the social norm. In this study, which tried to analyse physicians intentions to administer a single-dose of antibiotics after cord

clamping in caesarean to prevent post-infections, results showed that intentions to use a single dose of antibiotics were low among doctors. Furthermore, this intention was related to negative attitudes and reference groups who did not approved the use of single doses. It was verified that norms which were carried over from residency training had more long-term influence on physicians' practice than the new information provided by scientific literature. Finally, Sable, Schwartz, Kelly, Lisbon & Hall (2006) designed another study focused on physicians' intention to prescribe emergency contraception through the examination of their knowledge, attitudes, norms and PBC. Results indicated that high intention to prescribe emergency contraception was associated with positive attitudes towards doing so and also with the physician's perceptions that significant others supported that prescription.

Turning to studies on nurses' clinical practice, results appear to be consistent with those referred above for physicians. For instance, Renfroe, O'Sullivan & McGee (1990) assessed the predictors of nurses' intention to document all patients' records during their shift. The results showed that the subjective norm was the main predictor of their personal intention. Overall, subjective norm and attitudes explained around 46.1% of the variance in intention which also had a significant effect on the behaviour, explaining 15.2% of its variance. Bernaix (2000) designed a prospective study to identify nurses' characteristics and external factors that influence nurses' ability to provide effective informational, technical and emotional support to breastfeeding mothers. Results revealed that nurses' supportive behaviour was best predicted by their knowledge and attitudes. However, nurses' intentions to provide support did not influenced their actual behaviour. Also, Bernaix (2000) identified several gaps in nurses' knowledge about breastfeeding which indicated that in order to promote breastfeeding success, knowledge must be accurate. Finally, another study that focused clinical practice among nurses using the TPB was performed by Sauls (2007). The aim was to analyse the contribution of attitudes, norms and control on inter-partum nurses' intentions to provide professional labor support. The TPB predictors explained around 70% of variance in nurses' intentions with attitudes and norms as the most relevant predictors.

2.2.3 Theory of Planned Behavior predictor's of safety compliance

Healthcare safety implies all HCPs' responsibility in pursuing and maintaining a safe working environment through their personal compliance with safe working practices (e.g. infection control practices) in order to contribute to patient health and safety (Pittet, 2004). For instance, Godin, Naccache & Fortin (1998) tried to identify the main factors that might

explain doctors' intention to use gloves whenever contact with blood or body fluids was possible. About 80% of physicians had a strong intention to use the gloves and the subjective norm, attitudes and PBC were all main predictors. The authors also included several additional predictors such as risk perception of contracting an infection, personal habit of using gloves and belonging to a group with less work experience. However, none of these additional predictors showed significant results. On the other hand, Levin (1999) used an extended version of the TPB and TRA to analyze the predictors of HCPs' intention to use gloves when there is potential for blood exposure and found that the most significant predictors of intention were the PBC and attitudes explaining 69% of the variance in self-reported glove use. The subjective norm as well as the perceived risk did not provide a significant value (Levin, 1999). Behaviour, attitudes, PBC, perceived risk and intention were the most significant predictors of HCPs' glove use. HCPs who were determined to wear gloves were the most likely to report wearing them; unless, HCPs held a negative attitude about glove use or if they perceived themselves to be at less risk for bloodborne diseases than their peers (Levin, 1999).

In Maue, Segal, Kimberlin & Lipowski's (2004) study, the TPB was used to examine the relationship between doctors' intention to comply with infection control procedures by assessing the impact of perceived barriers (e.g. past behaviour) and examining the ability of those barriers to predict compliance. Perceived barriers to guideline implementation were the best predictors of both intention to comply and self-reported behaviour. Around 68% of the variance in physicians' intentions was accounted for perceived barriers. Beatty & Beatty (2004) investigated a different set of safety guidelines, anesthetists' compliance with three behaviours: failing to visit patients before surgery, failure to perform pre-anesthetic equipment checks and silencing alarms during anesthesia. Results demonstrated that normative beliefs about the violation, i.e. the opinion they believe a group of peers and other significant referents would hold about them performing the violation was the best predictor in forming anesthetists' personal intention of not performing those three violations. Beatty and Beatty (2004) determined that the more intense the anesthetist's belief that the norm violations were important, the less likely they were to violate.

Turning to nurse samples, Godin, Naccache, Morel & Ebacher (2000) tried to predict and explain nurses' compliance with UP when performing venipunctures. The results demonstrated that the best intention predictors were perceived barriers, social norm and personal normative belief. After the 3 months follow-up, 28% of behaviour variance was

explained by intention and perceived control. Overall, the results suggest that PBC was a key factor in explaining compliance. On the other hand, perceived barriers such as nurse's training on UP and inadequate working conditions presented a negative impact on these professionals' compliance (Godin, Naccache et al., 2000).

Watson & Myers (2001) also applied the TPB to infection control compliance directing their research to determine the cognitive factors underlying nurses' use of gloves. Results indicate that attitudes, subjective norm and PBC accounted for 45% and 61% of explained variance in intention and behaviour, respectively. Attitudes and PBC were the two main predictors of intention; while the use of gloves was predicted by nurses' intention to comply and the perceived availability of gloves. Finally, Puffer & Rashidian (2004) tried to analyse nurses' intention to use clinical guidelines towards smoke cessation in community settings. The TPB explained around 40% of variance in intentions to offer smoking cessation advice with attitudes and PBC as most important predictors. The subjective norm was not a significant predictor.

2.2.4 Conclusions

The results of these studies developed in the healthcare sector focusing on HCPs' behaviours through the application of the TPB demonstrate the effectiveness of this theoretical approach. Despite the limited number of studies, the results achieved are a good indicator that the use of this theory may increase the specificity and efficiency of future interventions aimed to change several clinical behaviours among these professionals (Perkins, Jensen Jaccard, Gollwitzer, Oettingen, Pappadopulos et al. 2007). Findings are consistent with the work done with this same theory with a non-medical population suggesting that the theoretical constructs underlying the TPB are adequate to predict intentions among different HCPs' groups and distinct compliance behaviours (Perkins, Jensen, et al., 2007).

However, several limitations can be pointed out. Most of the limitations presented by the studies reviewed focus on methodological issues, namely related with the definition of the constructs, their operationalisation and several theoretical incongruencies with the Fishbein & Ajzen guidelines (e.g. Jenner, Watson, Miller, Jones & Scott, 2002). For instance, the predictive ability shown by TPB intention predictors demonstrated higher variability between groups of health professional's (doctors and nurses) and types of behaviours. To that end, across studies it was possible to identify different predictive magnitudes among the main

theoretical constructs of the TPB which hinders the theoretical and practical consistency of the results.

Another factor that should be mentioned refers to the measures that were used to operationalise the behaviour. Most of the reviewed studies used objective behavioural measures which makes it difficult to apply the principle of correspondence between intention and behaviour (Fishbein & Ajzen, 2005). For example, in the study conducted by Sauls (2007) where a non-significant correlation was achieved between intention and behaviour, HCPs' intention focused on these professionals support for pregnant women during childbirth; however, the behavioural measure operationalised the women's length of labor. This lack of correspondence between how constructs are operationalised indicates the weakness of the applied methodology to study HCPs' intentions and behaviours, which puts at risk the quality of future interventions to change compliance behaviours.

Therefore, in the particular case of infection control, it would be useful to study HCPs' compliance with Standard Precautions framed upon the TPB due to a need to explore which constructs may have a greater impact on their intention to comply, by taking into account the specificities of the health professionals (e.g. simultaneously the three major groups of HCPs, namely doctors, nurses and cleaners as members of care-delivery teams) in order to understand the predictive impact that the TPB has towards the behaviour of each health professional category.

Another point that should be taken into account is the fact that the subjective norm may play a relevant role within this field as the main behavioural intention predictor. Actually, several results highlighted the relevance that perceived social norms may have on both physicians' and nurses' intentions about their clinical behaviours. For instance, Limbert & Lamb's (2002) findings indicate that the TPB normative component was able to explain intention variance in a way that it was not able to verify in other research fields because the norm tended to be the less predictive TPB component (Conner & Armitage, 2001). To that end, it would be important to explore the importance that this perceived social norm appears to have in the health sector contradicting its relative lack of importance in non-medical populations.

The next section focuses on a model that enhances the importance of the social context in influencing knowledge and behaviour and has in the TPB, one of the several socio-cognitive frameworks underpinning its theoretical foundations (Green & Kreuter, 1999).

2.3 Precede-Proceed Model

The Precede-Proceed model was first published as a cost-benefit model applied to the education of asthmatic patients as means of contributing to the decrease of these patients use of the hospital emergency services (Green, 1974). It has been widely applied in health prevention and health promotion having more than 750 published applications (Green & Kreuter, 1999; Frankish, 1994) in a variety of situations, such as maternal and child health projects, injury prevention, school nutrition and cancer education (Chaney, Hunt & Schulz 2000). This model differentiates itself from other theoretical approaches because it does not try to predict or explain the relationship between factors thought to be involved in the desired result. Conversely, the Precede-Proceed approach provides a framework that integrates other theories in order to design and implement the most appropriate intervention strategies (Gielen & McDonald, 2002).

The model takes into account several factors that attempt to determine the health and quality of life, allowing the researcher to focus on specific targets for intervention. The Precede phase generates specific objectives and criteria that will be integrated in the Proceed stage through the implementation and evaluation of the interventive program (Green & Kreuter, 1999). It provides a set of steps for planning, implementation and evaluation of an intervention. The identification of priorities for action during the Precede phase leads to quantitative targets that become intentions to be implemented in the Proceed stage (Green, 1974).

The model was developed in two different parts. For instance, the Precede phase (acronym for *"Predisposing, Reinforcing and Enabling Constructs for Educational Diagnosis and Evaluation")* appeared in the 1970s based on the premise that an educational diagnosis stands before an intervention plan. This premise tries to contradict the perspective that health education should be primarily focused on the intervention design, putting little attention on the planning of interventions (Bartholomew, Parcel, Kok & Gottlieb, 2001). The Precede theoretical framework directs its attention to the results instead of focusing on inputs, forcing the investigator to start the intervention planning by the end. The aim of starting planning by the end allows identifying the causes preceding the expected result (Green & Kreuter, 1992). Thus, this will define the determinants of health that should be diagnosed before designing the intervention; otherwise, the interventive procedure may become ineffective (Green & Kreuter, 1999).

Then, in 1991, the Proceed phase (acronym for *"Policy, Regulatory and Organizational Constructs in Educational and Environmental Development"*) was included in the Precede theoretical framework after the recognition that environmental factors have also an important role as health behaviour determinants. Thus, contextual features are considered powerful facets that are outside the individual level of analysis constraining the health behaviour (Gielen et al., 2002; Green & Kreuter, 1999). The Proceed components sheds light on the political, managerial and economic facets that must be taken into account to constitute contexts that promote health behaviours (Green, 1999). To that end, the Precede-Proceed model constitutes itself as an ecological approach that integrates health behaviour into a broader context in order to programme health interventions (McLeroy, Bibeau, Steckler & Glanz, 1988; Simons-Morton, Brink, Simons-Morton, McIntyre, Chapman, Longoria et al., 1989). In Figure 1.2 it is possible to analyse the visual representation of this model.

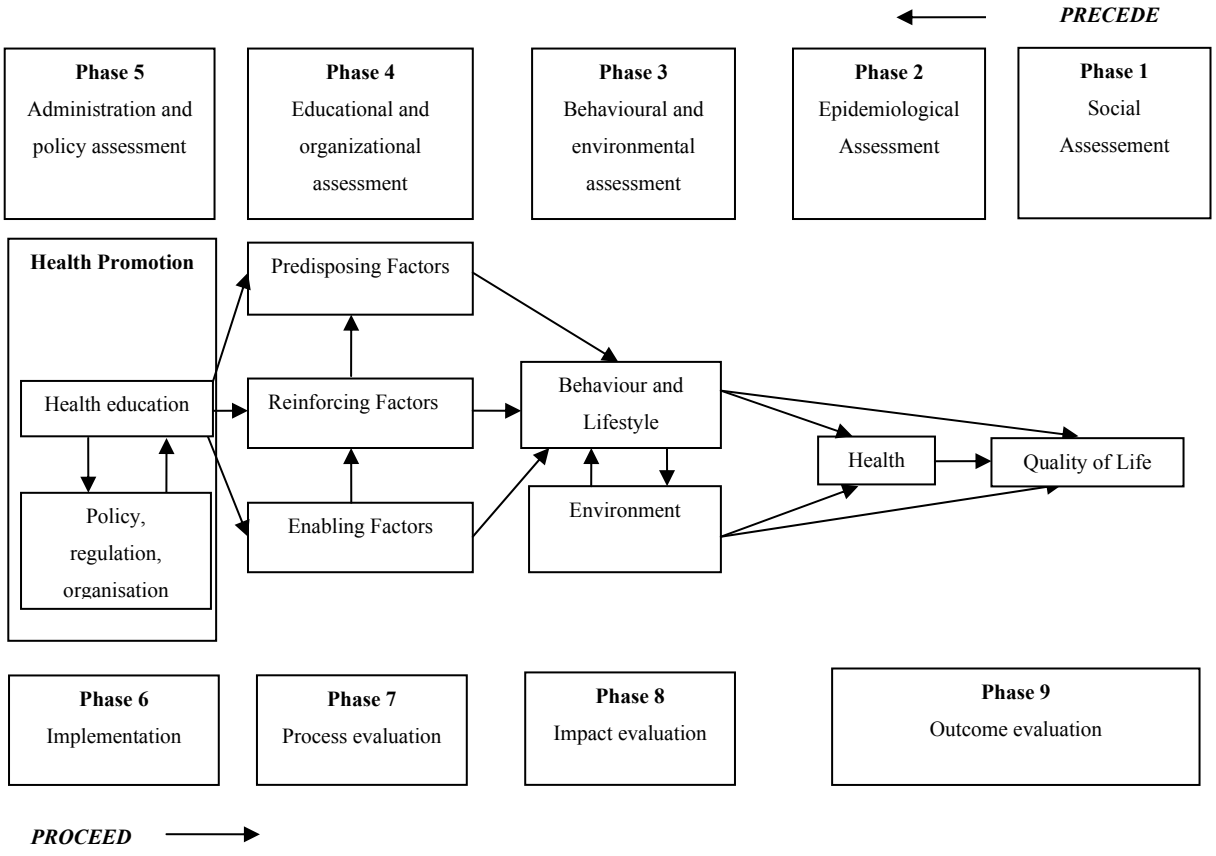


Figure 1.2 Visual representation of the Precede-Proceed model (Green & Kreuter, 1991)

Underlying the Precede-Proceed theoretical framework are two fundamental principles: 1) the *principle of participation* and 2) the *principle of environmental factors* as determinants of health education and health behaviours. The principle of participation is a key factor for

this approach and arises from other community models, as well as from empowerment and educational models (Green, 1999; Steckler, Dawson, Israel & Eng, 1993).

The premise of principle of participation states that the success of the health intervention will be magnified by the active participation of the target population. In this sense, the population under analysis should define, in a voluntary way, what their main problems are and also what are the goals they want to achieve through the implementation of the intervention program (Gielen et al., 2002; Green & Kreuter, 1999; Freudenberg, Eng, Flay, Parcel, Rogers & Wallerstein, 1995). So, each model stage should develop efforts that allow including inputs specified by the population coming from interviews, questionnaires, reports or other ways that include the perspective of those benefiting with the addressed change.

The planning process begins with the idea that health behaviours are complex, multidimensional and influenced by a variety of factors. According to Freudenberg, Eng, et al. (1995), the problem in recognizing that health behaviours have multiple causes is the way in which priorities are defined according to those different causes. Then, a robust theory can contribute to ease the distribution of the existing resources to the most important causes (Green, 1999). Despite the fact that Precede-Proceed model is not considered a theory it is seen in the literature as a planning model or a conceptual framework with a strong practical dimension that offers several guidelines to intervene in a successful way (Gielen et al., 2002).

2.3.1 Precede-Proceed Phases

The Precede-Proceed model evolves through the definition of nine phases that start by focusing on the expected health behaviour results and work backwards to diagnose which intervention strategies must be combined to achieve anticipated objectives (Green & Kreuter, 1999). So, working with the Precede-Proceed model implies that the researcher begins to develop an inductive reasoning approach, followed by a deductive one. The first five stages are included in the Precede phase and the remaining four in the Proceed part (Green & Kreuter, 1999).

Phase 1 - Social Assessment

In this first phase, the aim of the social assessment is to identify and evaluate the social problems that impact the quality of life of the population (e.g. Gielen et al., 2002). This assessment contributes to focus on the perceptions that the population has about their health

needs and problems. To articulate the population needs and wishes, the social assessment must take into consideration the community ability to solve the health problem as well as their willingness to change (Green, 1999). This stage expands the knowledge about the community and establishes a link between the identified problems and the health education planning. Several activities may be used to collect the data such as interviews, focus group, observations and questionnaires (Green & Kreuter, 1991).

Phase 2 – Epidemiological Assessment

Epidemiological assessment helps to determine which health problems are the most relevant to the community groups (Green, 1999). This assessment determines the extent to which health issues are associated with environmental and behavioural factors associated with poor quality of life. In this step it is expected to find the causes contributing to the problems or social objectives identified in phase 1 (Green & Kreuter, 1991).

The epidemiological data will provide indicators about the population that can help to specify high-risk groups. Data must be reliable to establish a measurable program. For collecting this information, statistics of mortality, morbidity or accident rates are a way to characterize the identified problem (Gielen et al., 2002).

After collecting this information it will be possible to prepare a set of priorities and to draw up the intervention program objectives. These objectives will respond to the *ultimate purpose of the intervention* (e.g. reduce HAIs by increasing HCPs' compliance with infection control procedures), its *programmatic purpose* (e.g. who benefits from the intervention; when will the benefits appear) and, finally, its *measurable purpose* (e.g. how are the available resources going to be distributed to apply and evaluate the intervention), (Green, 1999; Green & Kreuter, 1991).

Phase 3 – Behavioural and Environmental Assessment

The third phase implies systematic access to the factors that contribute to the health problem which were identified through the previous stage (Green & Kreuter, 1991). It will include non-behavioural causes (personal and environmental factors) that may contribute to health problems but also the behaviours that pose health problems in the examined population (Green, 1999). The former refers to physical and social facets, external to the individual, that occur beyond its control and that can be modified to support the desired health behaviour;

while the latter are those risk behaviours that add to the occurrence of the health problem by worsening it (Gielen et al., 2002).

This phase has another important characteristic, namely defining the changeability of each behavioural cause. To that end, each factor will be defined in terms of its importance to the health problem (Green, 1999). The most important factors are those that are strongly prevalent or strongly associated with health problems. Factors will be considered in the light of their ability to change (Green & Kreuter, 1991).

Phase 4 – Educational and Ecological Assessment

This is considered one of the most important stages of the Precede-Proceed model because identifies the factors that predispose, reinforce and enable the process of changing the behaviour (Gielen et al., 2002). The critical element of this step is the selection of the factors that will be modified to enhance the behavioural change. Therefore, positive and negative factors should be identified, in order to be grouped into an appropriate category, giving priority to those with greater relevance and potential for change (Green, 1999). *Predisposing factors* are prior to the behaviour and provide the motivation for changing. This includes factors such as knowledge, attitudes, beliefs, skills and perceptions (Green & Kreuter, 1991). On the other hand, *reinforcement factors* are those that occur after the behaviour to provide rewards or incentives that contribute to the proliferation or repetition of the behaviour. Some examples comprise social support, influence of significant others or vicarious reinforcement (Green & Kreuter, 1991). Finally, the *enabling factors* are antecedents of the behaviour allowing the motivation to take place. Enabling factors may affect behaviour directly or indirectly through an environmental factor. They include programs, services and resources provided to the environmental and behavioural outcomes (Green & Kreuter, 1991).

These factors are listed in order of their importance and ability to change, and are selected through their priority for the intervention. The decision to put a factor in a particular category is less important than setting a priority. In general, this stage will be responsible for the definition and development of the intervention program (Green, 1999).

Phase 5 – Administrative and Policy Assessment

The purpose of this step is to identify policies, resources and circumstances prevailing in the organisational context that can ease or inhibit the implementation of the program (Green, 1999). The meaning of Pro in Proceed is a set of objectives and rules that *guide* the

activities of an organisation or administration *regulate* the act of implementing policies and *develop* rules or laws to unify and coordinate the resources necessary to implement the intervention (Gielen et al., 2002).

At this stage, intervention strategies are numerous and based upon the submitted plan. An administrative (evaluating policies, resources and organisational circumstances) and political (evaluating the compatibility of the health program and its objectives with the mission, rules and culture of the organization) diagnosis is crucial to verify the possibility of implementing the program (Green & Kreuter, 1991).

Phases 6 to 9 – Implementation and evaluation of the program

In this phase, the health promotion program is ready to be implemented (*Phase 6*). The plans for data collection must be defined to evaluate the *process (Phase 7)*, its *impact (Phase 8)* and *outcomes (Phase 9),* (Green, 1999). Typically, the process of *evaluation* determines the extent to which the program was implemented in accordance with the protocol. The *impact* assessment relates to the change on the predisposing, reinforcing and enabling factors as well as the behavioural and environmental factors. Finally, the evaluation of the *results* determines the effect of the program on health indicators and quality of life. The programmatic goals drawn along the stages will facilitate the intervention evaluation (Green & Kreuter, 1991).

2.3.2 The use of Precede-Proceed model to understand health behaviours

The Precede-Proceed model (Green & Kreuter, 1991) is important for the implementation of health and safety intervention programs by providing a theoretical framework that aims to develop and implement appropriate intervention strategies (Gielen & et al., 2002). According to Green & Kreuter (1999), the emergence of this model stemmed from the difficulties encountered over the years to define clear guidelines for systematic planning, implementation and evaluation of educational interventions. According to a literature review conducted by Trifiletti, Gielen, Sleet & Hopkins (2005) focused on the prevention of unintentional injuries, the Precede-Proceed model (Green & Kreuter, 1991) emerges as one of the most mentioned frameworks, indicating its theoretical and empirical relevance as well as its ability to be applied in different research areas (e.g. health and safety).

Several health behaviours have been studied since the emergence of the Precede-Proceed model, most of them designed to promote patients' health. In general, literature findings indicate that the use of this theoretical perspective tends to increase the possibility of

achieving the expected behavioural change. For instance, Sjostrom, Karlsson, Kaat, Yngve, Green & Bygren (1999) developed a 4 week program aiming to control patients' obesity and several health associated risk factors (e.g. cardiovascular diseases) with post-evaluation results in the short-term (12 months) and long-term (5 years). Results indicated that the patients evaluated in the short and long term showed a decrease in their weight, blood pressure and use of medication. The authors concluded, then, that the application of the Precede-Proceed model was successful promoting a high involvement of the participants in the proposed intervention program.

Another study, developed by Imamura (2002), focused on an educational program for disease prevention through physical exercise directed at adults over the age of 65 years. Imamura (2002) found that the use of the Precede-Proceed model contributed to a change in the participants' knowledge and perceptions about disease prevention. Findings also enhanced several identified differences in the participants´ nutritional lifestyle which became more adequate in order to reinforce disease prevention.

Chiang, Huang, Lu & Yeh (2004) evaluated two educational programs on prevention of asthma directed at the parents of asthmatic children, developed in accordance with phase 4 of the Precede-Proceed model. The results showed that there was a substantial increase in knowledge, self-efficacy and self-management behaviours about asthma among parents who were in the group Precede-Proceed. This same result was not identified in the educational program which was not based upon the Precede-Proceed model. The change was sustained through periods varying from 3 to 6 months.

The model has also been used to plan the construction of events, such as community health fairs (Hecker, 2000), in which it was found that participants developed positive attitudes towards the educational program content promoted by them when they were involved in the definition of their community health problems.

Another type of research approach that includes the use of the Precede-Proceed model has only theoretical purposes, which means that several authors rely on using this approach to describe how Precede-Proceed model can be used to analyse a specific health problem, defining the steps and measures to be implemented. For instance, Frankish (1994) assessed the social problem of suicide by proposing the application of the model for building health programs aiming to reduce its incidence. The author explained in a theoretical paper which measures should be implemented in the 9 phases of the Precede-Proceed model. Similar theoretical purposes were also presented by Chaney et al. (2000) who examined the

prevention of school violence and by Wilkens (2003) who assessed the ability to prevent muscle diseases among health professionals through the need to identify the predisposing, enabling and reinforcing factors underlying those health problems.

2.3.3 Applying the Precede-Proceed model to analyse compliance in healthcare

The application of the Precede-Proceed model has also occurred in the health sector in order to assess HCPs' behaviours regarding their compliance both to clinical practice and safety guidelines. Turning to studies that focus on HCPs' clinical practice, Mann & Putnam (1989) developed a study in which they tried to determine the Precede factors related to physicians' role in reducing and controlling for cardiovascular risk in their patients. Results indicated that physicians believed that their personal relationships with patients as well as their personal commitment contributed to cardiovascular disease prevention. However, physicians tended to perceive themselves as least skilled in enhancing patient compliance. The interplay among these complex perceptions had implications for attempts to enhance physicians' preventive activities (Mann & Putnam, 1989).

In Constanza's (1992) study primary care physicians were also investigated, in particular their lack of compliance with screening for mammography utilization. Precede-Proceed model was used to identify physicians' beliefs, attitudes and practices with regard to breast cancer screening. Beliefs (e.g. physicians considerations of likely consequences of screening for mammography utilization), attitudes (e.g. physicians' positive or negative evaluation of screening mammography utilization) and practices (e.g. physicians' compliance with screening mammography guidelines) are constructs depicted from Predisposing, Enabling and Reinforcing factors highlighted in phase 4 of the Precede model. The results showed that physicians' compliance with mammography screening was low with three determinants as the most important to change physicians' behaviour: 1) the physicians' attitudes towards the benefits of mammography, 2) the medical community's consensus about the appropriateness and 3) the importance of guidelines for breast cancer screening.

Another study designed to analysed physicians' compliance with breast cancer screening techniques was conducted by Mahloch, Taylor, Taplin & Urban (1993) and aimed to describe the design, implementation and process evaluation of an intervention program targeting HCPs'. The Precede principles were used to guide the program definition and implementation with results indicating that medical office-based educational sessions had the

potential of reaching a large number of primary HCPs' which reinforced compliance with breast cancer screening.

On the other hand Mann, Lindsay, Putnam & Davis's (1996) study evaluated a multifaceted educational intervention designed to increase physician involvement in cholesterol-lowering practices. Results demonstrated that for the intervention group, physicians achieved significantly higher scores than the control group at the 6 week test regarding knowledge about cholesterol-lowering practices. Also, the physicians' dietary counseling scores were higher in the intervention group. However, these differences disappeared at a 15 month test demonstrating that physician behaviour change related to this health problem may not depend completely upon knowledge and perceptions.

Another characteristic that is particularly studied with the use of Precede-Proceed model is HCPs' compliance with pediatric clinical practice. For instance, in order to assess pediatrician goals and practice in counseling about preventive health issues Cheng, DeWitt, Savageau & O'Connor (1999) designed a study directed at six areas of health supervision: biomedical issues, development, behaviour, family functioning, safety education, and supportive interpersonal interaction. Results reinforced that the assurance of physical health and normal development were the most important goals of child health supervision among pediatricians; while goals involving behavioural, family, and safety issues were less important and less likely to be addressed in practice (Cheng, DeWitt et al., 1999). Thus, physician goals in child health supervision were primarily biomedical with psychosocial and safety issues of lesser importance. In this sense, in the Proceed phase it would be important to direct attention to increase physicians' knowledge about the importance of focusing their medical practice also on psychosocial and safety facets.

Similar results were found by Chaffee, Bridges & Boyer (2000) whose study focused on the need to examine pediatricians' provision of violence prevention services towards adolescent patients by identifying which factors are related to physicians' compliance with the prevention services. The Precede-Proceed model framework was used to discriminate the predisposing, reinforcing and enabling factors. Results indicated that factors associated with violence prevention screening practices among pediatricians included, for instance, positive attitudes and beliefs (e.g. considerations of likely consequences) regarding screening for violence, familiarity with violence prevention guidelines and the use of prompts in medical records. On the other hand, factors associated with violence prevention intervention practices included positive attitudes and beliefs for violence screening, availability of resources and

positive reinforcement from patients and colleagues for providing violence prevention services (Chaffee, Bridgeset al., 2000). In conclusion, the findings supported a lack of compliance among physicians to promote interventions among children at risk, indicating the PRECEDE factors that should be integrated to increase their compliance regarding screening for violence (Chaffee et al., 2000).

Finally, Chabot, Moisan, Gregoire & Milot (2003) conducted a study to improve outcomes in pharmaceutical programs aimed to follow the practice of community pharmacy by exploring the programs effect on blood pressure. The Precede-Proceed model was used as a conceptual framework to identify which factors were affecting blood pressure (predisposing, enabling and reinforcing factors) in order to integrate them in the intervention program. The importance of pharmacists was analysed through their enrolment with the community. Results determined that, compared with the control group, the pharmacy program resulted in blood pressure reduction among participants. To that end, it was concluded that pharmacist compliance with clinical practice that enhances knowledge about blood pressure contributes to modify the factors that undermine community adherence with antihypertensive agents (Chabot et al., 2003).

The second set of studies conducted in the healthcare sector focus on HCPs' compliance with safety guidelines, including infection control practices. For instance, Larson, McGee, Quraishi, et al. (1991) tried to assess the effects of an automated sink on hand hygiene and attitudes among health staff in a post-anesthesia recovery room and in a neonatal intensive care unit. The automated sink was installed to replace one handwashing sink for 5 weeks. Then, Larson, Mcgee et al. (1991) tried to assess HCPs' attitudes using a questionnaire based upon the Precede factors. Results indicated that hand hygiene differed among hospital sites and revealed that professionals wash their hands significantly less often with the automated sink. The Precede diagnosis identified that healthcare staff had negative attitudes about several features of the sink which increased throughout the study. Larson, Mcgee et al. (1991) concluded that automated devices must be flexible to promote adequate practice among staff. Also, Larson, Bryan, Adler & Blane (1997) designed another study to identify predisposing, enabling and reinforcing factors to improve hand hygiene frequency among HCPs. Over a 12 month period an intervention was developed which focused on group sessions, installation of automated sinks and feedback to staff on hand hygiene frequency. Results demonstrated some differences between the control and experimental group related to hand hygiene frequency which returned to baseline by the 2 month follow up. To that end, Larson et al. (1997)

concluded that despite the intervention promoting an increased use of the automated sink; its long term effect was minimal regarding hand hygiene compliance with professionals reverting to old compliance habits.

However, most of the studies related to HCPs' compliance using Precede-Proceed model were performed by DeJoy and colleagues. For example, DeJoy, Searcy, Murphy & Gershon (2000) used the Precede model to examine individual job-task and environmental factors related to compliance with UP among nurses. Results enhanced the role of predisposing (e.g. effectiveness of preventive actions, attitudes towards patients with HIV, knowledge of HIV transmission in healthcare), enabling (e.g. job hindrances, workload, training in Universal Precautions) and reinforcing factors (e.g. safety climate, prior exposure to blood or other contaminated materials) as sources of influence of general compliance; nevertheless, predisposing factors were less important for compliance with personal protective equipment. The prediction of general compliance was even greater with the inclusion of the reinforcing factors which had an indirect effect.

2.3.4 Conclusions

With this literature review focused on the Precede-Proceed model it seems clear that there are serious problems associated with compliance behaviours among healthcare staff (Grol, 2002). In general, results indicate that part of the solution involves the need to change HCPs' competence and performance, which is a difficult task as literature focused on the implementation of interventions have shown (Grol, 2002). However, its implementation has evident practical advantages that enhance the suitability of the intervention programs to problems of both health and safety. The first one focuses on the fact that it is a robust model, intuitive and logical that aims to achieve systematic planning supported by community involvement being applied to a variety of different contexts and behaviours (Gielen et al., 2002; Green & Kreuter, 1999). The model gathers information and allows for promoting changes during the intervention program, going beyond individual variables and giving prominence to social and environmental factors.

Another advantage relies on the fact that the Precede-Proceed model conceptualises the environment as a key factor to sustain self-protective behaviours (Dejoy et al., 2000). In this sense, to choose the Precede-Proceed model for the theoretical and practical constitution of a community framework stems not only from its ability to determine the factors that predispose, reinforce and enable the development of preventive practices; but also because it allows one

to implement and evaluate the intervention program designed to promote compliance with health and safety behaviours. Thus, after determining which key factors underpin these behaviours and aggregating them into the three groups of factors that predispose, enable and reinforce them, it will be possible to develop an intervention program focused on those indicators that will maximize the desired behavioural changes.

However, the model also presents a number of disadvantages that hinder its implementation and the evaluation of the results obtained. It requires huge resources, both financial and human, hindering its full implementation and leading the researchers to carry out: 1) partial implementation of the model, focusing mainly on stage 4 which identifies the predisposing, enabling and reinforcing factors or 2) writing theoretical proposals of future intervention programs. In both cases, there is a limited application of the model. Studies that only focus on the definition of Precede factors, neglect the constitution and implementation of the preventive program; studies that develop theoretical proposals are based on literature extrapolations to build up an intervention that may not meet the needs of the health problem.

Another limitation is that the Precede-Proceed model has not been evaluated in comparison with other behavioural change models, which constrains the way it can be related the other theoretical approaches (Gielen et al., 2002). Also, despite taking contextual variables into account, the model assumes a linear relationship between the different phases, not proposing any causal discontinuity provided by potential mediating or moderating variables. Finally, another issue is related to the general nature of the model. For instance, the Precede-Proceed stages, specifically the fourth one, in which predisposing, enabling and reinforcing factors are defined, allow the inclusion of the same variables in different groups of factors without the existence of a specific criterion for inclusion or exclusion. This ambiguity towards the definition of the main concepts of the model may contribute to its inadequate applicability, constraining the constitution of an effective interventive program.

After revealing the relevance of both socio-cognitive and community level approaches to analyse HCPs' compliance with infection control procedures, the aim is to turn attention to organisational facets of the healthcare sector that might contribute to constrain compliance, particularly the way safety priority is being perceived in medical institutions. In this sense, the next section highlights the contributions of safety climate to study compliance behaviours.

2.4 Safety Climate Approach

Since Zohar (1980) published his seminal paper about safety climate, there has been a growing interest in the role of safety climate in accident prevention and safety compliance behaviours (Hahn & Murphy, 2008). This trend seems to be more apparent in the present decade, with at last 25 empirical articles published since 2000 compared to the 10 studies published during the 1990's (Guldenmund, 2000; Hahn et al, 2008).

The safety climate construct can be defined as shared employee perceptions of how safety management is being operationalised in the workplace, at a particular moment in time (Zohar & Luria, 2004). These shared employee perceptions constitute an indication of the safety priority (Zohar, 2000) given in an organisation concerning other organisational priorities (e.g. quality and production). It provides a frame of reference for the behaviour and attitudes of individuals and groups of employees taking into account their accident involvement (Mearns, Whitaker & Flin 2003).

Safety climate is also particularly valuable in situations where it is unclear which performance facet or behaviour should be prioritized due to the ambiguities that arise from formally organisational espoused policies and enacted practices (e.g. Zohar, 2000, 2001). According to Schneider, Bowen, Erhart & Holcombe (2000), because the organisational environment is complex, facet-specific climates predict safety performance outcomes better than global ones. Therefore, climate perceptions should arise from policies and practices related to employees perceptions of specific focal facets of their work (Zohar, 2003).

2.4.1 Measuring safety climate: strength and level of analysis

Safety climate can be described in terms of two parameters, namely the strength and level of climate (Zohar & Luria, 2004). The strength of safety climate has been defined as the consensus concerning climate perceptions. Despite being a statistical criterion for aggregation of individual scores, the strength of safety climate has been recently defined as a descriptive unit-level attribute indicating the extent of cognitive consensus beyond its minimally required level. Therefore, the greater the consensus among individual members, the better defined climate has become as a group-level property (Bliese, 2000; Zohar, 2008).

Focusing on the level of climate, this property refers to the relative priorities of focal facets signified by climate perceptions. This will mean that low safety climate scores indicate

that safety is perceived as having lower priority than other organisational factors under conditions in which these two facets exert competing operational demands (Zohar, 2008).

2.4.2 The relationship between safety climate and safety performance

The empirical link between safety climate perceptions and objective injury data occurred through a study developed by Zohar (2000). In this study group-level safety climate perceptions concerning supervisory safety practices predicted micro-accidents records during the 5 month recording period that followed safety climate measurement. During this period of time, effects of group and individual-level risk factors were controlled.

Another way to evaluate the impact of safety climate on safety performance is through safety compliance behaviours. Most of the work focusing on compliance has been done by Neal and colleagues (Griffin & Neal 2000; Neal, Griffin & Hart 2000) who developed a two dimensional model, distinguishing between task and contextual performance, which comprises: safety compliance and safety participation. Safety compliance refers to the core activities that employees need to carry out to maintain workplace safety (e.g. adhering to safety procedures, wearing personal protective equipment). On the other hand, safety participation describes behaviours that do not directly contribute to employees personal safety but do help to develop an environment that supports safety (e.g. attending safety meetings, participating in voluntary safety activities), (Neal & Griffin, 2006). According to the results, safety climate is an antecedent of safety behaviour while safety motivation mediates the relationship between safety climate and safety behaviour. Therefore, employees should be motivated to comply with safe working practices and to participate in safety activities if they perceive that there is a positive safety climate in the workplace (Griffin & Neal, 2000; Neal & Griffin, 2006).

In a meta-analytic review, Clarke (2006) determined that safety compliance and safety participation both moderate the relationship between safety climate and safety performance (e.g. accident involvement), with safety participation having the stronger effect. These findings appear to be consistent with those obtained by Neal & Griffin (2006) in which they discovered a significant lagged effect of safety climate on safety participation, but not on safety compliance. To that end, safety climate seems to exert greater influence in ensuring adherence to safety procedures (safety compliance). In particular, safety climate plays a significant role in the promotion of employee commitment and involvement in safety (Clarke, 2006). Also, in a recent meta-analysis Christian, Bradley, Wallace & Burke (2009) focused on

workplace safety by examining person and situation based antecedents of safety performance behaviours and safety outcomes (e.g. accidents and injuries). The results indicated that safety knowledge and safety motivation were both strongly related to safety performance behaviours, followed by psychological and group safety climate. Turning to accidents and injuries, group safety climate was the variable with the strongest association.

2.4.3. Safety climate literature applied to the healthcare sector

Despite the fact that most socio-cognitive (e.g. TPB) and community models (e.g. Precede-Proceed model) have not been yet successfully applied to change behaviour in the field of infection control (Pittet, 2004), there also remains a lack of understanding and research about the potential role of safety climate to increase HCPs' compliance with infection control practices.

It appears that the safety climate construct needs to go beyond the prevailing industrial research findings in order to focus on the healthcare sector's unique characteristics that differentiate it from industrial settings (Navon, Naveh & Stern, 2005). In a healthcare organisation, the safety environment will not only have an impact on its practitioners, but also on patients. From the moment that each patient is assumed to have unique specificities, the safety environment will become even more complex according to the sort of task required by the patient's condition (Navon et al., 2005). Moreover, in the health sector, safety behaviours will be determined both by management safety guidelines and the social reality created by HCPs according to their own safety principles that will direct HCPs' personal actions (Navon et al., 2005). These factors may hinder the means of how to assess healthcare sector safety climate and involve a greater need to focus both on the level of analysis and the homogeneity of safety climate perceptions.

In 1992, National Institute for Occupational Safety and Health (NIOSH) developed several studies to analyze job and organisational factors as predictors of HCPs' compliance with safe work practices (e.g. DeJoy, Gershon & Murphy, 1998). Findings demonstrated that safety climate was a relevant predictor of adherence to those practices, explaining more variance than other variables, such as demographic (e.g. gender) and individual (e.g. attitudes) (e.g. DeJoy et al., 1998; Gershon, Vlahov, Felknor, Vesley, Johnson, Declos & Murphy 1995; Grosch, Gershon, Murphy & Dejoy, 1999; Murphy, Gershon & DeJoy, 1996; Murphy, Grosch, Gershon & Dejoy, 1997).

Gershon, Vlahov, Felknor, Vesley, Johnson, Declos et al. (1995) found that compliance rates with UP were higher for HCPs who perceived that the hospital had a strong commitment to safety than for those who did not perceive that commitment. Their findings also presented a strong association between safety training and compliance. Therefore, HCPs who received at least one hour of training on blood-borne pathogens each year, were more likely to be compliant than those who did not receive any training. Actually, the more training HCPs received the higher the compliance scores, with the highest scores being associated with six or more hours of safety training each year.

Focusing on the work of Dejoy and colleagues (1998), HCPs' behaviours are seen as complex and multidetermined, which can only be fully understood when they are examined in the broader organisational context. Medical settings are multifaceted and dynamic systems that involve groups of highly specialised employees who are interacting not only with each other but also with several sorts of medical equipment and technology. In Dejoy and colleagues' (1998) theoretical model, organisational factors are represented by physical and social characteristics of the work environment (e.g. workplace design and organizational safety climate). Findings elucidate the impact of safety climate in the organisation as an important contextual predictor of safety compliance. In addition, Grosch, Gershon, Murphy & Dejoy's (1999) study determined that a high compliance group of nurses reported greater management commitment to safety. Also Grosch et al. (1999) found that the safety climate dimension of job hindrances appeared to be especially critical since it can be related both to high compliance with UP and the absence of work-related accidents.

McGovern, Vesley, Kochevar, Gershon, Rhame & Anderson (2000) reported the relevant role of management commitment to safety but related to HCPs' compliance with personal protective equipment (PPE), instead of focusing on general compliance with UP, through a strong correlation between both variables; while Dejoy, Searcy, Murphy & Gershon (2000) found that HCPs' compliance with UP can be influenced by perceptions of job hindrances and informal feedback. Furthermore, the latter was a stronger predictor for nurses when compared to physicians.

Green-Mckenzie, Gershon & Karkashian's (2001) results indicated that HCPs' who perceived a high level of management support for safety were more than twice as likely to adhere to recommended infection control practices. Also, in a study done by Kermode, Jolley, Langkham, Thomas, Holmes & Gifford (2005) results showed that compliance with infection

control practices was better among HCPs' who perceived a strong commitment to safety by their management .

Finally, Navon et al. (2005) developed a different perspective of safety climate theory by applying it to explain the extent to which employees preserve the safety of others (e.g. patients). Results demonstrated a curvilinear relationship between the levels of the perceived detailing of safety procedures and the number of treatment errors. In addition, results demonstrated that perceived priority of safety moderated the relationship mentioned above as well as the relationship between the way employees interpreted their managers' safety practices and treatment errors.

2.4.5 Conclusions

All the above results appear to be consistent with those obtained within the industrial sector by indicating that safety climate may have an impact on how HCPs develop their safety behaviours, not only towards their own safety (e.g. Dejoy et al., 1998) but also concerning patients' safety (Navon et al., 2005). Nevertheless, it seems that studies focusing on safety climate dimensions within the healthcare sector tend to import the same dimensions from those measured in the industry setting, such as oil or aviation (Flin, Burns, Mearns, Yule & Robertson, 2006). For instance, the nature of work underlying high risk industries and healthcare is different. While, the former have well established hierarchical management structures; the latter raises more questions concerning leadership issues (Flin, Burns et al., 2006), which enhances the need to focus on specific characteristics of the health sector and particular caution when adapting measures that were first conceived to measure safety in industrial organisations.

Also, none of the studies that focus on safety climate in the healthcare sector mentioned how individual safety climate scores were aggregated in order to measure the cognitive consensus of safety climate perceptions among HCPs. In fact, most studies aggregated individual safety climate scores emerging from different healthcare settings which may confound the results achieved because each organisation may have members with specific safety climate perceptions (Flin, Burns et al., 2006).

Turning to the level of analysis, the studies measured safety climate at the organisational level without taking into account the complexity of the organisational environment from the healthcare sector, which comprises several subunits and professional teams. This may be particular relevant because literature findings state that HCPs' compliance

with infection control practices is inconsistent through wards and professional categories (WHO, 2005). Finally, there remains a lack of clarity concerning the reliability of safety climate scales, which is a factor that could pose some questions for the validity of the selected measures (Flin, et al., 2006).

2.5 Safety climate as a multi-level construct

2.5.1 An overview of multi-level theory

When organisations are perceived as social systems, the goal of a multi-level approach will be to identify the main principles that promote an integrated knowledge of the phenomena that occur between the different levels of the given organisational entity (Klein & Kowslozski, 2000; Kowslozski & Klein, 2000). In such case, neither a micro perspective that neglects the contextual factors that may constrain individual differences; nor a macro perspective which overlooks how behaviour, perceptions and affect interact to establish higher-level phenomena will be sufficient (e.g. House, Rousseau & Thomas-Hunt, 1995; Klein, Dansereau & Hall, 1994). So, the recognition that an organisation comprises several levels determines the need to constitute a levels approach that combines micro and macro perspectives in order to describe bottom-up and top-down processes (Klein & Kowzloski, 2000).

The constitution of this levels approach has its origin in two theoretical bases, namely the interactionist perspective (Lewin, 1951) and the study of organisational climate. In fact, the construct of organisational climate has been one of the most important constructs to multi-level theories due to two major contributions: (1) it highlights the existence of effects of a top-down nature within an organisation (e.g. establishes the need to conceptualise and analyse not only the organisation itself but also its sub-units and groups which can influence individual level characteristics (e.g. Herman & Hulin, 1972,); 2) it emphasizes the emergence of phenomena manifested at a higher level (e.g. individuals within an organisation interact and share personal interpretations about the organisation, representing consensual group perspectives about higher-level phenomenon (e.g. Kozlowski & Hattrup, 1992).

Nevertheless, some of the major limitations related to the implementation of a multi-level model arise from the difficulty in establishing the level at which the constructs under analysis are being conceptualised and measured. Indeed, this has been one of the biggest problems prevailing in the climate literature, which is the attempt to clarify if climate should

be a construct conceptualized and measured at the organisational level (unit) or at the psychological one (individual), (Klein & Kowzloski, 2000).

In order to shed some light on the controversy related to the way multi-level constructs representing unit-level phenomena are conceptualised and measured, it is possible to identify three basic types of construct, namely (1) *global unit properties,* (2) *shared unit properties* and (3) *configural unit properties.* With respect to global unit properties, its origin is the objective characteristics of the unit (e.g. unit size). Thus, the etiology of this sort of property is not based upon individual factors (Klein & Kowzloski, 2000). In the particular case of shared unit properties, it will represent the set of characteristics that are common, or shared by the unit members. These properties arise from the attitudes, experiences, perceptions or values that the individuals share among them in order to achieve a collective and consensual facet of their unit (Klein & Kowzloski, 2000).

Finally, configural unit properties capture the configurational pattern of individual characteristics within a unit. Like the shared properties, configurational unit properties have an individual etiology; however, they will focus on the individual contribution of each unit member. In this sense, configurational unit properties aim to capture the variability between the contributions of the unit members (Klein & Kowzloski, 2000).

After conceptualising the construct level of analysis it will be important to define the level of measurement at which data are going to be collected. For instance, for constructs that are at the unit level, data can be collected either at the *unit level* (through the inquiry of an expert source), or at the *individual one* (through the individual ratings of the unit members). In the case of shared perceptions, since these perceptions will represent consensual facets among unit members, it will be important to analyse the degree of *intra-unit variance* and the *intra-unit consistency* (Klein & Kowzloski, 2000).

The use of a multi-level approach also implies the definition of the types of model that can be made according to the level of analysis of their constructs and the established relationships between them. Therefore, it will be possible to find *single-level models*, which represent relationships between constructs that are at an individual level and more complex models, such as *unit-level models* which include at least a relationship between two shared constructs (Klein & Kowzloski, 2000). Finally, there are also *cross-level models* that describe the relationship between different constructs, dependent and independent, which are at distinct levels of analysis. In this case, we can specify the *cross-level direct-effect models* that will predict the direct effect of a higher-level construct on a lower-level one and *cross-level*

moderator models suggesting that the relationship between two constructs is moderated by an individual characteristic of a higher-level entity (or vice-versa) (Klein & Kowzloski, 2000).

2.5.2 Using a multi-level approach of safety climate to study compliance with infection control practices[8]

Despite the fact that individual characteristics are relevant to determine individual behaviour within an organisation, this behaviour will arise from a complexity of interactions that emerge from the interplay among individual and contextual variables (Cox, 1997; Griffiths, 1994). An organisation has specific policies and guidelines being disclosed at different levels of analysis and each individual because of their own characteristics will also interpret those principles in a very particular way.

Studies tend to examine both individual and contextual variables; however, the data is likely to be structured at the individual level which may constrain the interpretation of group level variables. Thus, context variables are rarely studied according to their distinctive patterns and have a propensity to be analysed as perceived independent factors (Kinket & Verkuyten, 1999).

A multi-level phenomenon is being analysed in organisations and incorporated in the study of several factors (e.g. safety climate, leadership), (Klein, Dansereau & Hall, 1994) to access both top-down and bottom-up processes. The view of safety climate as a multi-level construct has been widely recognised within the safety climate literature. Zohar's (2000) study results not only have impact on a possible connection among climate scores and subunit safety records, but also enhance the aggregation of employee perceptions to the group-level concerning supervisory practices and the way these safety perceptions will vary between subunits, expanding safety climate as a multi-level construct. The main idea is that safety climate should be decomposed on the identification of the agent responsible for each safety climate statement, meaning for each safety process, action, omission or responsibility (Melià, Mearns, Silva & Lima, 2008).

One particular result of decomposing safety climate perceptions in several responsible agents arises from the work done by Melià (1998) in which a psychosocial causal model of

[8] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Using a multi-level approach of safety climate to study healthcare professionals' compliance with infection control practices: a literature review.* (Submitted).

accidents was tested by proposing that safety climate would have causal effects on supervisory safety responses; which, by consequence, would have causal effects on co-workers safety responses. Both supervisors and co-workers responses would have a causal impact on worker safety behaviour. As a result, the more positive the safety climate is, the more favorable will be the safety response of supervisors and co-workers as well as co-workers safety behaviour.

Models of accident causation, such as the one proposed by Melià (1998), state a significant pathway between safety climate and accidents, in some cases mediated by workers unsafe behaviour (e.g. Tomas, Melià & Oliver, 1999). Furthermore, there is empirical evidence that a positive safety climate maintains safety-related behaviours, such as involvement in safety activities (e.g. Cheyne, Cox, Oliver & Thomas, 1998) and safety participation (Neal, Griffin & Hart, 2000).

Zohar (2000) argues that employees, as members of the organisation and of an organisational subunit will develop concurrent or coexisting climate perceptions. Then, a theoretical framework for a multi-level model will be established by adjusting the referent of climate perceptions across two levels of analysis; and, assuming that individuals discriminate between global and local emphasis on safety. Therefore, workers will be able to discriminate between priorities disclosed by the top and those emerging from their subunits and this premise will allow conceptualization of at least two sorts of climate.

To that end, turning to the literature reviewed in this paper which focuses on HCPs' compliance with infection control practices by analysing the role of safety climate, several constraints can be pointed out in order to enhance the need to develop a multi-level safety climate theoretical approach.

The benefits of a safety climate multi-level approach can be outlined by two reasons: (1) a *theoretical reason*, which is the fact that safety climate is a multi-level concept influenced by contextual factors (Cox, 1997); and (2) a *practical one*, which is a sort of non-independence among individuals´ perceptions who are exposed to a certain context and policies. This non-independence constrains the way data is analysed and interpreted and can lead to several individual level biases (Kreft & De Leeuw, 1998), which sustains the need to achieve consensus among the aggregation of safety perceptions at the group level.

2.5.3 Conclusions

Safety climate literature in the healthcare sector found positive results showing how this construct can be advantageous for compliance with infection control procedures among HCPs'. However, several weaknesses were pointed out in order to obtain a more comprehensive understanding about safety climate relevance and the need to develop a multi-level approach.

Overall the studies have tried to focus on the organisational level of analysis of safety climate, with most data being obtained from different hospitals. This will compromise the validity of the results achieved because it will reflect different perceptions from dissimilar safety climates of diverse healthcare sectors. Consequently, safety climate must take into account a multi-level conceptualisation because a healthcare organisation is composed of specific management principles and different subunits. It can be expected that safety perceptions will vary among them.

Also, a multi-level approach may contribute to cross-level moderator/ mediator models because new relationships can be detected between variables which were not evident when the data were analysed at the individual level. This occurs due to aggregation of perceptions that measure attributes of the environment in a more reliable way and was not detectable at a lower level (Bliese, 1998). By using a multi-level approach it is not only possible to analyse individual, group and organisational level characteristics, but also to perform an integrative conceptual approach of safety climate models and socio-cognitive ones (e.g. multi-level mediation model between safety climate and TPB). A cross-level moderator model will allow that variables from different levels interact with each other to predict the dependent variable from an individual level. For instance, an individual level variable emerging from a socio-cognitive model (e.g. attitudes) can moderate/ mediate the effects of a team/ group level variable (e.g. safety climate) on a dependent variable framed on an individual basis (e. g. compliance with infection control practices), (Klein & Kozlowski, 2000). In this sense, a socio-cognitive model may lend itself to a multi-level perspective generated by a safety climate model; but, in another way, a multi-level safety climate model can refine its predictive mechanisms by using the specificities of a socio-cognitive perspective, such as the TPB (e.g. Fogarty & Neal, 2002).

To join in a safety climate multi-level approach the possibility of a cross-level moderator/ mediator from a socio-cognitive model may be a useful tool to perform future

research because individual level models have not been successful in the study of HCPs' compliance with infection control practices. Furthermore, this be can itself an indicator that the study of HCPs' safety behaviours requires going beyond micro individual perspectives to obtain an overall linkage among individual, social and organisational factors arising from different levels of analysis.

In a micro-perspective, contextual factors are neglected which may constrain the effects of individual differences on safety. In turn, individual differences can enhance collective/ organisational responses. To that end to focus only on a macro-perspective it will put at risk the impact that attitudes, perceptions, norms and their interactions may have on top-level phenomena. A multi-level approach seeks to combine both perspectives, by capturing the essence of the organisational reality where influences can arise from both bottom-up and top-down events (Kozlowski & Klein, 2000). Thus, an element at a higher-level can exert an influence at a lower-level and vice versa.

Another facet that benefits from a multi-level approach of safety climate is the implementation of interventions. Since intervention programs tend to be implemented at the organisation/ group level the aggregate level results of safety perceptions will show a match between the level of analysis and the level of inference (Bliese, & Halverson, 1996).

Nevertheless, the utility of using this safety climate approach goes further than these theoretical assumptions and constraints. Actually, it also relies on the way the healthcare sector is structured. For instance, within the healthcare sector there are different HCPs' categories (e.g. doctors, nurses, cleaners) working in dissimilar wards. Each ward presents a specific challenge to these professionals according to the complexity of the unit (e.g. intensive care units). Literature indicates that compliance with infection control practices vary across the type of HCP and the sort of hospital ward (e.g. WHO, 2005). Therefore, it would be more adequate to study compliance by taking into account a group level perspective that allows for verifying differences among subunits.

Also, inside each ward HCPs' are grouped into teams which due to social influence processes will develop a predisposing tendency to create a non-independent relationship. This may constrain safety climate perceptions and reinforce the need to establish a multi-level approach. Thus, safety climate perceptions regarding compliance with infection control procedures should evaluate both shared perceptions among subunits (e.g. ward safety climate) and among teams inside each subunit (e.g. team safety climate). This will allow differentiation between the existence of multiple safety climates between units and to verify if

there remains intra-group consistency towards the unit regarding the way teams perceive disclosed safety policies. By ignoring the specificities of the healthcare sector as well as the way those factors interconnect with a safety climate multi-level approach will indeed bring to literature a lack of understanding about the processes underlying HCPs' compliance with safety procedures.

However, it is true that all organisations, despite being in the healthcare sector or in industry, face these types of characteristic. Organisations are complex systems, divided into several hierarchical levels and mostly, at the bottom level there are lower units such as teams, where professionals are integrated in order to perform their tasks. In this sense, safety climate should be perceived as a multi-level construct for each organisation. Nevertheless, the point here is that patient safety can be considered as a function of the safety perceptions of sub-groups of HCPs within wards (Deilkas & Hofoss, 2010). In fact, the Deilkas & Hofoss (2010) study demonstrated that patient safety attitudes vary across individual employees and also across wards, emphasizing that efforts to promote patient safety culture must target not only individual staff members but also healthcare organisational units, such as the wards.

The need to direct attention to a multi-level approach of safety climate within the healthcare sector, in the particular case of HCPs' infection control compliance arises from the assumption that care-delivery teams are micro-systems that work temporarily together. Staff in these teams suffer constant changes, for instance, according to schedules, number of HCP trainees (e.g. junior doctors) (Plsek, 2001). Also, these micro-systems are a group of HCPs who are free to behave in a not entirely predictable way, where organisational boundaries are unclear and membership can be simultaneous if HCPs cooperate with different wards in the same period of time (Plsek, 2001). Finally, actions of HCPs change and influence the actions and the context of other HCPs developing a complex net of interconnections (Plsek, 2001).

These characteristics are particular relevant inside medical departments and wards because safety is a property of the clinical micro-system that can be achieved only by directing the researcher attention to processes occurring within the system (e.g. training, teamwork, supervision) (Mohr, Batalden & Barach, 2004). In healthcare organisations, if we are focusing on patient safety, then it is at this micro-system level that patients and caregivers meet; also, it is at this level that changes in patient care occur; and, ultimately, it is in team and ward micro-systems that errors and non-compliance is developed compromising patient safety. In this sense, in order to study how HCPs perceive the priority given to infection control inside their micro-system it will be imperative to perform a multi-level approach of

safety climate because prevention and intervention plans can only function with clinical micro-systems as the unit of research (Mohr, Batalden & Barach, 2004).

According to Zohar (2010) the discussion of levels of analysis underlying safety climate is an avenue for conceptual development, meaning that the target of climate perceptions must be related to group levels of analysis as there is substantial variation in climate perceptions in different units within organisations. In this sense, the inclusion of multi-level analyses in the study of infection control stands for the need to conciliate micro-system units inside healthcare organisations with HCPs' individual characteristics because patient safety is a function of the study of such units.

CHAPTER 3

RESEARCH MODEL AND MAIN OBJECTIVES

3.1 Introduction

Despite of the contributions stated above, during the literature review in the previous chapters, and some of the empirical main findings achieved by the application of the TPB, Precede-Proceed Model and Safety Climate, most of the results have not been completely illustrative of HCPs' non-compliance with Standard Precautions either by the limited applicability of the TPB (e. g. Watson & Myers, 2001), the difficulty of defining the Precede-Proceed Model predisposing, enabling and reinforcing factors (e. g Dejoy, Gershon & Schaffer, 2004), or the controversial estimation of the healthcare safety climate (e. g. Flin, Burns, Mearns, Yule & Robertson, 2006).

However, in a more specific way, limitations concerning the applicability of those models can be differentiated into theoretical and methodological issues. For instance, focusing on the TPB, there remains in the study of HCPs' compliance with Standard Precautions a lack of understanding about this theory's ability to predict their safety compliance behaviours'. Pittet (2004) states that few studies have applied this model to evaluate HCPs' intentions towards infection control practices; furthermore, the author also states that there is a lack of intervention programmes focused on this theory to increase HCPs' compliance. Therefore, it is difficult to determine how successful TPB can be to predict and change behaviour in the field of infection control.

Nevertheless, when applied the TPB was able to explain around 69% of HCPs' intention to comply with safety compliance behaviours (e.g. use of gloves), (e.g. Levin, 1999) and around 56% of the variance in intention to comply with hand hygiene (e.g. O'Boyle, Henly & Larson, 2001). The problem lies in some inconsistency concerning which are the most relevant predictors among attitudes, subjective norm and PBC; and also, what is the contribution of additional predictors to explain HCPs' intention and behaviour. The existing body of research presents distinct results, for instance, Limbert & Lamb's (2002) study results focus on the relevance of the subjective norm to determine junior doctors' compliance with clinical guidelines; while, Levin (1999) referred to a greater significance of PBC. Another interesting finding was that of Roup (1997) who identified a small but negative correlation between attitudes and HCPs' intention to comply with Standard Precautions.

Methodologically, most of the studies have directed their attention to doctors and nurses neglecting other important health allied groups that also need to comply with infection control procedures because they play a significant role inside the healthcare facility (e.g. cleaners).

Furthermore, several studies that have chosen the TPB as a theoretical framework have, on the one hand, preferred to apply only some of the traditional TPB behavioural intention predictors; but, on the other hand, have operationalised the main constructs of this theory in an unclear way, which compromises Ajzen's guidelines related to the TPB applicability (e.g. Jenner, Miller, Jones & Scott, 2002).

In this sense, it would be useful to study HCPs' compliance with infection control procedures framed upon the TPB due to a need to explore:

(1) *Theoretically*

a) The role that the subjective norm may play within the field of infection control as the main predictor of HCPs' intention to comply. Studies that applied the TPB in the healthcare sector both to clinical practice and safety compliance behaviours indicate that social influence processes may have a significant contribution in explaining variance in intention (e.g. Levin, 1999). This pattern of results is not typical in the field of the TPB applicability in other research areas, where the subjective norm is the less predictive predictor (Conner & Armitage, 1998);

b) The TPB integration in a multi-level framework in order to optimize HCPs' compliance by focusing on possible interconnections between TPB main constructs and safety climate organisational facets;

c) The theory normative component by including an additional predictor (e.g. moral norm) in order to capture the moral dimension underlying HCPs' intention to comply;

d) The TPB application in a broader sample of different groups of HCPs to understand how behavioural intention predictors are distinctively related to intention according to the specificities of each professional category;

(2) Methodologically

a) The operationalisation of the main constructs of the TPB in the field of infection control by taking into account Ajzen guidelines, in particular the subjective norm construct that has been identified as the one with more difficulties in its operationalisation (e.g. Armitage & Conner, 2001);

b) The consistency between attitudes and behaviour. To that end, instead of focusing on a general attitude and behaviour such as Standard Precautions that imply a variety of infection control procedures, our aim is to develop a specific attitude compatible with a specific behaviour focused on the most relevant infection control procedure depicted from Standard Precautions, which is hand hygiene;

(3) Practically

a) Specific intervention strategies supported by the results achieved in the empirical studies in order to emphasize the importance of applying this model to intervention programs.

Turning to the Precede-Proceed model, this model has been widely applied to educational and health behaviours but few studies have used this community approach to explain and predict HCPs' safety compliance behaviours, in particular in the field of infection control. Precede-Proceed model has been revised and it has moved to a more multi-sectoral and multi-level approach that could contribute to predict and change the behaviour of HCPs. Attempts to both predict and change their behaviours should follow an assessment of the factors that require primary attention and subsequent modification. However, studies that used this framework to explain HCPs' compliance with Standard Precautions skip this required assessment by defining in a top-down way the factors that predispose, enable and reinforce compliance behaviours. Methodologically, this is an inconsistency with the model's propositions and constitutes one major limitation concerning the studies developed to evaluate HCPs' compliance (e.g. Dejoy et al., 2004). The usefulness of the Precede-Proceed model relies on the participation principle which is the ability to allow the professionals to recognize their own need for change by identifying the predisposing, enabling and reinforcing factors that underlie their compliance with the proposed safety behaviour. Thus, in terms of the Precede-Proceed model, the current research project tries to guarantee that:

(1) Theoretically

a) The principle of participation is implemented in order to try to obtain a bottom-up perspective in which HCPs determine the factors that predispose, enable and reinforce their compliance with infection control procedures using qualitative (e.g. interviews, documental analysis) and quantitative (e.g. questionnaires) methods to collect the data;

(2) Methodologically

a) The ability to determine with more precision the variables that are included in the Predisposing, Enabling and Reinforcing categories;

(3) Practically

a) The TPB behavioural intention predictors, and safety climate as predisposing, enabling and reinforcing factors suggesting a combination of strategies that can be used to design interventions able to strengthen HCPs' motivation to comply and enable and reinforce their adherence;

Finally, the safety climate approach within the healthcare sector literature seems to be developing a trend to mostly use constructs imported from the industrial sector (Flin, et al, 2006). Consistent with that, is the preference to give a greater relevance to the organisational climate, forgetting the need to think about the unit and/ or the team level safety climate, and underestimating the fact that patients' safety is an exclusive function of the healthcare micro-systems, such as care-delivery teams and wards.

In a methodological sense, literature in this field presents results where there is a combination of safety climate indicators that arise from dissimilar hospital facilities, units and teams, which may create different safety climate perceptions. Besides that, it is not clear how safety climate perceptions are aggregated. In fact, most of the times safety climate is defined as an organisational/ group construct but is still measured at the individual level without perception being aggregated at any superior level of analysis (Flin et al., 2006). In order to overcome this safety climate misconception, it would be useful to recognize which are the main facets of healthcare facilities relevant to be measured in the particular case of compliance with infection control procedures and to operationalise the unit safety climate which tends to be the most immediate safety perceptions that HCPs share. These unit perceptions regarding safety are intrinsically related to the constitution of a patient safety environment that can also be depicted from their personal compliance. In this sense, by focusing on healthcare safety climate issues we intend to:

(1) Theoretically

a) To define a need to embed safety climate in a multi-level approach to study hand hygiene compliance;

b) To explore the links between safety climate and the TPB main constructs in order to analyse possible multi-level interconnections;

c) To verify the impact that safety climate has on hand hygiene compliance;

(2) Methodologically

a) To operationalise safety climate by taking into account healthcare micro-systems (e.g. care-delivery teams);

b) To measure agreement and reliability of safety climate perceptions after computing a level 2 measure;

(3) Practically

a) To present preventive strategies based upon the multi-level nature of safety climate and its articulation with individual level variables (e.g. TPB behavioural intention predictors).

In a general sense, the aim of this project is to constitute a multi-level approach where it is possible to explore the interconnections between individual and group level variables and how these relationships impact professionals hand hygiene compliance. Nonetheless, despite the theoretical, methodological and practical aims presented above related to the three theoretical frameworks underlying this project, before presenting the conceptual model to be explored in this thesis, the specificities of two constructs will be discussed, namely: the moral norm and the vulnerability perception. Both constructs will be integrated in the conceptual model and a brief summary of their state of the art is given in the next section.

3.2 Specificities of the extended theoretical model: the moral norm

At the end of the 60s, Schwartz (1977) proposed a theoretical framework called the Norm Activation Theory, which develops the concept of personal norm. According to this theory, the individual behaviour will correspond to a personal norm which is internalized by the subject (e.g. Zuckerman & Reis, 1978). This personal or moral norm has an altruistic facet and can be activated by the individual assuming a prescriptive nature. This activation occurs when the individual believes that important moral values are being threatened. Punitive sanctions will be triggered by the individual (e.g. Stern, Dietz, Aberl, Guagno & Kalof, 1999).

Empirically, the moral norm has been applied to several research settings, namely those invoking moral dilemmas and pro-environmental behaviours indicating that some behaviours have an underlying moral concern which is stressed in moral judgments and individual choices (e.g. Sparks & Sheperd, 2002). Apart from the Norm Activation Theory (Schwartz, 1977), others have claimed the inclusion of this norm into the TPB. For instance, Harland, Staats & Wilke (1999) pointed out that none of the predictors proposed by Ajzen reflected the influence of moral considerations. Therefore, both theories can be integrated despite the fact they operate on different aspects of social behaviour and complement each other by increasing the predictive ability of the behavioural intention (e. g. Bamberg & Schmidt, 2003).

Moreover, Ajzen & Fishbein (1980) started to include the personal normative beliefs as determinants of the personal norm, however they have considered that this norm would only be an *"alternative way of measuring the behavioural intention"* (pp. 257). Nevertheless, the literature has shown that there is no overlap between the moral norm and the intention to

behave (e. g. Manstead, 2000). Taking into account a literature review conducted by Conner & Armitage (1998), focused on studies that expanded the TPB by including the moral norm, the use of this variable increases the explained variance of the behavioural intention by 4% after controlling for attitudes, subjective norm and PBC (e.g. Parker et al., 1995; Raats, Sheperd & Sparks, 1995).

Conceptually, the moral norm can be defined as the HCPs' perception of their moral conduct towards a particular behaviour (e.g. Godin, Conner & Sheeran, 2005). Therefore, this norm cannot be included within the subjective norm component, which refers to the social pressure perceived by the HCP (e. g. Ajzen & Fishbein, 2005). The Subjective Norm is an external norm that focuses on social pressure and it is anchored in the social group. By adding the moral norm to the TPB, the idea is to point out the existence of internal and prescriptive rules that may also have an impact on certain behaviours, namely those that appeal to moral concerns (e.g. Biel & Thogersen, 2007).

The development of the moral norm has been viewed through two major theories: the Theory of Moral Thinking (Kohlberg, 1976) and the Theory of Moral Socialization (Hoffman, 1983), which differ in the way in which the individual internalizes the norm. While Kohlberg (1976) defends that the development of the moral norm occurs in an intra-individual way, Hoffman (1983) refers to the fact that the moral norm starts with external standards which are subsequently internalized and perceived as being independent and anchored in the self. Thus, the moral norm will not reflect the social agent but the consequences of the behaviour. According to Gibbs (1991), Hoffman's moral perspective tends to be the assumption on which the research within the TPB framework rests. Then, the moral behaviour is the pro-social concern of what is right in a behaviour along with the anticipation of internal sanctions and independent feelings of guilt that arise when the internalized norm is not applied.

However, despite the fact that the moral norm can be triggered by social interaction, it still remains an internalized norm, independent of the influence of others. One may accept a social cue for the formation of a moral norm, but this imperative exercises its influence autonomously on thoughts, feelings and behaviours regardless of the immediate social context (Manstead, 2000).

Within the healthcare sector, Godin, Bélanger-Gravel et al.'s (2008) review stated that among factors explaining HCPs' clinical practice intentions and behaviours the moral norm is a relevant predictor being associated with several types of behaviours such as preventive actions (e.g. influenza vaccination) and patients treatment (e.g. intention to treat HIV infected

patients) (e.g. Astrom & Nasir, 2009; Godin, Vézina-Im & Naccache, 2010). Also some studies have shown that the moral norm could be one explanatory factor for HCPs' compliance with infection control procedures suggesting that in medical settings HCPs have to deal with moral care-delivery situations that will trigger internalized moral facets able to reinforce or hinder compliance (e. g. Lymer, Richter & Isaksson, 2004; Roberto & Silva, 2007). The relevance of this norm for HCPs can be stressed by the implicit value of ethical imperatives which rule their professional conduct emphasizing additional moral priorities beyond hand hygiene, such as prioritizing other patients' needs and reinforcing their personal commitment to the patient (e.g. Pittet, 2000).

For instance, Wendel, Maes, Labean, Vereecken & Blot (2010) developed a study whose aim was to identify and describe predictors of HCPs' compliance with hand hygiene in an ICU, by focusing on attitudes, moral norms, knowledge, social influence and self-efficacy as compliance predictors. Results indicated that HCPs' moral perceptions of feeling bad when not being able to wash their hands due to the moral imperative that washing their hands saves lives did not had any predictive value relative to hand hygiene compliance. Also, results highlighted that HCPs' reported poor self-efficacy perceptions and considered that washing hands whenever recommended mean precious loss of time with both being related to personal compliance. However, compliance rates in ICU where loss of time can be precious in terms of putting at risk a patients' life are similar to those wards where loss of time isn't a problem such as ambulatory wards (e.g. external consultations) suggesting that compliance with hand hygiene despite being a problem related with time barriers, should not be entirely perceived as a consequence of time constraints (e.g. WHO, 2005).

It would be plausible that if non-compliance with hand hygiene results in breaking a moral norm, internalized by the professional, where hand hygiene is perceived as an ultimate moral responsibility, then it would be logical that a sense of personal responsibility would predict HCPs' intention to comply with hand hygiene (Bartels, 2008). However, the fact is that HCPs may express dissonance between what they say, what they know, and what they do (Bartels, 2008) and if compromising such relevant moral imperatives causes any significant discomfort, studies focusing on moral issues, such as the one developed by Wendel, Maes et al. (2010) would not have indicated that morality issues may not be, as they are being conceptualized, the best way to focus on HCPs' moral conceptions. In this sense, HCPs may acknowledge that hand hygiene is, in fact, a moral behaviour that needs to be performed but this norm may not be the only one internalized by these professionals with a moral

prerogative. For instance, hand hygiene compliance may interfere with HCPs' sense of getting their work done, not due to a matter of time pressure because compliance rates are similar across high and low pressure wards, but because they have an additional moral norm that relies on giving priority to their commitment to the patient and to fulfill patients needs.

For instance, in a study developed by Ferguson, Waitzkin, Beekman, Bradley & Doebbeling (2004) that focused on the need to identify critical incidents of non-compliance with Standard Precautions among HCPs, results indicated that reasons given for not using precautions were: (1) the belief that complying with the precaution would compromise the patients' needs; (2) the belief that complying with precautions interfered with the ability to provide care to the patient; (3) and the professional disagreement with the need to comply with the precaution in a given situation. These results suggest that HCPs have several personal reasons to use in order to justify their non-compliance behaviour and, in most cases, reflect other moral concerns.

To that end, the internal nature of the moral norm may be associated with a multi-faceted expression of this norm (Bell, Trevino, Atkinson, Carlson, 2003). For instance, hand hygiene may be seen simultaneously as a moral practice and a barrier for obtaining other moral prerogatives (e.g. fulfilling the patient – HCP relationship needs). Thus, HCPs' moral norms may be cited as a justification for both compliance and non-compliance. Compliers may highlight the need to wash hands; while, non-compliers may claim interferences between that moral norm and other moral prerogatives, such as giving priority to patients needs. So, moral norms of hand hygiene compliance may have a multi-faceted meaning in the context of infection control with different moral motivations being activated to explain one's sense of doing what is right according to the personal moral emphasis given by each HCP.

In this sense, it is suggested that HCPs' moral obligations may be ambiguous and multi-faceted, indicating the importance of different moral influences despite the social ones reproduced by the subjective norm (Conner & Armitage, 1998). Thus, it is expected that the perceived moral norm will have an impact on predicting HCPs' intentions to comply with hand hygiene, to the extent that there may be an incompatibility between the moral norm of prioritizing the patient despite the relevance of hand hygiene and their personal compliance with this procedure which can be inhibited by the former (e.g. Bell, Trevino et al., 2003; Pittet et al., 2000).

In this sense, what we are suggesting is that an action is wrong if it violates a moral rule, such as non-complying with hand hygiene; however, and using *"rule utilitarian"* theorists as

basis, it is morally wrong to violate a rule that is justified by its consequences (e.g. Nichols & Mallon, 2006). This theoretical proposal acknowledges that an action is judged to be morally impermissible if the action violates a moral rule that is embraced by the judge (e.g. Nichols & Mallon, 2006). In this case, HCPs, as judges, may not embrace hand hygiene as an exclusive moral rule allowing them to have an obvious explanation for why personal non-compliance with this procedure occur and sustaining that explanation with other moral normative judgments. According to Nichols & Mallon (2006) multifarious psychological factors interact to develop personal intuitions regarding moral dilemmas, such as representations of rules, assessments of costs and benefits and emotional activations. It is misguided to expect that there is a single normative moral criterion that will capture the individual intention to behave in a specific way.

In fact, Conner & Armitage (1998) found in Social Psychology literature that the moral norm only accounts for an additional predictive ability of 4% of the explained variance in intention, meaning that most variability is explained by the traditional TPB constructs. In the field of infection control the predictive relevance of the moral norm has not been stated yet, however, our main goal is to go beyond its individual contribution as predictor and to explore the possible multi-faceted nature of this norm among HCPs by examining the likelihood of having a moral norm that is applied to explain and justify non-compliance.

3.3 Specificities of the extended theoretical model: the vulnerability perception

In the 1980s, Weinstein pointed out the popular belief that people tend to judge themselves as invulnerable, thereby contributing to the development of the theoretical construct of risk perception. This type of bias thus contributes to a wide variety of behaviours that may put individuals at risk, giving rise to the phenomenon of *"unrealistic optimism"*.

However, the literature on risk has no consensus regarding its definition. In fact, the concept of risk is a problematic one, with no accepted definition (Renn, 1998). Yet, despite the diversity of definitions, most of them have a common ground, in which the construct of risk will be based on the association between the likelihood of harm occurring and the aspirations towards its occurrence (Weyman & Kelly, 1999). Several studies have presented results which indicate that the likelihood and the consequences of harm occurring are perceived dimensions of risk, although the literature suggests that the severity of a hazard is a stronger dimension than the likelihood (e.g., Sjoberg & Drottz-Sjoberg, 1991).

The concept of perceived vulnerability is viewed as a subjective assessment of the magnitude of risk associated with an event or activity in particular. By contrast, an objective risk will involve risk estimates based on clearly defined criteria related to the probability of an event and its consequences (Weyman & Clarke, 2003). In this sense, one can determine the existence of an opposition between objective and subjective risk, where the second represents the way in which non-specialists think about risk, including a set of beliefs and values which give meaning to a threatening event (Lima, 1998; 1999). It involves a subjective perception of the likelihood that the individual has to be the victim of an accident at work or of an unhealthy event (Lima, 1998; 1999), being influenced by social, cultural, physical, political and psychological factors (Lima, 1998; 1999).

Perceptions of risk integrate different theories mostly in the context of health behaviours, even if their impact on behaviour remains unclear in the health literature (Brewer, Gibbons, Gerrard, Chapman, McCaul & Weinstein, 2007). Indeed, the construct of risk perception plays a central role in theories such as the health belief model (Rosenstock, 1966), protection motivation theory (Rogers, 1975), and the extended parallel process model (Witte, 1992) and is also integrated in other general theories namely the theory of reasoned action (Fishbein & Ajzen, 1980), the theory of planned behavior (Ajzen, 1991) and the subjective expected utility theory (Ronis, 1992). Risk perception, also known as probability, susceptibility or vulnerability is therefore a central construct in most theories that analyze and focus on health behaviours. According to these theoretical perspectives, a high sense of vulnerability will encourage individuals to pursue actions to reduce the risk to which the individual is exposed (Brewer, Weinstein, Cuite & Herrington, 2004).

In the risk perception literature, there are three main approaches that reflect the way risk is conceptualized (Holmes, Gifford & Triggs 1998): a *technical approach*, a *psychological* and a *social* one. The technical approach, postulates that identification and risk control depend on the degree of scientific, technical or medical expertise, which will define the type of prevailing risks and their social prevalence.

In an opposite way, the psychological approach refers to the perception of individual risk and the perceived qualities of the risks that will influence how individuals construct their risk judgments. This approach highlights the incongruity that tends to exist between the individual risk judgments and the scientific ones, in which the former are affected by socio-cognitive variables (Stroebe & Stroebe, 1995). A particular feature of this approach has been identified by some studies, indicating that individuals tend to develop a kind of comparative

risk estimate. Individuals estimate their personal risk by comparing them with risks experienced by other subjects, without providing any real assessment of the objective risk (Klein, 2003). So, people tend not only to make greater use of comparative risks, but also to decrease their personal likelihood of being affected by a particular risk, attributing to others the tendency to suffer more often the consequences of a specific issue or event of a negative nature (e.g. Klein, 2003; Sjoberg, 2003).

A greater contribution to the development of this psychological perspective of risk was made by Tversky & Kahneman's (1974) seminal paper, which suggests that risk perception and decision making processes are likely to be affected by a variety of perceptual biases due to cognitive heuristics that order the way individuals process their information. One of the heuristics most often cited as an example in the literature would be the availability heuristic, which suggests that information on risk would be handled with reference to examples that would be more cognitively available. Also expectancy models are particularly used within the psychological approach to risk. These models stem from the observation that people tend to estimate the severity of the risks, assess the costs and benefits of their actions and choose the course of action that will maximize the expected results (DeJoy, 1996). An example would be the precaution-adoption process model developed by Weinstein (1988) which introduced the concept of "unrealistic optimism". In this model, five phases are proposed for an individual to adopt safe behavior: 1) the individual must be aware of the hazard, 2) the individual must believe that people are likely to be affected by this hazard, 3) the individual must believe that he/she may be affected by the hazard, 4) the individual must weigh the risks associated with the risk and the costs and benefits of developing safe behaviour, and 5) the individual adopting safe behaviour (Weinstein, 1988).

However, the theoretical proposals that fall within value expectancy theory have been the target of much criticism, particularly the failure to include a higher incidence of social and cultural factors and overestimated the strength of the relationship between individual attitudes and behaviour (Weyman & Kelly, 1999). Yet, this theory remains very important in helping to explain the inconsistency between individual risk perception and behaviour arguing that individuals respond to a risk based on their estimate of personal risk rather than a general sense of risk (Sjoberg, 2003).

Finally, the last risk approach has a social nature and determines that the qualities of risk are not universal or absolute, having different meanings for different groups. This

highlights the evidence that social contexts contribute to define and construct the meaning associated with the risk (Stroebe & Stroebe, 1995).

Most studies that include risk perception indicate that the relationship between risk perception and behaviour can be positive, negative and non-existent; these misleading findings contributed to several authors acknowledging that maybe risk perception was a construct with little impact on behaviour (e.g. Leventhal, Kelly & Leventhal, 1999). Nevertheless, the problem underlying the literature inconsistency towards risk perception may be due to several methodological limitations that are related to the study of this construct. For instance, one problem arises from the fact that an individual's responses are given using a questionnaire which can reinforce the individual's tendency to develop their "optimistic bias" (Brewer, Gibbons et al., 2007).

A second possible problem emerges from the type of questions that tend to be used in which the referent is ambiguous referring often to the general population rather than focusing specifically on the respondent (Brewer, Gibbons et al., 2007). Finally, another problem arises from the fact that risk perceptions may not have a constant weight among all types of behaviour, meaning that the importance of risk perceptions may vary according to the sort of behaviour and its influences (Brewer, Gibbons et al., 2007).

Several health and safety behaviours stem from the way people perceive risk (Reyna, 2004), so the concept of vulnerability or risk perception is a key construct not only for several health theories; but also for safety literature where the estimated differences between objective and subjective risks can influence how professionals comply with safety procedures (e.g. Rundmo, 1997). In particular, it is of interest to determine how risk perceptions, allied to the knowledge people have about risk, contribute to the definition and conceptualization of strategies for risk control (Holmes, Gifford & Triggs, 1998). According to Mearns & Flin (1995), the problem is not the risk that is actually perceived, but the threat behind it leading to feelings of anxiety or insecurity. In this sense, the perception of risk or vulnerability will reflect the study of beliefs, attitudes, judgments and feelings that people develop about threats within the social and cultural context in which individuals are involved (Mearns & Flin, 1995).

Taking into account the characteristics of subjective risk, it can be proposed the existence of a complex and dynamic relationship between their subjective assessment, risk behaviour and the occurrence of factors that may have an impact on safety issues (Rundmo, 1997). Thus, one can define three different types of hypotheses from the safety literature: 1)

accidents can cause the perception of vulnerability (a professional who has experienced an accident assesses risks differently after the occurrence, feeling less secure), 2) the perception of vulnerability could cause accidents (when a professional feels insecure that may enhance stress increasing the likelihood of accidents), and 3) the perception of vulnerability and accidents/ safety are endogenous variables (these variables may be an effect of other variables that are independent from each other).

Overall, it appears that the perception of vulnerability may be relevant to safety due to its impact on workers' behaviour, and this behaviour may influence the likelihood of accidents. However, the perception of vulnerability itself is not a unique predictor of risk behaviour (Rundmo, 1997) which implies the preponderance of other variables in determining the outcome. To that end, it is proposed that the perception of vulnerability is one of the predisposing variables that facilitates or inhibits the behavioural change. Through a joint action with other variables, the perception of vulnerability will have a positive impact on safety behaviours when there remains an accurate estimation of the risk (Green & Kreuter, 1999).

Although studies tend to neglect the role of perceived vulnerability in the health sector, particularly in terms of its professionals, the data indicate that there is a perception that professionals are exposed to risks potentially harmful for their own health and safety (e.g. Lymer et al, 2004). However, non-compliance with preventive practices, despite the prevailing risks, may indicate that health professionals underestimate their personal risk perception by minimizing its importance, particularly through the comparative risk process. Within the workplace, the "unrealistic optimism" will refer to the fact that professionals believe they are less likely to be affected by a risk than their co-workers when both are exposed to the same risks, promoting a sense of perceived invulnerability (Weinstein, 1988).

For health professionals to make decisions on health and preventive measures, they will need to understand the risks and benefits that are associated with these alternative courses of action (e.g. Standard Precautions). In addition, it will be important for these professionals to know the limits of their knowledge in order to analyse the safety guidelines and, therefore, to apply them into their work context, reducing accidental events, non-compliance rates and HAIs (Fischhoff, 1997).

Standard Precautions are specific safety rules that aim to protect both HCPs and patients from a multitude of risks (e.g. Hepatitis B, HIV, MRSA). However, studies developed in the healthcare sector do not have a clear picture of how these professionals perceive the risks that

they have to face in their daily basis and, consequently, how vulnerable they feel about the likelihood of acquiring and/ or spreading one of those risks. While some studies indicate that these professionals perceive the risks and their susceptibility to them (e.g. Lymer et al. 2004); others show an underestimation of the likelihood to acquire them (e.g. Roberto & Silva, 2007) emphasizing a possible normalization of the perceived risk as an explanation for the result (Lima, Barnett, Vala, 2005).

For instance in the study developed by Ferguson, Waitzkin et al. (2004) results indicated that HCPs had a belief that patients did not pose any risk for them despite knowing that the use of precautions would have been recommended. Dinelli, Moreira, Paulino, Rocha, Graciani & Moraes-Pinto (2009) focused on HCPs' risk perceptions about acquiring vaccine preventable diseases and despite having a good risk perception towards acquiring most vaccine preventable diseases (e.g. Hepatitis B, influenza) only 35.8% of these professionals were fully immunized. In this sense, it can be argued that despite having a good perception of risk, knowing its existence in their daily practices, HCPs' vulnerability perception of personal susceptibility of exposure to a potential risk and, simultaneously, spreading that potential risk to the patient may be underestimated in order to cope with the high level of risk that each professional has to deal with everyday. This premise is based upon the Health Belief Model (Rosenstock, 1966) and Protection Motivation Theory (Rogers, 1975). In order to overcome this possible gap between perceived risk and perceived vulnerability, HCPs must acknowledge the personal consequences of non-compliance.

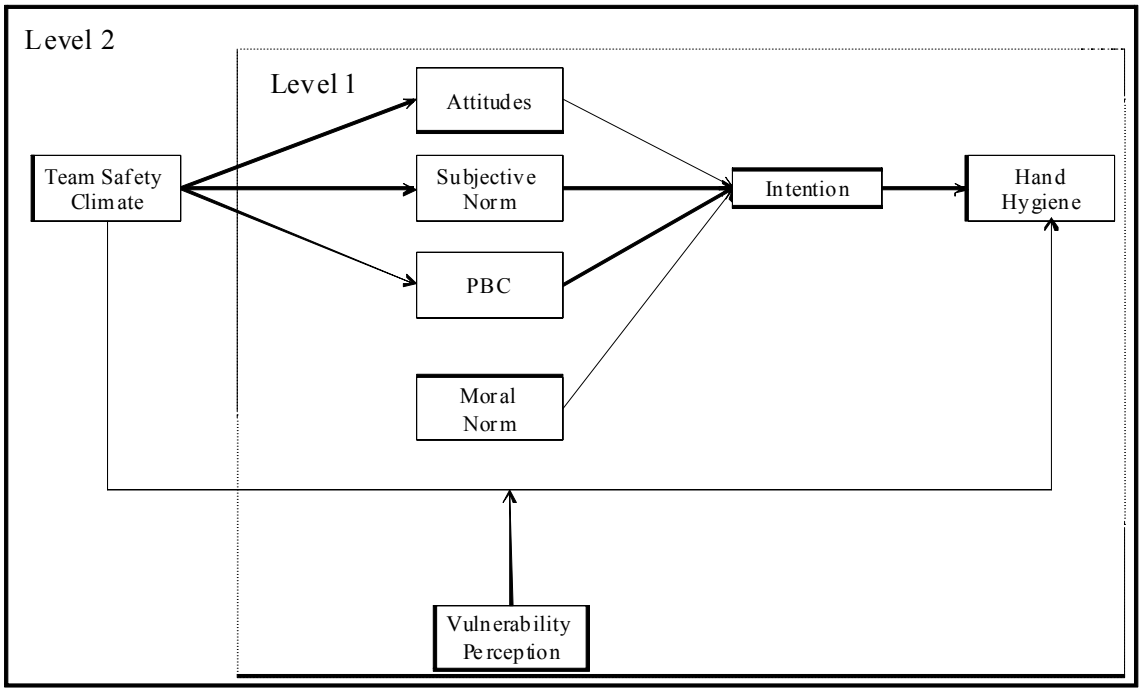
HCPs will only comply when they start to recognize the limits of their knowledge concerning infection control practices (Fischhoff, 1997). However, by itself, the vulnerability perception is not an exclusive predictor of HCPs' intention to comply with hand hygiene, indicating the preponderance of other variables in determining the behaviour (Rundmo, 1997). Based upon the theoretical framework presented, and taking into account the considerations referred to in the Precede-Proceed Model (Green & Kreuter, 1974, 1991), the vulnerability perception might predispose or inhibit the safety compliance behaviour depending on how susceptible the HCPs feel towards the likelihood of acquiring the assessed risk and spreading the possible HAIs, which suggests its potential as a moderator.

3.4 The conceptual research model

By taking into account the state of the art, the conceptual research model for this thesis attempts to capture the multi-level interplay between TPB and Safety Climate approach, with

inputs and outputs being also processed by Precede-Proceed model theoretical assumptions to study HCPs' compliance with hand hygiene. The model draws on the basic hypothesis of the TPB that relate attitudes, social norms and PBC as immediate antecedents of behavioural intention. The theoretical model can be seen in Figure 3.1.

However, this theoretical proposal extends the original TPB by including an additional construct in the normative component, namely the moral norm, as an internalized norm, to capture the moral dimension of this behavioural practice. Then, in a general way, these immediate antecedents, with the exception of the moral norm, will mediate the relationship between team safety climate and HCPs' individual intention. It is also expected that team safety climate has a positive impact on HCPs' compliance behaviour. However, this relationship can be moderated by HCPs' vulnerability perception in terms that, the relationship between team safety climate and hand hygiene compliance will be stronger when HCPs feel they have a high vulnerability perception.



3.1 Theoretical model projecting the multi-level relationships between team safety climate, TPB constructs and additional predictors

Finally, all these constructs will be grouped according to their nature as predisposing, enabling and reinforcing factors promoting the development of the Precede model fourth phase and consequently suggesting how Proceed phases can be implemented during a future intervention programme.

With an emphasis on a multi-level approach focusing on individual and group differences, the general aim of this thesis is to increase the knowledge about which predictors from distinct levels of analysis have a greater impact on HCPs in terms of their compliance with hand hygiene. Therefore, the thesis rests upon the following generic tenets.

Firstly, research on compliance with infection control needs to explore the development of a bottom-up perspective where HCPs are integrated in order to debate the factors that in their opinion contribute to explain their compliance (or non-compliance) with hand hygiene.

The second tenet of this thesis calls for the use of a psychological perspective on doctors' compliance with hand hygiene, as this group is considered 'at risk' for non-compliance (e.g. Pittet et al., 2000). By doing so we will departure from medical students perspectives and differences based on the assumption that compliance with hand hygiene starts to be shaped by the specificities of educational programmes about hand hygiene taught in medical schools. To that end we will emphasize different socialization stages of medical students in order to understand how processes of learning can contribute to constrain their behavioural intention predictors to comply with hand hygiene.

Thirdly, it is also important to recognize the relevance of a multi-level approach. HCPs' practices are integrated into micro-systems where these individuals are exposed to group perceptions that influence their behaviours and constrain the way patient safety is developed. However, to understand HCPs' compliance will also require a need to focus on their personal specificities because each professional develops beliefs, attitudes and perceptions that define their personal perspective and interact with organisational facets.

The fourth tenet of the thesis highlights the importance of analysing the specificities across doctors, nurses and cleaners as they work together in care-delivery teams and may have different motivations to comply with hand hygiene. Because these professionals are typically submitted to the same intervention programs, it is necessary to understand what are the common features and distinctive points among each professional category in order to develop adequate interventions directed to the necessities of these groups.

The fifth tenet of this thesis is to continue to explore the theoretical assumption that the professional category of doctors during their medical education and specialization can be particularly related with compliance issues. In this case, it will be important to analyse how socialization also contributes to constrain doctors' behavioural intention predictors.

Finally, we also intend to analyse the correspondence between self-reported and direct observation of HCPs' hand hygiene compliance. Few studies have analysed the compatibility

between these two data collection measures in order to verify its adequacy to study the problem of infection control, in particular with a sample comprising several categories of HCP.

Together, these s tenets correspond to six specific aims.

(1) The first aim of this thesis is to explore the principle of participation of the Precede-Proceed model in order to develop a bottom-up approach focused on HCPs' personal perspectives. Together with this aspect, we also intend to explore the heterogeneity between different professional categories and the impact this has on hand hygiene which is a significant behaviour to decrease the possibility of infection transmission (e.g. food handlers, educational professionals). In accordance with this first aim, Study I investigates whether HCPs' compliance with hand hygiene differed with respect to predisposing, enabling and reinforcing factors and behavioural intention predictors, when they were compared with food handlers and educational professionals.

(2) The second aim of this thesis is to study the role of the subjective norm (with distinct social referents) and the moral norm (with different moral emphases) in medical students according to their medical year and how that influences their intention to comply with hand hygiene. Corresponding to this aim, Study II and Study III investigated whether medical students from different Portuguese medical schools attributed a distinct importance to moral and social norms as a function of being integrated in the 1st or 6th years of their medical school training.

(3) The third aim of this thesis is to better understand the multi-level interconnections between team safety climate and the TPB by proposing a lower level mediation of upper level effect between team safety climate and HCPs' intention to comply with hand hygiene, where TPB behavioural intention predictors act as mediators. Furthermore, an additional lower level mediation is investigated that analyses the impact of intention on behaviour and the moderator role that vulnerability perception has on the relationship between team safety climate and hand hygiene behaviour. Accordingly, the first research goal of Study IV looks into how team safety climate can be integrated with the TPB and the vulnerability perception in order to contribute to better understand compliance with hand hygiene.

(4) The fourth specific aim of this thesis is to study how differences between professionals' categories contribute to distinctions in behavioural intention predictive patterns. Thus, the second research goal of Study IV examined how doctors, nurses and

cleaners may present distinctions in their behavioural intention predictors to comply with hand hygiene.

(5) The fifth specific aim is interconnected with the second purpose of this thesis. To that end, we continue to analyse in the third research goal of Study IV how doctors who are integrated into different socialization stages, in this case, due to their work experience may have a distinctive pattern in their behavioural intention predictors.

(6) The sixth, and final aim of this thesis, is not only to analyse two important methods to collect data, namely self-report questionnaires and direct observation, but also to explore the consistency between both measures and between them and behavioural intention predictors. Furthermore, we also expect to be able of aggregating individual level variables to the team level in order to explore observed and reported consistency among team members. In this sense, Study V aims to explore hand hygiene compliance rates in a Portuguese hospital, to verify internal consistency among team members and to compare the association between self-reported measures and direct observation compliance.

3.5 Conclusions

In this third chapter, the aim was to present the theoretical model that underlies this research project. The model aims to explore the hypothesized interconnections between the TPB, the Precede-Proceed model and the Safety Climate approach by taking into account the theoretical and methodological limitations that were identified during the literature review carried out in the previous chapters.

The theoretical model presented has a multi-level structure and is characterized by a relationship between team safety climate and HCPs' individual intention to comply with hand hygiene. It is expected this relationship will be mediated by TPB main behavioural intention predictors, namely attitudes, subjective norm and PBC. This mediation expresses the integration between both theoretical approaches and establishes itself as an innovative key facet in the safety compliance literature.

It is also proposed that team safety climate will have a positive impact on HCPs hand hygiene behaviour, in particular when their vulnerability perception is high, suggesting the potential moderator role of this individual-level variable, and again, suggesting a second multi-level relationship.

Finally, we included an additional variable to the TPB normative component to access the moral dimension of HCPs' hand hygiene behaviour. However, this variable explores the

moral prerogatives of these professionals giving more importance to other moral values than those underlying compliance with hand hygiene, constituting itself as a norm that hinders personal adherence. By taking this model and its theoretical assumptions into account, six generic proposals were made, namely (1) the importance of constituting a bottom-up perspective focused on HCPs' perceptions of the factors that predispose, enable and reinforce their compliance with hand hygiene; (2) to assess the importance social and moral norms in determining medical students intentions to comply with hand hygiene during their academic training; (3) the need to recognize the importance of applying a multi-level approach to the study of infection control which has failed to happen in previous studies that have directed the research mostly at the individual level; (4) to evaluate the differences and similarities in the behavioural intention predictors among HCP groups; (5) to continue to explore the doctors group by analysing the relevance of professional experience in constraining hand hygiene behavioural intention predictors; and, (6) to compare HCPs' self-report and observational measures of hand hygiene compliance.

In this sense, based on these general assumptions, six specific objectives were constituted and interconnected with the various studies to be presented at the third and final part of this project: (1) to explore the theoretical model Precede-Proceed by checking the specificities of HCPs' predisposing, enabling and reinforcing factors and behavioural intention predictors with the implementation of the principle of participation (Study 1); (2) to assess the role of social norms with distinct referents (professor and colleagues) and moral norms with different emphasis (hand hygiene and commitment to the patient) of medical students regarding hand hygiene compliance in different years of medical school curricula (Study 2 and 3); (3) to analyse the multi-level relationship between team-safety climate, TPB behavioural intention predictors and intention to comply and between the former and perceived vulnerability in order to explore how an integrative approach of these theoretical perspectives may contribute to explain compliance behaviours (Study 4 – research goal I); (4) to check how the differences in professional categories contribute to doctors, nurses and cleaners presenting differences in their behavioural intention predictors (Study 4 – research goal II); (5) to analyse junior and senior doctors behavioural intention predictors taking into account their amount of professional experience (Study IV – research goal III); and (6) to identify in what extent HCPs' reported behaviour can be correlated with observed behaviour and behavioural intention predictors. In addition, it also aims to focus on teams' internal consistency and the aggregation of level 1 variables to the team level (Study 5).

In the next part, throughout chapters 4 to 7 all the empirical studies will be presented as well as the implications of each one of these objectives in order to try to clarify HCPs' compliance with hand hygiene.

PART II

EMPIRICAL STUDIES

CHAPTER 4

EXPLORING HAND HYGIENE PREDICTORS AMONG HEALTHCARE, EDUCATIONAL AND FOOD PROFESSIONALS

4.1 Introduction

In the last decades, infectious disease has steadily moved back to the public health agenda by emphasizing the development of strategies for prevention and control such as hand hygiene to maintain personal healthier habits in order to prevent the spread of viruses (Bloomfield, Exner, Fara, Nath, Scott & Voorden, 2009). Because a significant proportion of the global burden of infectious disease is hygiene-related, standards of hygiene are required to decrease food-related, waterborne, and other infections such as HAIs (Bloomfield et al, 2009). In fact, several environments can be identified as vehicles of disease transmission, such as hospitals and schools, where large numbers of people associated with many inanimate objects and lack of time predispose the transmission of infections (White, Shynder, Shynder & Dyer, 2001); also, the food business environment has a relevant role in the proliferation of foodborne illnesses due to inaccurate food handling during all stages of its preparation and storage (National Health and Medical Research Council, 2003). Accordingly, HCPs, educational professionals and food handlers are examples of professional groups whose daily practices require the development of proper and continuous hygienic behaviours to prevent the spread of pathogens not only to themselves but also to those that benefit from their professional actions.

In the healthcare sector, HAIs are a major concern for infection control contributing to a worldwide burden of patients' mortality and morbidity associated with increased economic costs to countries' health systems (CDC, 2003). Several studies in the field of infection control have provided support for HCPs' compliance with proper hand hygiene to decrease the incidence of HAIs (e.g. Beggs, Noakes, Shepherd, Kerr, Sleigh & Banfield, 2006). However, hand hygiene compliance is less than optimal, with interventions having only minimal or temporary effect on hand hygiene behaviour (Korniewicz & El-Masri, 2010; Larson, Albrecht & O'Keefe, 2005; Sacar, Turgut, Kaleli, Cevahir, Asan, Sacar et al. 2006).

A different community setting also affected by hand-borne transmissible illness is the educational one. Schools, school children, teachers and other staff play a major role in the spread of colds and enteric diseases, such as influenza during epidemics (Schmidt, Wloch, Biran, Curtis & Montagni, 2009). Several studies have documented a connection between hand hygiene and illness-related absenteeism in schools. In fact, the Centers for Disease Control and Prevention determined in 2007 that more than two-thirds of American students aged 5 to 17 years missed school due to illness or injury (e.g. CDC, 2007; Nandrup-Bus

2009). In the Middleton study (1993) it was documented that students were absent from school 4.5 days per year and teachers 5.3 days per year due to infections that could be preventable with hand hygiene (e.g. Hammond, Yusuf, Fendler, Dolan & Donovan, 2000). Despite the fact that transmission of infectious disease among school children and educational professionals is frequent and probably inevitable it may be decreased by the correct use of hand hygiene techniques (e.g. Ohlund & Ericsson, 1994). In fact, literature findings emphasize that proper hand hygiene helped to reduce colds at a child-care centre after an intervention that put hand hygiene into practice (Niffingger, 1997). Butz, Larson, Fosarelli & Yolke (1990) obtained similar results after implementing an intervention programme, in which a significant reduction in enteric disease symptoms was found.

Finally, the increased number of food-borne illnesses has led to the development of pathogenic viruses affecting consumers as a result of inadequate food handling behaviour in the food business industry (Mullan & Wong, 2010). Food handlers not complying with adequate safety guidelines and proper hand hygiene results in an increased risk of food contamination with pathogens through hand contact (Food and Drug Administration, 2010). In a study developed by Olsen, Mackinon, Goulding, Bean & Slutsken (2000) most foodborne illnesses have their origin in a restaurant, which reinforces the importance of investigating food safety in this particular context. In fact, the number of restaurant employees that show non-compliance with hand hygiene and other safety guidelines is higher than those of other food businesses (e.g. schools, hospitals, nursing homes) (Pilling, Brennon, Roberts, Shanklin, Howells, 2009). Accordingly, observational studies indicate that most food handlers wash their hands properly in 9% of the times in which they touched their face or hair and in 25% of those instances in which they touched potentially contaminated objects (Clayton & Griffith, 2004). The prevailing body of research has also concluded that little improvement in food safety compliance tends to occur after training (Howes, McEwen, Griffith & Harris 1996).

Attempts to predict health behaviours such as hand hygiene compliance are not always successful (Mullan & Wong, 2009) but some theoretical frameworks like the TPB and the Precede-Proceed model have been quite important in explaining a wide range of behaviours, such as hand hygiene (e.g. Clayton & Griffith, 2008; Dejoy, Searcy, Murphy, Gershon, 2000; Larson, 1997; O'Boyle, Henly & Larson, 2001) and food handling (e.g. Seaman & Eves, 2010a; Seaman & Eves, 2010b) as demonstrated in a number of studies.

In this sense, the general aim of this study[9] is to consider both the TPB and the Precede phase of the Precede-Proceed model to analyse HCPs, educational professionals and food handlers hand hygiene compliance behaviours. The need to conciliate both theoretical perspectives arises from the fact that in order to design robust intervention programs there is a strong need to fully understand all factors underlying compliance with hand hygiene in the workplace (e.g. Clayton, Griffith, Price & Peters, 2002; Seaman & Eves, 2010a). Thus, in this study, we have defined a methodology that explores the benefits of qualitative and quantitative data collection to explore the socio-cognitive and organisational factors that may affect compliance behaviours.

The primary aim of the study is to fill a literature void by drawing upon a qualitative exploratory design having a socio-cognitive and a community model as theoretical framework. Most of hand hygiene studies use a single quantitative approach which neglects compliance specificities related to the professional perspective. In fact, studies that are exclusively focused on a quantitative design overlook behavioural processes underlying compliance that can only be outlined by those who participate in the workplace: the professionals. So, our purpose goes beyond the aim of defining a solely quantitative perspective, by trying to address a bottom-up approach able to clarify the personal views that healthcare, educational and food workers have about hand hygiene compliance.

In consideration with this purpose, the second aim of the study is to provide a more detailed overview of the interrelationships between individual (e.g. attitudes), social (e.g. social norms) and organisational variables (e.g. safety climate) in determining professionals' compliance with hand hygiene. To that end, the study integrates a theoretical framework that acknowledges the contributions and interchanges of both socio-cognitive and community models using the TPB and the Precede-Proceed model respectively.

We expect that the development of this approach will help to explain the documented lack of compliance, particularly among these groups of professionals, and provide reasons why interventions often fail or have only temporary effects (e.g. Pittet, 2004). The usefulness of this approach relies in the principle of participation defended by the Precede-Proceed model. This principle assumes that participants will take an active part in defining their own

[9] Roberto, M., S., Mearns, K. & Silva, S. A. (2010). *Hand hygiene compliance among health, educational and food professionals: a study on social influence and PRECEDE factors*. (Submitted).

needs and solutions to solve the behavioural problem (Green & Kreuter, 1999). The non-implementation of such principles will compromise the proposed behavioural change aimed at by any future intervention. Therefore, is of utmost importance to consult those who are directly affected by the desired outcome.

Finally, the third purpose of this study is to explore the three groups of respondents based on the assumption that hand hygiene compliance is defined by different characteristics according to their professional category. By doing so, we attempt to contribute to a broader knowledge of compliance in other occupational contexts by trying to identify the genesis of these professionals' motivational responses towards hand hygiene compliance that is mostly focused on the healthcare sector.

Many attempts have been made to improve hand hygiene compliance through education and indeed elementary hand hygiene should be taught in these professional settings to increase preventive behaviours (e.g. Teare, Cookson, French, Gould, Jenner, McCulloch et al., 1999). Since the effectiveness of hand hygiene relies on a workers' daily routine of compliance (Bloomfield, Aiello, Cookson, O'Boyle & Larson, 2007) this study draws its theoretical framework from health promotion, in particular from community models such as the Precede-Proceed model. Because this perspective has a theoretical base that allows the combination of socio-cognitive models to explore the complexities between individual, social and environmental influences, its interconnection with the TPB will address the fundamentals of beliefs, attitudes and perceptions that hand hygiene may reflect (e.g. Ritchie, Amos, Phillips, Cunningham-Burley & Martin, 2009). In this sense, we draw upon the reciprocal relationship between socio-cognitive and socio-environmental influences allied with the benefits of conciliating a qualitative and quantitative methodology to understand how changes in professional and workplace specificities constrain personal hand hygiene behaviour.

Both parts of the study were developed at the same time. First, qualitative data was collected followed by quantitative data. In the qualitative part of the study we conducted in-depth semi-structured interviews with HCPs, educational and food professionals who had the opportunity to describe their hand hygiene compliance experiences. After the end of the interviews, we collected quantitative data with participants filling out a self-reported questionnaire to assess the behavioural intention predictors of their hand hygiene compliance. The detailed methodology and results will be described in the next sections accordingly to the qualitative and quantitative parts of the study.

4.2. Study I – Qualitative Part

4.2.1 Objectives

While there have been qualitative studies that have examined hand hygiene compliance of HCPs, educational and food professionals, none have yet explored a comparative approach of their hand hygiene compliance determinants. Despite the fact that these groups belong to a different professional sector, in several circumstances they will share the same workplace facilities. For example, in schools we can find teachers who are responsible for students' education, school nurses responsible for health planning and school food handlers who prepare and deliver students' meals. Thus, the interconnection between these professionals goes beyond the fact that they do, in fact, share a common infection control practice among them; it also relies on the assumption that these professionals interact in the same workplace setting and, as such, can be targeted by general hand hygiene intervention programs that are not directed to the specificities of each group.

Given that previous quantitative research has demonstrated a clear picture that it is difficult to maintain high levels of hand hygiene compliance across professional groups even after the implementation of intervention programs (CDC, 2003), there is a need of these professionals to identify the determinants of their compliance and explore how hand hygiene promotion can be planned and changed over time. In this sense, we intend to apply the principle of participation stated in the Precede-Proceed model because any attempt to change professional behaviour will be greater if the professionals have helped to identify their own need for change and have recognized the factors that predispose, enable and reinforce their behaviour, because those factors will allow them to make the change (Green & Kreuter, 1999, pp. 457).

4.2.2 Method

4.2.2.1 Participants

Participants were selected using a purposive sample recruited by the interview team in easily accessible institutions using pre-defined quotas based on three primary criteria: *(i)* participants needed to be drawn from three different sectors, including both male and female, and have different professional roles within health, educational and food organisations; *(ii)*

participants also needed to have at least 23 years old and *(iii)* work the full number of hours defined by their employer for at least 1 year.

The aim in defining the sample was not to obtain a statistically representative sample, but instead a sample that would be able to include participants who represented characteristics of the three main professional groups. In particular our major concern was to include professionals from the main occupational categories from the health, educational and food sector. However, our sample was large enough to achieve data saturation. In the literature, data saturation refers to the point at which no new thematic information is identified in the collected data regarding the categories, which contributes to validate the coding system (Glaser & Strauss, 1967) and is determined when no new concepts emerge from the ongoing analysis. In this study, data saturation was obtained in the same proportion for each selected sector, i.e., 19 individuals for each professional group (Hersht, Massicotte & Bernstein, 2007).

Thus, the sample comprised 57 individuals (19 HCPs', 19 educational professionals, 19 food handlers) 47 female and 10 male, who were subjected to semi-structured, face-to-face interviews. The mean age of participants was 40.4 years (ranging between 22 and 58 years). All professionals were employed in several Portuguese healthcare, educational and food organisations. Professionals' average work experience was 11.02 years. The HCPs group consisted of 8 Nurses, 6 Doctors and 5 Hospital Cleaners. Hospital Cleaners were included in the sample because, in Portugal, these professionals are integrated into hospital care-delivery teams. HCPs worked in medium and large-sized organisations (6 public hospitals, 5 public health centres, 1 private clinic) located mostly in the broader agglomeration of the Lisbon Metropolitan Region. Seven HCPs already had previous management experience and 12 worked in rotational shifts. Only 10 professionals had received training in infection control. The educational professionals group was represented by 9 School Support Staff, 6 School Teachers and 4 Nursery School Teachers. These professionals represented medium and large-sized public organisations located in Lisbon (10 schools and 4 nursery schools). Twelve professionals already had previous management experience and only 3 worked in shifts. Also, only 9 professionals had participated in an infection control course.

Finally, the food handlers group included 13 Restaurant/ Cafe Waiting Staff and 6 Cooks. These professionals worked in 15 small and medium-sized restaurants and/ or cafes in Lisbon. Only 9 professionals had previous management experience and 8 developed their functions through a system of rotational shifts. Training in infection control was only given to four professionals.

4.2.2.2 Data collection

Data were generated from face-to-face audio-recorded, semi-structured interviews. The interviews took place during work time, lasted 60 minutes on average, and were scheduled according to the professional's availability. Ethical considerations were carefully observed and prior consent was obtained from participants, who were informed about the study goals and data confidentiality. The interview schedules were designed to explore the professionals' experiences of hand hygiene compliance within the context of their professional activity. The questions were developed from the existing literature on hand hygiene but other ideas emerged from other areas focused on different health compliance behaviours whose research questions have also been framed upon the Precede-Proceed model and the TPB (e.g. giving blood, non-smoking behaviour). Open-ended questions were utilised in order to obtain more depth in the professionals' answers and explore their meaning in order to saturate the data (Legard, Keegan & Ward 2003).

The main themes of the questions focused on social influence processes and factors that predispose, enable and reinforce hand hygiene compliance. The interview schedule was organised in four main topics to be explored: (1) knowledge about hand hygiene referring to professionals' information about recommended hand hygiene practices guidelines (e.g. *In which particular situation do you need to wash your hands?*); (2) consequences of non-compliance with hand hygiene exploring the repercussions that can occur to the professional and the community when infection control practices are neglected (e.g. *What sort of viruses can you acquire and/ or spread to the community if you don't wash your hands?*); (3) factors that predispose (e.g. *How do professionals evaluate the importance of hand hygiene?*), enable (e.g. *What sort of barriers difficult hand hygiene compliance*) and reinforce compliance (e.g. *Is hand hygiene important for your organisation?*); (4) social influence processes as a way to strengthen or inhibit compliance due the importance given to relevant social referents (e.g. *Is your colleagues' hand hygiene behaviour important to you?*)

4.2.2.3 Data analysis

Interviews were recorded and transcribed verbatim with the consent of all participants. Transcripts were codified to maintain privacy and confidentiality. Interviews content was analysed using Atlas.ti 5.0, a qualitative software package to allow electronic coding and retrieval of data. The research team decided to perform a conceptual content analysis, by

choosing concepts for examination and rating the frequency of its occurrence within the recorded data. The use of this systematic research method for analysing the data was a helpful tool that allowed the research team to make inferences about the transcribed material (Bardin, 2007).

Transcriptions were analysed line by line to identify segments of data with identical concepts giving particular attention to social influence processes and predisposing, enabling and reinforcing factors. The different categories evolved into a coding system, where similar codes were grouped into more inclusive categories. Categories were compared, extended and reformulated in order to achieve a clear definition of the coding scheme. The final coding system was illustrated with quotations representing the thematic categories. In the end, the final coding system was thematically defined with reference to the main questions in the interview schedule (e.g. codes for predisposing, enabling and reinforcing factors and social influence processes) and with novel themes that emerged through the analysis of the narratives (e.g. perceptions of risks and health behaviours). The data were analysed, first, on a case by case basis by focusing on the hand hygiene experiences of each interviewee. After that preliminary analysis, other types of analyses were made, in particular those across occupational categories and, finally, those across professional groups. A validation of the analysis was performed as the research team has discussed the results achieving a very good Cohen's Kappa Index of Inter-Reliability of 0.82 (Pedhazur & Schelkin, 1991).

4.2.3 Results

Results are presented by taking into account the final coding system themes. Professionals' quotations will be used to illustrate their narratives according to the topics under analysis. In addition, results will not only focus on the differences and similarities among the occupational categories inside each professional group, but also on the differences and similarities across professional group. A brief summary of this study main results are presented in Table 4.1.

4.2.3.1 Professionals' perceptions of risks and health behaviours

This was a topic that emerged from the narratives of professionals and refers to the risk that these groups consider that may affect them during their working practices. This topic also refers to the health behaviours that these professionals have to develop not only to protect them but also to protect those who benefit from their daily actions.

In the group of HCPs, all participants acknowledged that the main risks they may face are the infectious diseases *"... we are always at risk of getting infected with some sort of infectious disease..."* (HCP, Doctor, Participant 1), musculoskeletal problems *"We work in the same position for long periods of time and by the end of the our day we have low back pain"* (HCP, Nurse, Participant 7) and the risk of exposure to biological factors *"...we are daily exposed to biological fluids and because of the risk of sharp injuries and exposure to blood we are always at risk of biological factors "* (HCP, Cleaner, Participant 15).

At the level of health behaviours, the consensus among the three occupational categories is also achieved because the three reported that the best health behaviour that can be performed is to comply with healthcare universal safety precautions *"Compliance with Standard Precautions is essential to prevent transmission of infectious agents"* (HCP, Doctor, Participant 2). These precautions involve, in particular, one of the most basic and important techniques in infection control, hand hygiene. This procedure is seen as a way to protect patients' health and the professionals' safety *"... among precautions, hand hygiene is very important and it's an easy way to protect you and the patient"* (HCP, Nurse, Participant 8). *"Hand hygiene is an important element of my daily practices"* (HCP, Cleaner, Participant 16).

Turning to educational professionals, the narratives highlighted risks that focus on respiratory problems, particularly the flu and the threat of influenza epidemics. *"Children get sick with colds really easy. It's simple to spread the viruses"* (Educational Professional, School Teacher, Participant 29). *"Nursery schools are full of children; when one gets sick, everyone gets sick too. Schools have an important role in spreading influenza because it's difficult to control every germs route of transmission"* (Educational professional, Nursery School Teacher, Participant 38). *"Children sneeze and then they come to talk to us; they also come to play with us. It's easy to get the flu."* (Educational Professional, Supporting Staff, Participant 28). To deal with the above mentioned risks, the health behaviour that is recognized as more efficient is hand hygiene *"Hand hygiene is the best way to eliminate germs from our hands and from childrens' hands"* (Educational professional, School Teacher, Participant 51). *"Hand washing is our best way to reduce the possibility of getting sick so often"* "(Educational professional, Nursery School Teacher, 36). *"I try to wash my hands as much as I can to prevent myself getting sick"* (Educational professional, Supporting Staff, Participant 21).

4.1. Summary of the topics and themes identified in the content analysis

Topic	Theme	Typical Quote
Perception of risk and health behaviours	Infectious diseases	"We are always at risk of getting infected with some sort of infectious disease" (HCP)
	Respiratory problems	"Children get sick with colds really easy. It´s simple to spread the viruses" (Educational Professional)
		"Every day we have a lot of people in our restaurant and it's easy to get sick with colds" (Food Handler)
		"(…) Hand hygiene is very important (…)" (HCP)
	Hand hygiene	"Hand washing is our best way to reduce the possibility of getting sick" (Educational Professional)
		"(…) it's the only way to prevent that our hands will not contaminate the food" (Food Handler)
Precede factors Predisposing	Beliefs related to commitment to the patient	"(…) I don't want the patient to feel that for doing that I need to wash my hands" (Nurse)
		"(…) Sometimes taking care of the patient means not complying (…)" (Doctor)
	Beliefs related to personal safety	"(…) I need to protect myself." (Cleaner)
	Beliefs related to home environment	"Parents should teach their children how to wash their hands and in what situations they need to go to the bathroom" (Educational professional)
	Beliefs related to costumer safety	"We need to wash our hands because we are serving costumers (…)" (Food handler)

Enabling	Hand hygiene training	"Hand hygiene training is important to raise awareness" (HCP) "If we learn from the first day it will be better for us" (Food handler)
	Resources	"Clean towels and soaps would be determinant in every bathrooms" (Educational professional)
Reinforcing	Feedback about risks	"If we had more reliable data on compliance and infection rates it would be easier to implement measures to increase hand hygiene" (HCP)
	Management commitment	"With the spread of influenza, schools should start thinking that hand hygiene is really important to prevent viruses (…)" (Educational professional) "(…) the manager has the responsibility to provide us what we need to do our best" (Food handler).
Social Influence	Peer pressure	"Colleagues are really important. The more professionals comply, the higher the rates will become because if we see everyone complying we will also comply in every situation" (HCP)
	Significant other in early stages of life	"I suppose our parents taught us what we should know about hygiene and now we do what we´ve learned" (Educational professional) "(…) I think it depends on us and on what you have learned when you were a child (…)" (Food handler)
Reasons for not complying	Occupational stress	"Sometimes we don't wash our hands, especially if we are in a stressful situation like life and death situation" (HCP) "It's a very stressful work always running from one side of the school to the other (…)" (Educational professional)

	"(…) it's hard to deal with costumers (…)" (Food handler)
Lack of time	"If we have to rush we will not stop to wash our hands (…)" (HCP)
	"I just can't leave the children alone every time I need to wash my hands" (Educational professional)
	"Sometimes we don't have time to go to the place where the sink is" (Food handler)
Knowledge about risks	"(…) everyone who works in a healthcare organisation needs to be clarified about risks" (HCP)
	"(…) we need to understand the real risks (…)" (Educational professional)
	"We need to have information about how to wash our hands (…)" (Food handler)
Moral imperatives	"I focus my attention on patients. I don't need to be constantly washing my hands (…)" (Doctor)
	"(…) Because it was a routine procedure the patient thought he had a problem (…) that can compromise the quality of our relationship and our first commitment is with the patient" (Nurse)
Vulnerability perception	"We know that the risks exist. We just don't think too much about the possibility of acquiring them" (HCP)

Organisational features	Safety climate perceptions	"Senior doctors and other authorities specialised in infection control should be the ones managing infection control guidelines in hospital departments" (Doctor) "Infection control committees work with limited budgets (…)" (Nurse) "Facilities and equipments need to be improved (…)" (Cleaner) "Schools boards should start thinking about intervention programmes to increase hand hygiene compliance" (Educational professional) "It would be easier for us to be able to talk with our manager and discuss hygiene and other safety guidelines" (Food handler)

Finally, among the food handlers group, the importance given to the risks varied according to the occupational category. Thus, for the waiting staff, the most relevant risks were the respiratory problems *"every day we have a lot of people in our restaurant and it's easy to get sick with colds ..."* (Food Handler, Waiting Staff, Participant 39) while cooks focused on the musculoskeletal problems *"cooking the whole day can give you major pain in your back and knees..."* (Food Handler, Cook, Participant 52). In these professionals' narratives, the most relevant health behavior to their activity was hand hygiene, perceived as a vital procedure to prevent the transmission of microorganisms to food to protect the proliferation of foodborne illnesses *"... hand hygiene is really important because it's the only way to prevent that our hands will not contaminate the food..."* (Food Handler, Cook, Participant 54). *"Hand hygiene is important to avoid customers from getting sick"* (Food Handler, Waiting Staff, Participant 53).

4.2.3.2 Precede factors: Predisposing, Enabling and Reinforcing Factors

According to the principles of the Precede part of the Precede-Proceed model, there are three general categories of factors affecting behaviour, predisposing, enabling and reinforcing factors, each one exerting a specific type of influence on behaviour (Green & Kreuter, 1999).

Predisposing factors refer to any characteristic of a person such as beliefs, attitudes or skills that motivates behaviour prior to its occurrence (Green & Kreuter, 1999). It was possible to identify in participants' narratives their convictions regarding the need to comply with hand hygiene, referred to as their personal beliefs. In this case, there were some differences among the professionals groups and occupational categories. For instance, in the HCPs' group, doctors and nurses highlighted their call for prioritizing their personal commitment to the patient and also to give importance to patients' needs by stating that in this particular case, hand hygiene may interfere with their personal compliance. *"A patient's life is always on the front line, the only thing we want is to save that life and we neglect the risks"* (HCP, Nurse, Participant 6). In fact, these two groups of HCPs state that the first commitment they have is the professional relationship with the patient and that hand hygiene despite being a relevant procedure can compromise that relationship in some situations. *"Sometimes, when I go see a patient and I'm just going to check if everything's ok I know that I should wash my*

hands but I also don't want the patient to feel that for doing that I need to wash my hands" (HCP, Doctor, Participant 7).

These moral imperatives that the narratives of doctors and nurses appear to emphasize are also strengthened by other explanations. In particular, doctors refer to the fact that their medical background gives them information to decide whether to comply with hand hygiene in situations where they don't agree with the application of the technique. *"As a doctor we need to take care of the patient and the disease. Hand hygiene is a great procedure but does not eliminate infections. Sometimes taking care of the patient means not complying. It's always for the patient interest."* (HCP, Doctor, Participant 5). Only cleaners have not expressed in their narratives an overt moral commitment towards the patient as a determinant of their personal beliefs to comply with hand hygiene. In fact, cleaners state their personal safety as their motive to comply *"This is a very risky job. Once I cut myself while cleaning the patients' room. I immediately washed my hands. I need to protect myself. "* (HCP, Cleaner, Participant 17).

In terms of educational professionals beliefs, as predisposing factors, their narratives reveal that hand hygiene is perceived as part of general health education that families should teach to their children in order to behave adequately. *"Parents should teach their children how to wash their hands and in what situations they need to go to the bathroom"* (Educational professional, School Teacher, Participant 40). These professionals acknowledge the importance of the home environment in influencing and determining children's hand hygiene behaviour and consequently, parents and family must be the primary sources of hand hygiene rules. *"Parents play a significant role in telling their children that they need to comply with hand hygiene"* (Educational professional, Nursery Teacher, Participant 38). Schools will be places where those rules will be implemented and reinforced. *"...when the children are at school, hygiene rules are strict; everyone needs to obey them."* (Educational professional, School Teacher, Participant 33). *"Children learn in the home when and why they need to wash their hands; here we only have time to supervise them"* (Educational professional, Supporting Staff, Participant 28).

In the case of food handlers, their beliefs focus on the importance of establishing a trustful relationship with the costumer and hand hygiene is the procedure that allows protecting the quality of the food in a way that satisfies the customers' needs. *"We need*

to wash our hands because we are serving customers. We need to put the customer first as well as his personal health." (Food handler, Waiting Staff, Participant 30). *"If we want a customer to return to our restaurant we need to comply with every single procedure, in particular hand hygiene. Customers' will have trust in us."* (Food handler, Cook, Participant 53).

In general, it is possible to verify in the participants' narratives of all professional groups that they are well-informed about recommended hand hygiene practices and generally presented a positive attitude towards this practice indicating the relevance to comply with the procedure. *"I am aware of possible person to person transmission if I don't wash my hands and I perceive the benefits that compliance has, in particular during severe outbreaks"* (HCP, Doctor, Participant 4). *"We have a lot more consciousness in this area. We see how important it is to wash our hands in order to prevent epidemics"* (Educational professional, School Teacher, Participant 34). *"I received hand hygiene training sessions since the time I was studying to be a cook. So I know how important hygiene is."* (Food handler, Cook, Participant 55).

Also, professionals referred to the occasions that in their opinion required compliance with hand hygiene according to their daily activities. In the case of HCPs it appears that compliance must occur when there is a personal contact with a patient or the surrounding environment or when the professional needs to perform a procedure. Hygiene must be performed before and after the contact or procedure. *"When I have a personal contact with a patient or the surrounding environment. But it will depend on the procedure."* (HCP, Doctor, Participant 7). *"Before and after a procedure and before and after having a contact with a patient."*(HCP, Nurse, Participant 14). *"Almost in every situation I should wash my hands."* (HCP, Cleaner, Participant 17).

Turning to educational professionals, hygiene is seen as a procedure that must be applied before eating, after going to toilet, after sneezing or when hands have visible dirt. *"I wash my hands every time I go to the toilet and after eating with my hands"* (Educational professional, School Teacher, Participant 29). *"As a teacher I need to be an example so I always wash my hands after sneezing, before eating, after going to the toilet. Sometimes when I play with the kids my hands get dirty and we all go the bathroom to clean them"*. (Educational professional, Nursery School Teacher, Participant 37). *"I always wash my hands before eating and after going to the toilet"* (Educational professional, Supporting Staff, Participant 26).

Finally, food handlers indicate that occasions to wash hands occur in particular after touching money or other part of their body (e.g. hair, nose), before and after touching unwrapped raw and cooked foods and before and after using gloves. *"Every time we touch in money we need to wash our hands. Also, if we touch our hair or our nose, or if we sneeze we need to wash our hands."* (Food handler, Waiting Staff, Participant 43). *"When we touch unwrapped raw food we need to wash our hands. It's the same thing with cooked foods. As a cook we are always touching different things. We are always washing our hands. Now we also use gloves but we still need to wash our hands. Before and after."* (Food handler, Cook, Participant 55).

Enabling factors are characteristics of the environment that facilitate the behaviour and any skill or resource required to obtain the specific behaviour (Green & Kreuter, 1999). In the HCPs' narratives hand hygiene training is emphasized as an important enabling factor that should be continuously promoted in the healthcare sector throughout the education of the professional. *"There must be hand hygiene training sessions during our career"* (HCP, Nurse, Participant 14). *"Hand hygiene training is important to raise awareness"* (HCP, Doctor, Participant 2). In the particular case of cleaners, hand hygiene training is perceived as a way to acquire skills that allow them to gain more control over this procedure and overcome daily barriers *"Sometimes I just don't know how to wash my hands. There are so many situations that I've to face, so many surfaces to clean, so many techniques to apply that I get confused. I suppose it would be easier if we had more training."* (HCP, Cleaner, Participant 19).

Educational professionals consider that resources should be available in order to enable compliance. The unavailability of these resources develops physical barriers to action. *"It would be easier if our bathrooms were properly equipped with all the materials that we need to."* (Educational professional, Nursery School Teacher, Participant 56). *"It would be easier if we had sinks inside the classrooms"* (Educational professional, School Teacher, Participant 40). *"Clean towels and soaps would be determinant in every bathroom"* (Educational professional, Supporting Staff, Participant 28).

Finally, food handlers also believe that training in hand hygiene is important and should be implemented before the professional starts working, in order to learn food safety and enable compliance. *"If we learn from the first day it will be better for us"*

(Food handler, Cook, Participant 52). *"Better start learning as soon as possible"* (Food handler, Waiting Staff, Participant 39).

According to Green & Kreuter (1999) reinforcing factors represent any reward or punishment following or anticipated as a consequence of behaviour, serving to strengthen the motivation for or against the behaviour. In the narratives, HCPs focus on the need for risk advice concerning hand hygiene, in particular the development of internal surveillance systems and the constitution of routine feedback about risks and infections. *"If we had more reliable data on compliance and infection rates it would be easier to implement measures to increase hand hygiene"* (HCP, Nurse, Participant 10). *"Surveillance systems are determinant inside hospital facilities to monitor infections and practices and provide accurate feedback about what is happening inside a hospital and about what should be done."* (HCP, Doctor, Participant 3). *"It's easier to comply when we know if we are doing things right"* (HCP, Cleaner, Participant 15).

In the particular case of educational professionals, all narratives emphasize that schools should publicize more the need to wash hands, to distribute flyers and put some information on the walls concerning this problem. *"I think schools should publicize more the need to wash hands, to distribute some flyers and put some information on the walls. Both kids and teachers would feel that there's a social concern about it."* (Educational professional, School Teacher, Participant 34). *"Maybe putting some information about it in walls and bathrooms"* (Educational professional, Supporting Staff, Participant 28). In fact, nursery school teachers refer to the fact that schools must prepare to target hand hygiene behaviour by promoting school-based interventions. *"With the spread of influenza, schools should start thinking that hand hygiene is really important to prevent viruses and schools are perfect targets for the spread of viruses. To reinforce hand hygiene schools must think about starting to develop interventions"*. (Educational professional, Nursery School Teacher, Participant 37).

Finally, food handlers determined in their narratives that compliance would be reinforced if they perceived a management commitment to maintain the equipment in strategic places where every professional could easily wash their hands without constraining their work. *"... we need more sinks in the restaurant. The manager has the responsibility to provide us what we need to do our best."* (Food handler, Cook, Participant 20). *"Managers are responsible for giving us the soaps and towels we need.*

Sometimes we don't have everything we need." (Food handler, Waiting Staff, Participant 44).

4.2.3.3 Social influence

Narratives from all participants focused on how social influence processes may be related to their hand hygiene compliance. Although socialization and norm internalization occur throughout the cycle of life (Kohlberg, 1976) the three professional groups present different social referents as a product of their hand cleansing habits.

HCPs give particular relevance to co-workers behaviours and expectations and somehow determine their compliance according to their perceptions regarding the relevance of peer pressure. *"I think the ward supervisor and the team supervisor are extremely important to help us understand that we need to wash our hands. If we are in a team where every colleague applies the safety rules, then we don't want to be the one who's seen as a non-complier. But when we are in teams where no one does that, it's difficult to not go with the flow."* (HCP, Doctor, Participant 1). *"Colleagues are really important. The more professionals comply, the higher the rates will become because if we see everyone complying we will also comply in every situation"* (HCP, Nurse, Participant 13). *"I feel that I comply more when my colleagues also comply"* (HCP, Cleaner, Participant 17). In addition, HCPs' narratives emphasize that several social referents play a specific role in compliance. In the particular case of doctors, narratives determined that it's important to have other doctors in hospital infection control committees in order to communicate information regarding hand hygiene and promote compliance. *"Doctors communicate better with each other"*. (HCP, Doctor, Participant 7). On the other hand, nurses considered that the best social referents to disseminate infection control information are nurses´ supervisors. *"Infection control committees are mostly represented by nurses. We also spend more time with patients. Nurses' supervisors have everything they need to be good examples to all professionals."* (HCP, Nurse, Participant 8). Finally, cleaners indicated that both doctors and nurses are good referents in infection control and both can help them improve compliance. *"We are included in teams with doctors and nurses. They all know a lot more than us about this. So we listen to them."* (HCP, Cleaner, Participant 15).

In terms of educational professionals social influence processes these coincide with food handlers' narratives. Both stress that their personal compliance with hand

hygiene relies on hygiene habits and rules acquired during their childhood and adolescence. *"To wash my hands is a norm that I've learned during my childhood and adolescence. It's my own responsibility."* (Educational professional, School Teacher, Participant 36) *"No one influences me here. I think it depends on us and on what you have learned when you were a child. It's a habit we've acquired."* (Food handler, Cook, Participant 27). Those rules have been taught by their parents and significant peers in that period of their life and now play a significant role as internalized rules. *"I suppose our parents taught us what we should know about hygiene and now we do what we've learned."* (Educational professional, Supporting Staff, Participant 23). *"I remember that I need to wash my hands because my family told me that I needed to do that when I was a child. It's an old habit."* (Food handler, Waiting Staff, Participant 39). All professionals from these two groups consider that hygiene education is formally taught as part of health education in a person's daily life. To that end, no one but the person him or herself will be responsible for hygiene. *"Hygiene is a personal responsibility; we should know that we need to comply with it."* (Educational professional, Nursery Teacher, Participant 35). *"Whether I wash my hands it's my own business."* (Food handler, Wait Staff, Participant 38). Nevertheless, despite these professionals' hand hygiene practices indicating that their social influence processes rely on internalized norms enacted by hygiene habits acquired during their early infancy, their narratives also highlight that hand hygiene is a practice where compliance is needed to set an example for children, in the specific case of educational professionals *"It's important to comply because I want children to see me as an example."* (Educational professional, Nursery Teacher, Participant 37); and, to contribute to customers' health, in the case of food handlers *"…our purpose is to see our customers' healthy…"* (Food handler, Waiting Staff, Participant 39). In this sense, children and customers can also play a role as social referents that influence these professionals' compliance practices.

In the end, hand hygiene compliance appears to be linked with two sorts of social influence processes exerted by external norms focused on overt social pressure as shown by HCPs' colleagues; and, a prescriptive, internalized rule acquired during childhood, perceived as being independent and anchored in the self of educational and food professionals. However, these last two groups also have social referents anchored in their proximal working groups that contribute to their compliance.

4.2.3.4 Reasons for not complying with hand hygiene

The three professional groups presented in their narratives several factors that they considered may hinder compliance. Three factors were common across professional groups and all health, educational and food professionals highlighted their importance, in particular, the relevance of occupational stress, the lack of time and the knowledge about risks.

In the particular case of occupational stress each professional group deals with a distinct stress etiology but all considered that their daily activities contribute to emotional fatigue. This fatigue, in their opinion, contributes to decreases in compliance. *"Sometimes we don't wash our hands, especially if we are in a stressful situation like life and death situations"* (HCP, Doctor, Participant 4). *"It's a very stressful work always running from one side of the school to the other. Because of that sometimes we just forget."* (Educational professional, School Teacher, Participant 57). "*…it's hard to deal with customers and be constantly washing our hands."* (Food handler, Waiting Staff, Participant 23).

Lack of time occurs when professionals feel that they don't have enough time to accomplish every action they need to perform. HCPs' as well as food handlers' narratives indicate that overwork can be responsible for their non-compliance. In the case of HCPs hospitals deal with large numbers of people who, in some cases, wait a considerable number of hours to be examined by a professional. Doctors, nurses and cleaners feel that they don't have enough time to wash their hands in every required situation and to perform their activities when there is a high number of patients. *"We see patients waiting. We don't have time to wash our hands every single moment."* (HCP, Nurse, Participant 18). *"If we have to rush, we will not stop to wash our hands because we have patients to see."* (HCP, Doctor, Participant 3). *"When we have a high number of patients, we need to clean more, to help more. We also fail more because we comply less."* (HCP, Cleaner, Participant 16). Turning to food handlers' narratives, compliance is particularly difficult when restaurants or coffee houses are full of customers waiting for being served. *"Sometimes we don't have time to go to the place where the sink is. The lack of time hinders hand washing and we need to rush. The place is full and we need to hurry up."* (Food handler, Waiting Staff, Participant 22). *"Cooking for a lot of people requires more time and sometimes it's more complicated*

because we don't have the time do to everything that we needed to do." (Food handler, Cook, Participant 52).

Finally, educational professionals state that because most classrooms don't have sinks, it's not possible to go out during classes every time they need to wash their hands. Also their breaks between classes aren't long enough to go to the bathroom and they need to prioritize their needs according to the time they have available. *"I think that one of the reasons that can hinder compliance with hand hygiene is the lack of time. Sometimes we spend 10 minutes of our break talking with other teacher (…) and because there's no time to do everything we just don't wash our hands."* (Educational professional, School Teacher, Participant 35). *"I just can't leave the children alone every time I need to wash my hands."* (Educational professional, Nursery School Teacher, Participant 37). Supporting staff report that they spend much time helping teachers which constrains their time to go wash their hands. *"Much of our time is spent helping the teachers or looking after the children so we don't have all the time we need to wash our hands"*. (Educational professional, Supporting Staff, Participant 28).

To conclude, knowledge about risks refers to the fact that despite having information that non-compliance with hand hygiene contributes to the spread of viruses and allows developing diseases, professionals still feel that there is a lack of effective information given by management about the risks they face when they don't comply with hand hygiene. These professionals consider that not being fully aware of the risks constrains the way they perceive the consequences of not complying. *"I think that HCPs need to be clarified; everyone who works in a healthcare organisation needs to be clarified about risks."* (HCP, Doctor, Participant 7). *"We know that compliance decreases infections but it would be more effective if we had detailed information about what sort of infections it decreases more easily and so on."* (HCP, Nurse, Participant 8). *"Despite knowing about the benefits of hand hygiene in some situations it's difficult to understand the risk. It would be easier if we have more information."* (HCP, Cleaner, Participant 15).

In the case of educational professionals information about risks constrains compliance because children, families, educational professionals and the community in general may not be fully aware of the types of virus that can be transmitted. *"What we need is to use flyers trying to show the risks that children and teachers incur and that all that can be prevented. Also families need to know about risks in order to comply."*

(Educational professional, School Teacher, Participant 35). *"Information is important to all of us because we need to understand the real risks. But I think families will benefit from that to; they will know what to do if their children are sick with something that can be easily spread by hands"* (Educational professional, Nursery School Teacher, Participant 38). *"Information is really important to everyone in schools. It would be easier to comply if we know more about it."* (Educational professional, Supporting Staff, Participant 21).

Finally, food handlers considered in their narratives that non-compliance may occur because information, in some situations, may not be sufficient regarding how to wash their hands. Hand hygiene is a technique that requires specific steps and these professionals think that would comply more if they have more information about hand hygiene technique. *"We need to have information about how to wash our hands. We struggle for that. Sometimes we wash our hands but they're not really washed because the procedure was not well applied."* (Food handler, Waiting Staff, Participant 30).

Despite these common factors that were identified in the narratives of all professional groups, it was possible to find two additional topics in the narratives of HCPs regarding their reasons for not complying, namely moral imperatives and vulnerability perception. In the particular case of the moral imperatives, it is possible to associate these reasons with the moral beliefs previously highlighted as predisposing factors. These imperatives emphasize that that there are moments when hand hygiene compliance is given second place so that doctors and nurses can ensure that they will give full priority to the quality of their professional relationship with the patient. *"I focus my attention on patients'. I don't need to be constantly washing my hands if I know that a patient does not carry any infectious disease."* (HCP, Doctor, Participant 1). *"The most important thing between a professional and a patient is the relationship that we can establish with him. Compliance protects the patient from getting infected but once I was also asked why I was always washing my hands. Because it was a routine procedure the patient thought that he had a problem. I tried to explain but not everyone understands. That can compromises the quality of our relationships and our first compromise is with the patient."*(HCP, Nurse, Participant 8). It is also important to mention that these professionals narratives highlight that when the professionals values interfere with compliance, priority is given to the needs that the professional considers that the patients have. These moral imperatives have a normative, prescriptive nature,

and were only identified in the narratives of doctors and nurses. *"Infection control is an important part of medicine, but patients need to be evaluated according to medicine standards and infection control must be only used to help medicine."* (HCP, Doctor, Participant 3). *"Our purpose is to take care of the patient and that means not complying with hand hygiene if we consider that non-compliance is the best decision for a specific situation."* (HCP, Nurse, Participant 14).

Regarding the vulnerability perception, this refers to the fact that HCPs despite being aware of occupational risks, underestimate the likelihood of acquiring an infection because they do not think about the risk itself. On those occasions compliance may be compromised. *"I know that we have risks. I can tell you one thing that happened to me. One day I needed to give an injection to a patient. He was an old man. It was winter; it was cold so I did not ask him to take the clothes off. Instead I pushed up his clothes in order to make the procedure. I never thought he had anything bad. We were still waiting for the blood tests. He was a nice old man. The procedure was difficult because he was really skinny. In the end I got a needlestick injury and this patient blood tests result indicated that he was HIV positive. I was terrified for months. Fortunately, everything ended well but everything happened because I did not evaluate the risk well."* (HCP, Nurse, Participant 10). *"It's not the case that we forget the risks. We know the risks exist. We just don't think too much about the possibility of acquiring them."* (HCP, Doctor, Participant 4). *"I try to think that I'm inside a hospital, working with dangerous materials but sometimes you get so used with the procedures that you stop thinking that you can get infected."* (HCP, Cleaner, Participant 19).

4.2.3.5 The role of safety climate in hand hygiene compliance

The last topic to emerge in the narratives of professionals was the one related to safety climate organisational features that emphasized environmental facets of priority given to safety procedures by supervisors in the workplace (Zohar & Luria, 2004). HCPs determined that compliance rates may be compromised due to limited equipment, inadequate budgets given to the infection control committees, and lack of organisational authority regarding infection control practices in wards and teams. *"Facilities and equipment need to be improved. More paper towels. More sinks. More appropriate materials if hospital authorities want us to wash our hands."* (HCP, Cleaner, Participant 16). *"Infection control committees work with limited budgets because it's seen as a cost*

rather than a benefit for the hospital. That's how infection control is perceived inside a hospital. If that doesn't change, compliance will not increase either." (HCP, Nurse, Participant 13). *"Senior doctors and other authorities specialised in infection control should be the ones managing infection control guidelines in hospital departments"* (HCP, Doctor, Participant 5).

In the case of educational professionals, safety climate perceptions are addressed by the need of developing school based interventions to promote hand hygiene. *"Responsible schools should start thinking about intervention programmes to increase hand hygiene compliance"* (Educational professional, School Teacher, Participant 29). *"We can't wait until we have an epidemic to develop a hand hygiene campaign"* (Educational professional, Nursery School Teacher, Participant 35). *"Interventions are really important"* (Educational professional, Supporting Staff, Participant 24).

Finally, food handlers' narratives focus on the fact that most managers do not talk to them about hand hygiene and consider that it would be important to have more support in the workplace environment. *"When I'm working, if I'm doing something wrong I feel that I can't go talk about it with my manager. We don't talk about hand hygiene."* (Food handler, Wait Staff, Participant 45). *"It can be a very isolated place despite being very crowded. It would be easier for us to be able to talk with our manager and discuss hand hygiene and other safety guidelines"* (Food handler, Cook, Participant 53).

4.2.4 Discussion

The results that emerged through the analyses of the coding system were developed according to the interview schedule and expanded due to new topics that were integrated by the additional information's collected during the narratives. The collected information allowed the constitution of themes with reference to questions in the interview schedule and themes defined by novel insights.

The first category to emerge was an additional one, and provided an insight to identify the occupational risks associated with each professional group. The infectious disease risk appeared as the most important for all professionals, and associated with that risk, hand hygiene was defined as the most relevant health and safety behaviour because, at a same time it ensures the health and safety of both the professional and those who benefit with their daily actions. These findings support previous research

(e.g. CDC, 2003; WHO, 2005) that determines that infectious disease is a major burden for HCPs, educational professionals and food handlers, acknowledging that good hand hygiene practices contribute to decrease its prevalence.

Factors that predispose, enable and reinforce hand hygiene compliance were the second theme to be integrated in the category coding system. This was defined in the interview schedule and represents the Precede-Proceed model factors. Results indicate that among predisposing factors different sets of beliefs that motivate professionals to comply with hand hygiene were identified among groups. While HCPs express beliefs of a moral nature that will play a significant role in situations where professionals feel that their relationship with the patient is being compromised (in these situations, professionals prefer not to comply with hand hygiene; the only exception is given by cleaners whose beliefs address their own safety); educational professionals' beliefs emphasize their internalized hygiene rules and habits experienced during childhood; while, food handlers beliefs focus on their personal commitment towards customers. These results appear to have support in other literature. In the particular case of HCPs Ferguson, Waitzkin, Beekman & Doebbeling (2004) indicated that these professionals may emphasize moral concerns that interfere with their ability to provide adequate care to patients. Also, Schmidt et al., (2009) developed a study in the educational field in which results stated that teachers feel that hygiene is an activity that must be promoted at home and only reinforced at school. Finally, Bertin, Rezende, Sigulem & Morais (2009) found that food handlers are aware of the role they play in customers' health and how they contribute to their good diet habits.

In terms of their attitudes, professionals from all groups have, in general, a positive attitude towards hand hygiene, referring to its importance and agreeing with its application to reduce the spread of infectious disease. Professionals also refer to several occasions where they consider hand hygiene compliance is important. Other studies have also indicated that these professionals have positive attitudes and knowledge towards hand hygiene compliance. However, having these attitudes and knowledge does not translate into positive behaviours (e.g. Howes, McEwen, Griffiths & Harris, 1996).

Regarding the enabling factors, training in hand hygiene appears to be crucial for HCPs during their career as a professional not only to increase their awareness of the importance of hand hygiene, but also to increase their ability to overcome the daily barriers to comply with this practice. The training seems to be particularly

important in the case of cleaners. In terms of educational professionals, availability of resources is important to facilitate the access to materials such as towels and soap, whereas in the case of food handlers, training in hand hygiene is also a relevant factor, but in this particular case at the beginning of their professional career, so that they learn how to work with food safety properly. The literature also reveals that training is a good determinant to enable hand hygiene. In fact, Worsfold, Griffith & Worsfold (2004) study emphasized that the more opportunities trainees have to use the skills they learn, the greater the possibility of changing their behaviour and increasing compliance.

Factors that reinforce compliance in the case of HCPs are those that imply the need to build surveillance and feedback systems so that information about risks, infection, and compliance can be seen as reliable. Several studies have indicated that data monitoring and feedback are central strategies to improve compliance such as hand hygiene (e.g. Bradley, Holboe, Mattera, Roumanis, Radford & Krumholz, 2004). Educational professionals consider it important to implement interventions because schools are places of risk, which leads to the need to disseminate information in appropriate places. In fact schools are crowded environments where infections proliferate with ease and intervention strategies need to be applied (White, Shinder, Shinder & Dyer, 2001). Finally, food handlers state that there must be a management commitment to maintain the equipment in strategic places in order to reinforce compliance. These findings appear to be consistent with those achieved by Seaman & Eves (2010a) that determined the relevance of managers in reinforcing compliance.

In terms of social influence the processes that were emphasized in the narratives of professionals indicate that social influence may have two etiologies, an internalized one expressed by educational and food professionals, although they also continue to have external social referents such as children and customers; and an external one expressed by overt pressure in the case of HCPs. This dissimilar way of conceptualizing their social influence referents may be related to the fact that HCPs have to work aggregated into teams. In healthcare, teamwork is the ongoing process of interaction between team members as they work together to provide care to patients (Clements, Dault & Priest, 2007). Hand hygiene is then a behaviour that operates within a social context where normative pressures are exerted. To that extent teams develop behavioural norms that put their values into action. These norms take a “heightened intensity” (Kalberg, 1980) and become powerful social rules among the team.

Consequently, team rules may favor or inhibit HCPs to comply with hand hygiene and team members will be likely to conform to the salient group rule in order to maintain their social approval needs that will guarantee their social integration in the team (Barker, 1993).

It should be noted that in the case of HCPs' narratives there are still some differences in the way social referents are valued according to their occupational category, which may indicate that there are distinctions in how power relationships and communications are perceived and distributed in this professional group. For instance, doctors consider that the best social referents to disseminate infection control information are doctors, while nurses believe that nurses are the best infection control referents. In the particular case of cleaners, both nurses and doctors are perceived as important referents. This result indicates that the best way to disseminate infection control information will be by the constitution of teams that integrate referents from different occupational categories in order to fill the hierarchical gap between doctors and nurses and to guarantee that all HCPs follow the infection control recommendations (e.g. Yuan, Dembry, Higa, Fu, Wang & Bradley, 2009).

Among the reasons for not complying with hand hygiene, there are three factors that cut across the three groups of professionals, namely occupational stress that demonstrates that the activities of each of these groups involves fatigue and emotional distress that diminishes their personal tendency to comply; lack of time referring to the fact that each of these groups work in environments that concentrate on large numbers of people, to whom they need to respond with speed and quality; and knowledge about risks, demonstrating that despite the professional groups being aware that compliance with hand hygiene promotes a decrease in infectious pathology, they still don't have much information about the type of pathology that is effectively decreased, and that gap in their knowledge can contribute to decrease their compliance. These results reinforce those prevailing in the literature that when people are stressed because of work overload or time pressures, they are more likely to ignore or neglect safety compliance (Cox, 1993). Also, when there are information gaps and professionals are not fully aware of the risks they incur adherence may be compromised more often (e.g. Hugonnet & Pittet, 2004).

We also identified two additional factors in the narratives of HCPs, insights that explain why they don't comply in some situations: moral imperatives and the

vulnerability perception. In the case of moral imperatives, they inhibit compliance when the professional decides to enhance the patients' needs as well as their professional commitment with the patient, considering that hand hygiene somehow interferes with those imperatives. Only cleaners did not have these moral imperatives. These moral imperatives are consistent with the moral beliefs highlighted as predisposing factors. The vulnerability perception reflects the ability of HCPs to underestimate the likelihood of acquiring an infection resulting in less compliance. This result is consistent with several results identified in the risk literature that determine that a continued exposure to threatening situations such as those experienced by HCPs leads to the constitution of risk strategies that will minimize the perception of these circumstances in order to cognitively adapt to the situation (Lima, Barnett & Vala, 2005).

Finally, another topic that emerged is the one that relates to safety climate. At this level, HCPs indicated the need to improve hospitals' physical environment indicating the need of hospital authorities to give priority to safety. In the case of educational professionals, the school management is seen as responsible for constructing intervention programs. Finally, food handlers referred to the need to be supported by management in order to enhance compliance. According to safety climate literature a supportive climate is an important contributing factor for good safety performance (Zohar & Luria, 2004). Research findings identified that management's involvement in safety programs, safety training and safety communications as determinants of a workplace safety that contribute to compliance with safety practices, such as hand hygiene (Gershon, Vlahov, Felknor, Vesley, Johnson, Declos et al., 1995). Also, Rennie (1994) indicated that improvements in hand hygiene practices can be enabled by the development of a physical and social environment that supports adequate behaviours and proper training activities.

4.3 Study Part II – Quantitative Part

4.3.1 Objectives and hypotheses

Results from part one indicate the possibility that each professional group may have a distinctive predictor of their behavioural intention to comply with hand hygiene due to the fact that each group emphasized in their narratives different factors

underlying their personal compliance. Therefore, this quantitative part tries to identify according to the TPB, which variable from attitudes, subjective norm and PBC will predict the professional groups' behavioural intentions.

Hence, it is hypothesized that attitudes will be a relevant predictor for all professionals because in every narrative professionals emphasized positive attitudes towards hand hygiene practices. Regarding social influence processes, it is expected that the subjective norm will be a significant predictor among HCPs because in these professional groups the norm exerts a relevant role; while, in the educational and food professionals group its impact will be less significant according to their narratives. Finally, in terms of PBC it will play a relevant role in particular among HCPs and food handlers who have given importance to the need to have hand hygiene training in order to develop their skills to overcome daily barriers in performing hygiene practices.

4.3.2 Method

4.3.2.1 Participants

The participants were 75 professionals (56 female, 19 male) with a mean age of 40.1 years (ranging between 22 and 58 years). Thirty-four professionals were from the food sector (28 Waiting Staff, 6 Cooks), 22 professionals were employed in the educational sector (10 Nursery School Teachers, 8 Teachers, 4 School Support Staff); finally, 19 professionals were from the healthcare sector (8 Nurses, 6 Doctors, 5 Cleaners). In the second part of this study the number of participants included within the sample was increased in order to guarantee the minimal cut-off point necessary to perform hierarchical multiple regressions by taking into account the number of items per construct.

4.3.2.2 Instrument

Participants completed a self-reported questionnaire after concluding the interview (see Appendix A). Questions were related to demographic information and TPB variables, including attitudes, subjective norm, PBC and intention. The questionnaire was based on previous research investigating the applicability of the TPB by Ajzen, Brown & Carvahal (2004).

Attitudes were assessed with three items referring to professionals' personal evaluation of the benefits of hand hygiene compliance. An item example is "Hand hygiene is a valuable technique for professionals like me" (Cronbach's $\alpha = .82$). The answers were recorded on a 7-point Likert scale anchored by (1) strongly disagree and (7) strongly agree.

Subjective norm was determined by three items assessing whether the most important people to the professionals consider the worker should or should not comply with hand hygiene. An item example is "What my colleagues think I should do about hand hygiene matters to me" (Cronbach's $\alpha = .71$). The answers were recorded on a 7-point Likert scale ranging from (1) strongly disagree to (7) strongly agree.

Perceived behavioural control was measured with three items focused on the professionals' perception of how easy or difficult it would be to comply with hand hygiene. An item example is "I consider hand hygiene as an easy procedure to perform" (Cronbach's $\alpha = .79$). The answers were recorded on a 7-point Likert scale anchored by (1) strongly agree and (7) strongly disagree.

Finally, professionals' *intention* to comply with hand hygiene was also assessed with three items. An example is "I intend to comply with hand hygiene in every situation where this procedure is required" (Cronbach's $\alpha = .80$). The answers were recorded on a 7-point Likert scale ranging from (1) strongly disagree to (7) strongly agree.

4.3.2.3 Data analysis

To exanimate content validity we investigated whether the participants had been able to differentiate between the four TPB constructs under analysis a Principal Component Analysis (PCA) with varimax rotation was employed. This exploratory reduction procedure extracts a meaningful number of components according to the amount of variance explained in the observed variables. It is expected, that the number of components extracted in a PCA is equal to the number of observed variables being analysed (Stevens, 1986). Eigenvalues greater than 1 were set as the criterion for selecting components. The PCA extracted the four components corresponding to the four observed variables in our study (KMO = 0.65 < 0.001) that explained 72% of the variance in the correlation matrix (see Appendix A).

In order to analyse the success of the application of the TPB model to the study of these professionals' intention to comply with hand hygiene, one hierarchical multiple regression was performed by taking into account a sample split file by professional group. The regression analysis tested the importance of attitudes, subjective norm and PBC as behavioural intention predictors of healthcare, food and educational professionals. Data were analysed using SPSS version 18.

4.3.3 Results

4.3.3.1 Descriptive statistics and correlations

Mean scores, standard deviations and correlations among TPB variables for all three professional groups are presented in Table 4.2. By analysing these descriptive results we can see that, on average, mean results are high for all professional categories with all means being positioned above point 5 on the 7-point Likert scale, with the exception of the mean given by food handlers to the subjective norm (M = 4.91).

These values indicate that, on average, the three groups have a positive evaluation of hand hygiene as an important technique (attitude), consider that relevant social referents contribute to personal hand hygiene compliance (subjective norm) and also agree that this technique is an easy one to perform (PBC), which expresses their intention to comply with hand hygiene all times it is necessary.

However, it is also possible to see, that the dispersion measures, i.e. standard deviations, are high suggesting that there is a large variation in the given means. The subjective norm value of food handlers had the lowest standard deviation score (0.13). For all other values presented the standard deviation is equal or above 0.50, which if we take into account the fact that this is a small sample suggests that dispersion around the mean is high.

Finally, with regard to correlations all coefficients were positive expressing a moderate association. The strongest association occurred in the HCPs group between PBC and intention (0.63) and the lowest in the group of Food handlers between PBC and attitudes (0.37).

Table 4.2 Descriptive statistics for health, educational and food professionals (means, standard deviations [SD] and correlations)

TPB Predictors	Mean	SD	1	2	3
Healthcare professionals					
1 Attitudes	6.56	1.01			
2 Subjective Norm	5.73	0.58	0.46**		
3 PBC	5.80	0.93	0.41**	0.43**	
4 Intention	6.59	0.50	0.60**	0.61**	0.63**
Educational Professionals					
1 Attitudes	6.47	1.20			
2 Subjective Norm	5.73	0.78	0.41**		
3 PBC	5.80	0.93	0.43**	0.40**	
4 Intention	6.59	0.50	0.53**	0.50**	0.53**
Food Handlers					
1 Attitudes	6.68	0.41			
2 Subjective Norm	4.91	0.13	0.39**		
3 PBC	6.23	0.91	0.37**	0.45**	
4 Intention	6.65	0.58	0.56**	0.50**	0.51**

** p < . 01; * p < .05

4.3.3.2 Predicting professionals' intentions to comply with hand hygiene

A hierarchical multiple regression analysis was performed to test the ability of attitudes, subjective norm and PBC to predict HCPs', food handlers' and educational professionals' intention to comply with hand hygiene. In order to reduce multicollinearity problems all variable scores were mean-centred (Aiken & West, 1991). As can be seen in Table 4.3, the TPB behavioural intention predictors made distinctive contributions to explain variance in intention according to the professional category.

The TPB predicted 53% of the variance in HCPs' intention to comply with hand hygiene. Only the subjective norm was a significant predictor of intention. In the particular case of educational professionals, the PBC followed by the subjective norm were the only significant predictors of intention, explaining 75% of variance in intention to comply with hand hygiene. Finally, in predicting food handlers' intention to comply, both attitudes and PBC were, respectively, the most relevant predictors contributing to explain 65% of the variance in intention.

Table 4.3 Hierarchical multiple regression coefficients of attitudes, subjective norm and PBC concerning professionals' intention to comply with hand hygiene

TPB Predictors	HCPs	Educational Professionals	Food Professionals
Attitudes	0.13	0.07	0.83**
Subjective Norm	0.52**	0.23*	0.01
PBC	0.17	0.76**	0.26*
F	5.97	10.73	22.24
R^2	0.53	0.75	0.65

** p < . 01; * p < .05

However, due to the size of the correlation coefficients, and the percentage of explained variance in the regression models presented, we decided to analyse the multicollinearity statistics, in order to verify if the variables included in our regression model were highly correlated. To do so we focused on Tolerance and its reciprocal statistic the Variance Inflation Factor (VIF). Tolerance values close to 1 means that there are little multicollinearity, whereas values close to 0 suggest the existence of a multicollinearity problem (Cohen, Cohen, West & Aiken, 2003, pp. 423). The VIF values will show how much variance of the coefficient estimate is being inflated by multicollinearity. A common rule of thumb is that any VIF of 10 or more provides evidence of serious multicollinearity (Cohen, Cohen, West & Aiken, 2003, pp. 423). In our results, Tolerance values are closer to 1 (mean Tolerance value 0.83), while VIF scores are less than 10 (mean VIF value 1.21).

4.3.4 Discussion

The results from the second part of this study demonstrated that the TPB was quite successful in predicting professionals' intention to comply with hand hygiene. The TPB behavioural intention components accounted for 53% of the variance in HCPs' intention to comply with hand hygiene with the subjective norm being the most relevant predictor. PBC and subjective norm together predicted educational professionals' intention, explaining 75% of its variance. Finally, we also identified attitudes and PBC as main predictors of food handlers' intention to comply explaining 65% of its variance.

Unlike other TPB studies (e.g. Armitage & Conner, 2001), the subjective norm was the only significant predictor of HCPs' behavioural intentions and, in the case of educational professionals, was a more important predictor of intention to comply than attitudes. The norm was only non-significant in the particular case of food handlers. The

constitution of subjective norm as the main predictor of the HCPs' intention may emphasize that compliance with hand hygiene is highly associated with social pressures, namely the awareness of being observed (e.g. Buffet-Bataillon, Leray, Poisson, Michelet, Bonnaure-Mallet & Cornier, 2010).

Also, Azjen (1991) determines that the contributions of the behavioural intention predictors may vary across behaviours, situations and groups. In fact, subjective norms appear to be particularly important within the health domain, while attitudes are more relevant in general fields (Trafimow & Finlay, 1996). This would suggest that HCPs and educational professionals are more concerned about social normative influences than their own personal attitudes towards hand hygiene compliance (Mullan & Wong, 2009). A similar result was found by Quine, Rutter & Arnold (1988) in relation to safety helmet use. In this study the subjective norm was more likely than attitudes to predict intention. In the particular case of food handlers, a study developed by Bas, Ersun & Kivanc (2006) demonstrated that these professionals consider that the way they handle food is related to safety, highlighting the positive role of their personal attitudes. The salience of their evaluations towards hand hygiene may be one possible explanation why attitudes appear to be such a strong predictor to this professional group.

Finally, the PBC was the most significant predictor of intention for educational professionals suggesting that intention is not considered to be completely within these professionals' volitional control. In a study developed by Schmidt et al. (2009) the demands of teaching compete with organised hand hygiene which, in some situations, may constrain compliance.

4.4 Final Conclusions

This study is a qualitative and a quantitative analysis of hand hygiene compliance and contributes to offer scope for understanding how different professional groups make everyday sense about their hand hygiene compliance. Our aim was to first achieve an understanding of the bottom-up viewpoint anchored in the professionals' perspectives about social influence processes and also factors that predispose, enable and reinforce their daily hand hygiene practices; and, also, to identify the behavioural intention predictors that each of the professional groups have towards their intention to comply with hand hygiene. The factors that could be important for the implementation of hand hygiene promotion across professional sectors were explored in some detail.

Through a qualitative design we tried to implement the principle of participation where professionals identified individual, social and organisational factors underlying their personal hand hygiene compliance. This sort of diagnosis allows interventions to become educational instead of coercive by involving the workers and revealing the factors that they consider predispose, enable and reinforce the behaviour (Green & Kreuter, 1999). Also, by focusing on educational and food professionals, this study tries to go beyond the prevailing literature of directing hand hygiene compliance issues mostly to HCPs. To the best of our knowledge this is one of the first studies that has developed this type of methodology and applied it to a sample comprising three professional groups, each one representing a different occupational category.

4.4.1 Theoretical and practical considerations for the healthcare sector

HCPs appear to be well-informed regarding hand hygiene practices with a positive attitude towards compliance in order to decrease the prevalence of infectious pathology and protect themselves and the patient. However, contrary to our expectations, in the exploratory quantitative study, HCPs' attitudes were not a significant predictor of these professionals' intention to comply with hand hygiene. In fact, the subjective norm was the only predictor of these professionals' behavioural intention which appears to be consistent with the topics that emerged in their narratives where social influence processes highlighted that colleagues play an important role in determining HCPs' personal compliance. In order to try to increase compliance among professionals these results indicate that it might be important to: reinforce the perception that compliance is the rule among significant social referents by focusing on the advantages of complying with hand hygiene, counteract its perceived disadvantages and enhance the ability of HCPs to circumvent the possible interferences that may exist.

Despite the fact that HCPs emphasized the need for hand hygiene training as an enabling factor, the PBC appear not to have a predictive impact on their intention to comply. One thing that must be taken into consideration is the fact that hygiene training was particularly important for cleaners according to the qualitative results. However, due to sample size we were not able to make distinctions in the quantitative analysis among the different occupational categories. It is therefore possible that with an extended sample differentiated by occupational categories results for PBC would be distinctive. Nevertheless, because hygiene training was referred to as an enabling factor,

one possible intervention strategy could focus on periodic training programs on hand hygiene to keep the level of knowledge and awareness high in order to prevent risk information being forgotten and also to develop professionals' skills regarding hand hygiene practices. To focus on training and also on information that gives professionals a sense of control over hygiene by focusing on ways to overcome perceived barriers to perform correct practices when developing hand hygiene will help professionals and cleaners in particular, to develop their daily activities.

HCPs identified that ineffective safety climate may constrain compliance and improvements require the involvement of the healthcare organisation, namely a budget that allows the organisation to develop a strong infection control environment, the constitution of feedback strategies and the development of monitored processes of hand hygiene practices. Surveillances systems are needed to monitor compliance, infection rates and main risks in order to provide accurate feedback to HCPs about their performance and also about how infection control is being operationalised.

These measures will contribute to overcome some characteristics that were particularly identified in the group of HCPs that also constrain compliance. For instance, doctors' and nurses' beliefs assume in their narratives a moral prerogative based upon values of giving priority to patient medical needs and emphasize a personal commitment to the patient. This may indicate that some behaviour they perform may have an underlying moral norm which is stressed in moral judgments (Sparks & Sheperd, 2002). That norm may have an altruistic facet and that can be activated by the individual assuming a prescriptive nature. That activation will occur when the professional believes that important moral values are being threatened (Stern, Dietz, Abel, Guagnano & Kalof, 1999).

Moral norm starts with external standards which are subsequently internalized and perceived as being independent and anchored in the self (Hoffman, 1983). The norm will not reflect the social agent but the consequences of the behaviour instead. Therefore, it is possible that HCPs' hand hygiene compliance emerges from interconnections between the team's social pressure and individual moral norms. However, because this moral norm appears to reflect HCPs' beliefs about their commitment towards the patient, compliance with hand cleansing may arise from a moral dilemma where the professional struggles between their need to prioritize their relationship with the patient and the need to apply the infection control procedure. This

interference might suggest that HCPs' moral concern regarding a patient's needs and their personal commitment to the patient may inhibit compliance with hand hygiene as the narratives appear to reflect. In this particular case, HCPs must become aware that compliance with hand hygiene has advantages that only benefit the patient. Focus groups should be carried out to clarify what interference exists regarding this moral imperative and compliance in order to develop specific strategies to counteract its perceived disadvantages. HCPs will circumvent the interferences that contribute to non-compliance by recognizing that their moral imperatives will not be compromised by complying with hand hygiene.

Another factor of interest was the vulnerability perception. HCPs develop their daily practices depending on what counts as a risk and how risks should be managed (Dixon-Woods, Suokas, Pitchforth & Tarrant, 2009). This will influence the way they perceive the likelihood of being exposed to a specific risk. Due to their continued experience with risk management, professionals underestimate the likelihood of acquiring specific risks (Dixon-Woods et al. 2009). In this sense, a reliable source of feedback and surveillance will contribute to addressing risk perceptions and changing professionals' behaviour. Finally, in order to overcome stress and lack of time (factors that also compromise HCPs' compliance), several measures have been developed in the health sector in order to enable compliance. For instance, the use of portable alcohol-based hand rubs that reduce the time needed for hand hygiene, which can be placed in the professionals' belt or pocket are a solution applied in wards with high numbers of patients (e.g. Emergency Rooms) and contribute to a decrease in professionals' non-compliance.

4.4.2 Theoretical and practical considerations in the educational sector

In their narratives, educational professionals emphasized positive attitudes towards hand hygiene and were able to identify the need to implement this procedure in order to prevent the spread of viruses in schools, which are risky because of their crowded environments. However, attitudes appeared not to be a significant predictor of this group's behavioural intention. In fact, the quantitative exploratory results indicated that the PBC appeared to be the most relevant predictor followed by the subjective norm. In their narratives, educational professionals determined that availability of resources was a compliance enabling factor. Appropriate resources to comply with hand

hygiene such as towels, soaps and sinks inside classrooms are not always available thus constraining compliance. Professionals may feel that compliance is not under complete volitional control and that without appropriate resources it would be difficult to overcome the perceived barriers to comply with hand hygiene. To that end, it might be possible to understand the role that PBC appears to have inside this sector. According to these professionals narratives, equipment and supplies for hand hygiene must be strategically placed around schools and utilization of alcohol-containing gels is a good option instead of conventional classroom hand hygiene provision and acceptable for both children and educational professionals (Schimdt et al, 2009).

Turning to the importance of social influence processes, educational professionals emphasized their internalized norms acquired during infancy and childhood and how this related to hand hygiene habits. However, in the exploratory quantitative part of the study, the subjective norm appeared to be a significant predictor of these professionals' intentions to comply despite the fact that in their narratives it was not possible to identify a specific social referent that teachers and supporting staff considered able to influence their practices. The only referent that was identified was the children because these professionals considered that it was important to comply in order to become a good example for them. In this sense, it is possible that educational professionals may have underestimated the relevance of other social referents such as colleagues and the relevance of their personal opinions regarding their compliance with hand hygiene. By taking this result into account it would be interesting to analyse the impact of a peer education program involving teachers, supporting staff and children in order to address social influence processes and identify the potential impact of different social referents on their personal practices.

Despite the fact that, in their narratives, educational professionals consider that they don't have the personal responsibility of encouraging hand hygiene in children because they consider that families should be responsible for teaching their children hand hygiene rules, their narratives also demonstrated that both teachers and school support staff are willing to develop intervention measures in schools in order to promote hand hygiene campaigns. According to their narratives education combined with accessible information about risks, and convenient hand hygiene products can contribute to an increase in compliance in hand hygiene and reduce the negative impact that lack of time, stress and gaps in information have in compliance. In this sense, it

seems that health education programs might be developed in order to maximize the benefits of hand hygiene compliance in the school environment and strategies must take into account the need to deliver proper materials to overcome obstacles and reinforce compliance.

4.4.3 Theoretical and practical considerations in the food sector

These study exploratory results indicated that food handlers are, in general, aware of their need to comply with hand hygiene procedures in order to contribute to food safety and decrease the prevalence of foodborne diseases. These professionals present, in their narratives, positive attitudes towards compliance. Also, attitudes appeared to be the most relevant predictor of these professionals' intention to comply with hand hygiene. Besides attitudes, also PBC seems to be an important additional predictor of intention and its ability to determine food handlers' intention to comply may be related to the fact that in their narratives food handlers revealed that sometimes they feel that they don't have the skills they need to comply. In fact they suggest the importance of hand hygiene training prior to their food handling duties in order to learn how to manage food properly. In this sense, hand hygiene training might be one important strategy to be developed in accordance to their work related activities and in order to promote theoretical and practical knowledge regarding hand hygiene.

Food handlers compliance with safe practices also appear to be motivated by a set of beliefs related to their need to fulfill costumers' expectations and needs that all products being served are high quality, which will exert an influence on their compliance behaviour. However, food handlers' narratives also reinforce the fact that their hand hygiene habits represent norms acquired during their infancy emphasizing that in their personal compliance colleagues do not play a significant role in terms of influencing their behaviour. However, it should be mentioned that food handlers refer to their managers' contribution to increase compliance. In fact, food handlers' narratives emphasize the importance of managers as the main people responsible for providing the resources and the information that professionals need about hand hygiene. According to Seaman & Eves (2010b) managers in the food industry do not have sufficient awareness or the correct attitude towards food hygiene in order to facilitate an effective learning environment within the workplace. To that end improvements in hand hygiene may need to focus not only food handlers, but also on managers in order to establish a

management commitment towards food safety that reinforces a positive climate that enables compliance. Future intervention programmes may consider extending their applicability to change the food sector's physical and social environment and enable it to sustain correct practices. This sort of environment will be important to overcome the occupational stress and perceived lack of time that professionals have because they will receive support directly from their management which is a way to reinforce compliance and provide sufficient risk information to give them confidence to develop positive increments in their daily job performance.

4.4.4 Limitations

Several limitations can be identified in our study. First, the sample may be biased by the process of participant selection, despite the fact that in the qualitative part its size was obtained by taking into account sample saturation. Also study findings are limited by the small number of organisations involved. Another important point regarding the sample was the fact that selected organisations were not able to be randomly selected. Yet, the study makes no claims to generalisability beyond that of its sample.

An additional limitation arises from the fact that we only performed individual interviews. It would be interesting to develop group methods (e.g. focus group) where it would be easier to understand social influence processes and to achieve a broader and clearer perspective about factors underlying compliance. In terms of the quantitative part, even though behavioural intention predictors presented a high percentage of explained variance in intention to comply, and despite the fact that multicollinearity problems were not identified, it should be emphasized that the sample only had 75 participants divided in three groups. This fact contributed to increase the inter-correlation coefficients between variables which were a determinant in enhancing the explained variance.

Because this was an exploratory study, with a limited sample size, caution must be exercised in addressing results. Nevertheless, we note several parallels in our findings with other literature that demonstrates the emergence of interesting themes that should be taken into account. Furthermore, we consider that both parts of the study complement each other, and professionals' narratives emerge as important considerations in explaining the predictors of each group behavioural intention to comply with hand hygiene. Interesting results were achieved, such as the role of social

and internalized norms that must be explored and related to other environmental factors. This study suggests that HCPs tend to accept social cues for the development of their group norms; while educational and food professionals may be exposed to similar cues but their internalized norms will exercise their influence autonomously on their behaviours regardless of the immediate social context (Manstead, 2000). To that end, future quantitative studies should try to better understand the normative component underlying professionals' intention to comply with hand hygiene. The need to explore the role of moral norms and childhood habits reveal a necessity of extending the application of the TPB to understand the consequences of how social processes of different etiologies may work together in predicting intention.

Within healthcare organisations, it appears that there is a moral concern towards the patient that may interfere with compliance. This concern may also be perceived as a moral norm because it can play a prescriptive role by leading the professional to a moral dilemma. In this case, it would be interesting to understand the predictive ability and strength of this norm between doctors and nurses who according to their narratives are the only professionals among those who were interviewed that appear to have that norm.

In conclusion, the Precede-Proceed model and the TPB were found to be adequate models to explore and predict hand hygiene compliance behaviours, respectively providing further support for their applicability in this health domain using a methodology that conciliates qualitative and quantitative data. Exploratory results provided an interesting framework from which to conduct future research in the field of infection control across sectors and also offered insights regarding future intervention measures that can be applied in health, educational and food sectors. Considering this bottom-up perspective on hand hygiene compliance we can determine that there is a need to contextualize this behaviour according to the specificities of each professional group. By doing so, hand hygiene will be explained not just in terms of an individual response to disease threats but mostly as an interconnection between socio-cognitive factors and organisational facets.

By taking into account the findings of this exploratory study, we have an important basis on which to delineate the rest of our studies, not only in terms of insights regarding the major variables outlined in these professionals' narratives as determinants of their compliance, but also as a reinforcement in the need to reconcile

theoretical perspectives from different levels of analysis to study this problem of compliance.

In the next chapter, we will continue to develop an exploratory approach by focusing on medical students' behavioural intention predictors. The importance of medical students appears due to the fact that doctors are the professional group with more difficulties in complying and these students are going to be the future physicians of healthcare organisations. Issues that appeared to be relevant in this study for the HCP group, such as social influence processes and the importance of social referents, and also the moral norm, particularly relevant for doctors and nurses are some of the aspects to be analysed in the next two quantitative studies to be presented in chapter 5.

CHAPTER 5
EXPLORING THE ROLE OF SOCIAL AND MORAL NORMS IN DETERMINING MEDICAL STUDENTS' INTENTION TO COMPLY WITH HAND HYGIENE

5.1 Introduction

The importance of HCPs' education in infection control has emerged since the discovery of the significance of hand hygiene in the nineteenth century by Semmelweis' work with medical students. Indeed, education in infection control is assumed to be a crucial tool to fight HAIs, since it has the ability to train future HCPs by providing them the necessary strategies to reinforce patient safety and enhance the role of infection control inside healthcare facilities (CDC, 2003). Education and training in infection control of future HCPs starts at the beginning of their academic curricula. In the particular case of medical students, the importance of hand hygiene must be taught from the first year and integrated into their clinical curricula as they are continuously included in health activities involving patients throughout medical school (Duroy & Coutour, 2010).

In this sense, it is possible to determine that education is a cornerstone of effective practice as a way to promote an adequate level of future professional practices emphasizing the fact that compliance with hand hygiene and other infection control procedures arises during early education stages (Cole, 2009; Fordham, 2005). To that end, compliance is a problem that goes beyond HCPs as it also affects those who are going to be future HCPs (Cole, 2009). This problem is particularly relevant among one specific group of future professionals. In the prevailing body of literature, results have shown that being a doctor is considered a risk-factor for non-compliance (CDC, 2002; Mortel, Apostolopoulou & Petrikkos, 2010). By taking that premise into account Mortel et al. (2010) developed a study to evaluate hand hygiene education during undergraduate training and compared nursing and medical students' behaviours upon entering the workforce. Results indicated that nursing students have more knowledge about hand hygiene as well as more positive beliefs and practices towards this procedure than medical students. Also, Mortel et al. (2010) determined that nursing students considered that hand hygiene was more important in their nursing curricula as an infection control subject than medical students. In this sense, the former received more hand hygiene training than the latter. Turning to medical students, findings from this study highlighted that little importance was given to infection control topics in their curricula. In fact, medical students considered that this type of subject had little impact

in their knowledge and beliefs which decreased their ability to comply (Mortel et al., 2010).

However, medical students' non-compliance with infection control procedures, not only arises from the fact that infection control tends to be underestimated in their medical curricula at undergraduate programs. According to Apisarnthanarak, Babcook & Fraser (2006) medical students' decisions to comply with infection control procedures was constrained by several factors, such as knowing the patient HIV/ AIDS status, Hepatitis status and type of surgery or procedure. Students also reported that they do not always consider that they needed to comply with the recommended procedures not only because they personally underestimated some risks but also because other colleagues acted in similar ways. In fact, Lankford, Zembower, Trick, Hacek, Noskin & Peterson (2003) concluded that medical students were less likely to comply with hand hygiene if a peer or a higher ranking person was seen as a non-complier suggesting that a role model's behaviour may negatively influence compliance and enhance the impact of peer and group behaviours which emphasizes the power of social influence processes (e.g. Feather, Stone, Wessier, Boursicot & Pratt, 2000).

Apart from the fact that little importance is given to infection control during clinical practice where medical students demonstrated that they tend not to comply with infection control procedures most of the required times (Feather et al, 2000), the results of Duray & Coutour's (2010) work also indicated that compliance problems can go beyond the impact of social referents' behaviour. Duray et al.'s (2010) study indicated that medical students, after comparing the importance given to infection control and their need to comply with hand hygiene to decrease HAIs, considered that in Medicine there were themes of higher priority and value that must be addressed in medical curricula and clinical practice such as acquiring the knowledge they need to prepare them for their role as doctors. Previous research has established that HCPs' compliance with hand hygiene and other infection control procedures, in the particular case of doctors, can be connected with internalized moral concerns (e.g. Godin, Bélanger-Gravel, Eccles & Grimshaw, 2008; Lymer, Richter & Isaksson, 2004; Roberto & Silva, 2007). However, Duray & Coutour's (2010) results suggest the possibility of the expression of these concerns, identified in HCPs' practices, to appear in the early stages of medical students' education with an expression that might contribute to the development of moral beliefs that can interfere with their intention to comply with hand

hygiene. To that end, non-compliance may be perceived as a way to justify a recognizable deviant behaviour, which is not performed in order to ensure that supra-moral values are not being placed at risk highlighting the possibility of these medical students having multi-faceted moral motivations that according to their sense of doing what is right will be activated to explain their compliance or, in this case, their non-compliance (e.g. Bell, Trevino, Atkinson & Carlson, 2003; Jeanes, 2003).

Additionally, among the scarce literature that focused on medical students' compliance with infection control procedures, some studies have compared the attitudes and behaviours of students from different medical school years. For instance, Calabro, Bright & Kouzekanani (2000) discovered that 4th year medical students who received infection control training during their 2nd year showed increased infection control knowledge immediately after the training but two years later there was no significant knowledge retention when compared to a control group. Also Amorim-Finzi, Cury, Costa, Santos & Melo (2010) analysed compliance with hand hygiene among three different groups, one integrating professors, another focusing on residents and the third one including graduation students. Findings determined that professors had the highest compliance rates, while both residents and graduation students did not even achieve 50% compliance, with graduation students being less compliant than residents. Professors were considered as future role models in order to influence graduate medical students (Amorim-Finzi et al, 2010).

These results may indicate not only that inadequate infection control behaviours may arise during academic training due to a lack of long-term effectiveness of infection control knowledge among medical students which can contribute to reduce their compliance after becoming HCPs; but also that compliance programs should be implemented early in training, mostly in graduation and professional courses with the help of role models or mentors to influence the knowledge, skills and values of those who are becoming future HCPs (e.g. Amorim-Finzi et al, 2010; Calabro, et al, 2000; Schneider, Moromisato, Zemetra, Rizzi-Wagner, Rivero, Mason et al, 2009). Furthermore, these findings suggest that there are attitudinal and behavioural differences among medical students from distinct medical school years which emphasizes the need to explore the specificities of such students regarding their compliance.

Literature focusing this topic is limited. Most studies about hand hygiene compliance have been directed to HCPs and have underestimated the impact that students also have on infection control as future HCPs (CDC, 2003). Recent studies have identified the importance of role models as referents for medical students' behaviours, however, few have examined who would be the best role models to persuade medical students to comply with hand hygiene since these students are constantly integrated into different educational contexts due to their learning curricula. Also, the role of internalized norms such as moral norms has not been well examined in the field of infection control regarding medical students' compliance behaviours. The current research literature has not explored the possibility of these norms expressing a multi-faceted influence on non-compliance and appearing during medical school education. Furthermore, to our knowledge none of the existing studies focusing on medical students' hand hygiene compliance has applied the TPB to explore how their intention can be predicted according to distinct stages of the students' academic training. In this regard, little is known about the impact that attitudes, subjective norm and PBC have on medical students' intention to comply with hand hygiene across medical school years.

Therefore, the general purpose of the two studies[10] that are going to be presented was to investigate multiple components of the TPB for the prediction of medical students' intention to comply with hand hygiene. In the first study the main objective was to determine the 6th year medical students' best behavioural intention predictors to comply by extending the TPB normative component with the inclusion of the moral norm. The second study also examined an extended application of the TPB with additional predictors being included in the normative component to better explore the role of the subjective and the moral norms. The aim was to test whether different social referents and moral norms emphasis were able to predict medical students' intentions to comply with hand hygiene. This second study examined these predictive differences with two medical students' samples from distinct years (1st and 6th years) based on the idea that research literature has demonstrated that medical students from different

[10] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Perceptions of social and moral norms towards hand hygiene compliance from first and sixth year Portuguese medical students.* (Submitted).

medical school years report distinctions in their long-term knowledge and behaviour regarding hand hygiene compliance and infection control procedures (e.g. Amorim-Finzi et al., 2010; Calabro et al, 2000). It can therefore be assumed that differences in knowledge and behaviour can be related to a distinctive predictive role given to behavioural intention predictors across medical school years.

Since medical students will be the future practitioners of healthcare organisations, it's important to study their intention to comply with hand hygiene. First, it will allow assessing their knowledge and perceptions (Kampf, 2004); secondly, it will contribute to explore the need of including more formal teaching of infection control in medical curricula (Duray & Coutour, 2010).

5.2 Study II: Exploring 6th year medical students' behavioural intention predictors

5.2.1 Objectives and hypotheses

The present research examines the predictors of medical students' intention to comply with the most important infection control technique, which is hand hygiene. However, an extended version of the TPB will be presented, which includes an additional predictor of intention, namely the moral norm. As previously stated in the literature review, medical students apparently consider that infection control is a topic with less moral importance when compared with other medical mainstream themes, to which they must give their priority (Duroy et al., 2010). To that end, it is expected that the moral norm will play a significant role as a predictor of their intention to comply with hand hygiene.

Moreover, our research aims to analyse this extended application of the TPB with 6th year medical students' who are engaged in healthcare undergraduate internships, which means that these students will be integrated into care-delivery teams where, due to socialization efforts, students will have to learn the established team rules, including those regarding infection control practices (e.g. Bauer, Morrisson & Callister, 1998). Therefore, during such an important socialization stage the role of subjective norms might be enhanced when compared to other behavioural intention predictors.

Three hypotheses were formulated. The first determines whether all behavioural intention predictors will have a positive impact on intention to comply with hand

hygiene, with the exception of the moral norm because this last variable interferes with compliance and, to that end, hinders the personal intention to comply. The second hypothesis is that the subjective norm will become the best behavioural intention predictor. This assumption relies on the fact that medical students are integrated in undergraduate internships in healthcare organisations, where they will work in care-delivery teams. Inside these teams socialization tactics will be developed, and medical students will need to take those tactics into consideration. The process of adaptation to the team and to the socialization tactics will constrain their intention to comply which will contribute to enhance the importance of the subjective norm as a behavioural intention predictor (e.g. Bauer et al, 1998). Finally, the third hypothesis states that the moral norm will have a negative influence on medical students' intention to comply with hand hygiene contributing to explain non-compliance and suggesting that moral concerns may appear during education and express a multi-faceted nature, where despite the fact that hand hygiene is a moral behaviour, non-compliance emerges as a way to attain other moral imperatives of higher value than those expressed by compliance.

5.2.2 Method

5.2.2.1 Participants

The sample consisted of 102 medical students' from the final year (6th year) of a hospital internship, from a Portuguese School of Medicine. All students had infection control training during their academic curricula. Around 58.8% of participants were females and 41.2% were males. Respondents were on average 23.81 years old (ranging between 23 and 27 years). Data was collected with a self-report questionnaire using a quantitative methodology. Questionnaires were distributed to the medical students' class representatives, who were responsible for their distribution among the students.

5.2.2.2 Instrument

Questions covered the main TPB predictors and socio-demographic questions in order to characterize the participants. Behavioural intention predictors and intention to comply were measured with items derived from the study of Ajzen, Brown & Carvahal (2004). *Attitudes* were measured with three items. An item example is "Hand hygiene is a beneficial technique for me and for the patient". The response scale ranged from (1)

"Completely Disagree" to (7) "Completely Agree" (Cronbach $\alpha = .71$). *Subjective Norms* were measured with three items and specified colleagues as social referents:" My colleagues comply with hand hygiene procedures ". The response scale for the items ranged from (1) "Completely Disagree" to (7) "Completely Agree" (Cronbach $\alpha = .72$). *Perceived behavioural control* was also assessed with three items. "I consider that I control hand hygiene technique " is an item example. All items were ranged from (1) "Completely Disagree" to (7) "Completely Agree" (Cronbach $\alpha = .72$). *Intention* to comply with hand hygiene was measured with three items. An item example is "I intend to comply with hand hygiene in every situation where this procedure is required ". All items were ranged from (1) "Completely Disagree" to (7) "Completely Agree" (Cronbach $\alpha = .73$). Finally, moral norm items were adapted from the work of Biel & Thogersen (2007) and Godin, Conner & Sheeran (2005) and this construct was assessed with three items giving emphasis to the professional commitment towards the patient as a moral prerogative. An item example is "I consider my personal commitment towards the patient more important than hand hygiene". The response scale ranged from (1) "Completely Disagree" to (7) "Completely Agree" (Cronbach $\alpha = .73$).

5.2.2.3 Data analysis

A PCA with varimax rotation of the items was employed to measure all variables identified in the study. Our aim was to assess the content validity of the five constructs under analysis. Eigenvalues greater than 1 were set as the criterion for selecting components and the results revealed that the 15 items could be reduced to five factors (KMO = .63 < .001) which corresponded to the five identified variables in our study that explained 68% of the variance in the correlation matrix (see Appendix B).

In order to analyse the extended application of the TPB model to the medical students' intention to comply with hand hygiene, two hierarchical multiple regressions were run. In the first hierarchical multiple regression the purpose was to verify which was the best predictor among the attitudes, subjective norm and PBC. In the second one, our aim was to explore the impact of the moral norm to the predictive equation and to identify its contribution to the explained variance in intention. Data were analysed using SPSS version 18.

5.2.3 Results

5.2.3.1 Descriptive statistics and correlations

The results of descriptive statistics presented in Table 5.1 indicate that, on average, medical students have positive attitudes towards hand hygiene, consider the role of relevant social referents in determining their compliance behaviour and evaluate this practice as being easy to perform. The moral norm is the only variable whose mean value, on average, expresses a higher agreement.

Thus, despite evidence that students hold positive attitudes towards hand hygiene, they also appear to agree that there are moral imperatives to which they also give importance in order to focus on their commitment to the patient. However, medical students' intention to comply with hand hygiene demonstrates that, on average, there is strong agreement with the need to comply with this procedure in every required situation.

At the level of the dispersion measures, it can be seen that the values of standard deviation range between 0.40 and 0.52. Although the sample has only 102 medical students, these values are found to be relatively low and consistent for all variables in the study, which reveals a tendency to data points being very close to the mean.

Finally, turning to the Pearson correlations, results indicate that there are only two significant correlations: one between subjective norm and intention which shows a positive moderate correlation (it should be mentioned that the subjective norm was the only behavioural intention predictor to be correlated with intention); and, a negative low correlation between the moral norm and the PBC.

This low negative but significant correlation suggests that these future professionals who have a strong moral norm tend to lower their levels of perceived control; or inversely, the higher the levels of control that the medical students' present, the lower the strength of their moral norm incidence.

Table 5.1. Descriptive statistics for 6th year medical students (means, standard deviation and correlations)

	Mean	SD	1	2	3	4
1 Attitudes	6.26	0.47				
2 Subjective Norm	6.47	0.41	.11			
3 PBC	5.72	0.49	-.15	.08		
4 Moral Norm	6.69	0.40	-.02	-.17	-.22*	
5 Intention	6.26	0.52	.01	.30**	.14	-.14

**p <.001; *p <.05

5.2.3.2 Medical students' behavioural intention predictors to comply with hand hygiene

To identify the intention predictors two multiple linear regressions of the TPB main variables were performed. In the first regression attitudes, subjective norm and PBC were entered into the model equation. The model only explained 8% of the variance in intention with the subjective norm being the only significant predictor among attitudes and PBC (Table 5.2). In the second regression, the moral norm was added as additional predictor to the regression equation. The additional proportion of variance that the moral norm added to the model was around 6% and became with the subjective norm the second significant predictor of medical students' intention to comply (Table 5.2).

The moral norm presented a negative coefficient towards intention indicating that intention decreases 0.31 points when the moral norm increases. The overall model explained 13% of the variance in intention. Since the moral norm was not significantly correlated with the criterion variable, it appears that this pattern of results highlights the moral norm as a suppressor variable because despite a value close to zero correlation with intention, it contributes to the predictive validity of the test.

Despite the fact that no multicollinearity issues were identified (VIF < 2.5), this suppressor result may emphasize that there is some error associated with the subjective norm in that instead of being correlated with intention, it is correlated with the moral norm. When the moral norm is included in the equation model, this error was suppressed error (or accounted for) and the subjective norm became an improved predictor of the medical students' intention to comply with hand hygiene. In other

words, even although the moral norm was not correlated with intention, when it was included in the equation it increased the R^2 from what it would have been with just the subjective norm (Cohen & Cohen, 1983).

Table 5.2 Hierarchical multiple regression coefficients of 6th year medical students' intention to comply with hand hygiene (N=102)

TPB Predictors	1st Regression	2nd Regression
Attitudes	0.01	0.01
Subjective Norm	0.38*	0.43*
PBC	0.13	0.18
Moral Norm	-	-0.31*
F	3.96	4.85
R^2	0.08	0.13

** p < .001; * p < .05

5.2.4 Discussion

Overall, this study enhances the role of both subjective and moral norms as the main predictors of medical students' compliance with hand hygiene procedures. These indicators not only support the need for TPB to include additional variables, but also highlight the impact that social and internal norms may have among medical newcomers to predict their intention to comply with infection control techniques.

The first interesting indicator is the fact that the moral norm appears to be negatively correlated with the PBC. These future HCPs who have a strong moral norm may feel less control. Somehow, the moral commitment that these students appear to have towards the patient may inhibit the way their ability to comply with hand hygiene is perceived because they will be more focused upon their moral obligation.

Another indicator that should be stressed is the fact that the subjective norm was the main intention predictor. This is, in some way, incongruent with most of the prevailing literature focusing on health psychology (Armitage & Conner, 2001). However, in this study we specifically referred to a sample which comprised medical newcomers who strongly depended upon their internship team to make clinical decisions and to perform their behaviours. Furthermore, the subjective norm operationalization included three items while most of the studies in the literature using the TPB only use one item to measure this perceived social influence norm (Armitage &

Conner, 2001). Therefore, subjective norm predictive ability may be due to these specific particularities.

Nevertheless, within the healthcare sector another study enhanced the role of the subjective norm as a main predictor of physicians' intention to comply with clinical guidelines, namely their intention to prescribe antibiotics. Limbert & Lamb (2002) found that the subjective norm was the main predictor of junior doctors' intention to comply with antibiotics prescription while attitudes were the main predictor of senior doctors' intention to comply. In this sense, Limbert & Lamb (2002) assumed the possibility of doctors with less experience being more willing to accept perceived social pressures from their peers because they practice as a junior doctor depends on a need to report their behaviours. Taking into account this previous finding, it seems feasible that medical newcomers with less experience feel a strong social influence from peers and supervisors who are more experienced during their internship. This may explain why attitudes were not the main predictor of the medical students' behavioural intention to comply with hand hygiene.

It was also interesting to verify in this analysis that the moral norm, as a norm that interferes with compliance, seems to arise during medical academic programmes because these senior medical students reveal its existence. To that end, it could be argued that physicians' have to deal with an internalized norm that arises during their academic curricula which can pose three questions (1) when do these moral concerns arise; (2) how does the moral norm perform throughout a physician's career; and (3) in what sense does it enable or inhibit medical newcomers compliance with hand hygiene. According to a qualitative study performed by Racine (2008) healthcare ethics committee members have a view of clinical ethics based upon respect for people and commitment to the patient's good. In a specific situation where medical newcomers perceive an incompatibility between their moral norm of prioritizing the patient and the need to comply with hand hygiene the former may inhibit compliance because despite the fact that hand hygiene is a moral behaviour it may be perceived as less relevant than other medical topics (e.g. Racine, 2008).

However, the non-significance of attitudes and PBC was an intriguing finding that should be analysed. Among the possible explanations is the fact that hand hygiene behaviour has a strong social desirability component so that the expression of attitudes and PBC would be translated by socially desirable responses. The second possibility is

that the subjective norm and the moral norm can both act as moderator variables to explain those effects of attitudes and control concerning medical students' intention to comply with hand hygiene.

This study presents several limitations that may constrain the results obtained. First, the sample size was quite small which did not allow other statistical analyses to be performed (e.g. Structural Equation Modeling), that could be more reliable than Multiple Hierarchical Regressions. Also, the sample comprised medical students' who came from the same School of Medicine which makes it difficult to generalize these findings to all medical students. Another point that can be highlighted concerning the sample is the fact that we only analyzed medical student data from the final year. Because our findings indicate the prevalence of the moral norm, it would be interesting to develop further studies which allowed for the comparison of different stages of socialization. For example, to verify if medical students from the 1st year already have a moral concern. The same sort of comparisons should be made to evaluate the role of the subjective norm in order to verify if there remains a distinctive pattern among medical newcomers and medical students from earlier medical school years.

In this study social influence only took into account colleagues' perceived influence. However, it would be interesting to verify the role that both professors and internship supervisors can have in the determination of the subjective norm, as they both constitute relevant social referents in medical students' socialization stages.

Finally, another limitation of our work is the low explained variance of the model. Even with the inclusion of the moral norm which incremented the explained variance by 6%, a result consistent with the literature findings (Conner & Armitage, 1998), the model only explained around 13% of the medical newcomers' intention to comply with hand hygiene. This could be due to the fact that attitudes and PBC were not significant intention predictors. To conclude, the study findings enhance interesting indicators suggesting that social and internalized factors may play a key role in medical newcomers' intentions to comply with hand hygiene. The relevance of both subjective and moral norms, can propose that compliance may be increased during these students' socialization stages if greater levels of social support are present while newcomers are being integrated into their internship programmes.

5.3 Study III: Differences in social referents and moral norms according to medical students' school year belongness: a comparison of 1st and 6th years

5.3.1 Objectives and hypotheses

After analysing the results of study II, the aim of this third study was to explore the role of the two main predictors, subjective and moral norms, by taking into account the relevance of different social referents and the importance of distinct moral emphasis when medical students from dissimilar school years are included in the sample. In this study, behavioural intention predictors of medical students from the 1st and the 6th year were compared after analysing an extended applicability of the TPB. Turning to the study's first hypothesis it is expected that the subjective and the moral norm will be the best predictors of 1st and 6th year medical students' intention to comply with hand hygiene among attitudes and PBC. However, because in this second study our aim is to analyse different social referents such as professors and colleagues, and different moral emphasis, namely the emphasis on hand hygiene and on commitment to the patient, we expect that the ability of these predictors to explain intention variance will change according to the medical students' school year.

The theoretical assumption on which these hypotheses are based arises from the fact that several studies have determined that both professors and colleagues play a significant role in medical students' compliance behaviours (e.g. Buffet-Bataillon, Leray, Poisson, Michelet, Mallet & Cormier, 2010); however, the impact that these potential social referents might have on medical students may be different due to the fact that medical students' during their training education are integrated in distinct socialization stages (e.g. Wright, Wong & Newill, 1997). For instance, in the early stages of their medical school curricula professors have a relevant role in disseminating their knowledge, expressing a great influence on these students' skills and values (e.g. Schneider et al, 2009). On the other hand, as medical students' progress in their academic training, and consequently become more integrated into clinical practice, the impact of other social referents increases, in particular the importance given to colleagues, who are mostly perceived with reference to their personal practices (e.g. Paukert & Richards, 2000). To that end, we expect that the subjective norm whose referent focuses on professors to be a relevant predictor of 1st year medical students' intention to comply with hand hygiene, and conversely that the subjective norm that

emphasizes the relevance of colleagues to be a better predictor of intentions of medical students from the 6th year.

In the particular case of the moral norm, literature highlights the importance that hand hygiene has on patient safety as an infection control procedure (CDC, 2003). In this sense, complying with hand hygiene is not only a relevant safety behaviour but also a moral prerogative that must be taught during academic curricula to protect both patients and future professionals (e.g. Duroy et al., 2010). Nevertheless, literature findings also determine that despite acknowledging the importance of hand hygiene, medical students appear to have other moral concerns that may interfere with compliance, such as attributing more moral importance to other medical topics related to their clinical practice as future professionals (e.g. Duroy et al., 2010). Because clinical practice evolves during medical training, and infection control is a topic that is mostly focused on during the first year of medical students' academic curricula (e.g. Mortel et al. 2010), it is expected that the awareness of the topics that medical students mention as more relevant than infection control emerge in the course of their education. In this sense, it is expected that intentions from 6th year students will be better predicted by a moral norm that emphasizes the significance of their commitment to the patient and consequently interferes with compliance; while intentions from 1st year students will be better predicted by a moral norm that gives particular relevance to hand hygiene, favouring compliance.

5.3.2 Method

5.3.2.1 Participants

Participants were 175 undergraduates selected from a Portuguese Medical School. Students were from the 1st (N=121) and 6th (N=54) years. There were 48 male participants and 127 female participants ranging in ages from 18 to 46 (mean age = 20.9 years). All students had infection control training during their academic curricula. Self-report questionnaires were delivered to participants during their classes. At the end of the classes, all questionnaires were collected.

5.3.2.2 Instrument

Participants completed a questionnaire equivalent to the previous one with the exception that in this study new subjective and moral norm items were included. In this sense, *subjective norms* despite measuring the importance of colleagues as social referents also assessed three additional items that focused on the relevance of professors. An item example is "What my Professor consider that I should do about hand hygiene is important to me". The response scale for the items ranged from (1) "Completely Disagree" to (7) "Completely Agree" (Cronbach $\alpha = .79$).

In the case of moral norms, three new items were included to measure medical students' moral prerogatives by expanding the moral emphasis with items focused on the relevance of the personal commitment to hygiene. "I consider hand hygiene a personal moral obligation towards the patient" is an item example. The response scale ranged from (1) "Completely Disagree" to (7) "Completely Agree" (Cronbach $\alpha = .88$). Work by Ajzen, Brown & Carvahal (2004), Biel & Thogersen (2007) and Godin, Conner & Sheeran (2005) was also used to adapt these additional measures.

5.3.2.3 Data analysis

As in the previous study a principal component analysis (varimax rotation) was employed to assess the content validity of the seven measures. Extracted components had eigenvalues greater than 1. The results revealed that the 21 items could be reduced to seven factors (KMO = .74 < .001) which corresponded to the seven specified constructs under analysis that explained 81% of the variance in the correlation matrix (see Appendix C).

The impact of the extended TPB in the 1st and 6th year medical students' intentions to comply with hand hygiene was assessed by the use of one hierarchical multiple regression which takes into account the split file of the sample by medical year. Our purpose was to verify the best behavioural intention predictors of 1st and 6th year medical students. Data were analysed using SPSS version 18 and comparative results are presented in the next section.

5.3.3 Results

5.3.3.1 Descriptive statistics and correlations

The descriptive analysis of the data verifies that medical students from the 1st year present, on average, general agreement that hand hygiene is a valuable procedure, and as a practice it can be performed with ease. In the case of the subjective norm, the variables that represent this dimension had the lowest mean value yet continued to show agreement among respondents. It should be noted that these students agree, on average, with the importance of both professors and colleagues as important social referents to determine their behavioural compliance practices, particularly the former. Turning to the moral norm, there is also an average agreement with both norms despite the fact that the moral emphasis on hand hygiene appeared to show a slight increase in mean value. In general, 1st year students show an average willingness to comply with hand hygiene whenever this behaviour is required.

Regarding the standard deviation results, the presented values are high, particularly in the case of the subjective norm. Standard deviation values range between 0.12 and 1.12, which shows that there is a high dispersion of the medical students' responses around the midpoint value, and consequently, a limited consensus among them. Results can be seen in Table 5.3.

In terms of correlations, results indicate that attitudes, the subjective norm that focuses on the professor as social referent and the moral norm with emphasis on hand hygiene were the only variables correlated with intention. Correlation coefficients were positive and moderate. However, several interesting results were found after examining the various inter-correlations, including the fact that attitudes are positively correlated with the subjective norm that emphasizes the role of professors as social referent. This correlation may suggest that there is a positive relationship between the dissemination of information concerning hand hygiene and the constitution of a positive attitude about this procedure. Furthermore, the moral norm with emphasis on hand hygiene also presents a positive correlation with this subjective norm that is focused on the role of the professor reinforcing the idea that professors can be models that are associated with the importance given to hand hygiene. Conversely, a negative correlation was obtained between the moral norm with an emphasis on the patient and attitudes. This negative

correlation suggests that the higher the importance given to this moral norm, the lower the positive attitude to hand hygiene.

Finally, the PBC appears to be positively correlated with attitudes and the subjective norm that focuses on professors, indicating that knowledge and the positive evaluation of hand hygiene associated with the relevance of the social referent contributes to increase the students' perception of control.

Turning to the medical students from the 6th year, it appears that, on average, there is a strengthening of their agreement in expressing their intention to comply with hand hygiene due to a greater expression of the variable means. In terms of the subjective norm, whose mean values were also the ones expressing the lowest agreement results, both norms focusing on colleagues and professors as relevant social referents were seen as important to determine medical students practices, in particular, the former. The same happened to the moral norm where, on average, both norms were seen as relevant despite the fact that the one giving emphasis to patients received higher mean values.

Standard deviation values are extremely high (ranging from 0.65 and 1.20) given the fact that the sample size only comprised 54 medical students, which reinforces the idea of disagreement between the respondents.

Finally, correlations indicate that the subjective norm that focuses on the professor as a social referent is positively correlated with attitudes. This result was also identified in the 1st year students. However, in this particular case this norm is also positively correlated with the subjective norm that emphasizes the role of colleagues. It is possible that as the importance of professors increases through time, the importance of other social referents such as colleagues also increases. In terms of the moral norm it was also found that the moral norm that emphasizes the patient is negatively correlated with attitudes, but positively correlated with the subjective norm that focuses on colleagues. This result may indicate that the relevance of this norm can be associated particularly with peers. PBC was found to be positively correlated with the subjective norm that focuses on colleagues, negatively correlated with the moral norm that emphasizes patients and positively correlated with the moral norm that focus on hand hygiene. These results demonstrate that colleagues as relevant social referents can contribute to increase medical students' perceptions of control. Also, the correlations with the moral norms highlight that the medical students with a strong moral norm focused on patients

may lower their levels of perceived control, while when there is a focus on the moral norm that emphasizes hand hygiene perceived control increases.

Table 5.3 Descriptive statistics 1st year (N = 121) and 6th year medical students (N = 54)

	Mean	SD	1	2	3	4	5	6
1st Year								
1 Attitudes	5.12	0.96						
2 Subjective Norm Colleague	4.64	0.76	0.06					
3 Subjective Norm Professor	4.70	0.92	0.31**	0.04				
4 Moral Norm Patient	5.10	1.12	-0.23*	0.04	0.09			
5 Moral Norm Hygiene	5.76	1.03	0.46**	-0.17	0.42*	-0.02		
6 PBC	5.42	0.82	0.21*	0.05	0.19*	0.15	0.04	
7 Intention	5.35	0.99	0.46**	0.04	0.43**	-0.15	0.44**	0.10
6th Year								
1 Attitudes	5.77	1.20						
2 Subjective Norm Colleague	4.88	0.72	-0.08					
3 Subjective Norm Professor	4.03	0.82	0.28*	0.29*				
4 Moral Norm Patient	5.79	0.79	-0.33*	0.41*	-0.05			
5 Moral Norm Hygiene	5.45	0.69	0.08	0.19	0.10	0.13		
6 PBC	5.94	0.65	-0.21	0.34*	-0.13	-0.21*	0.29*	
7 Intention	6.04	0.81	0.39**	0.53**	0.07	0.37**	0.15	0.47*

** $p < .001$; * $p < .05$

5.3.3.2 Medical students' behavioural intention predictors to comply with hand hygiene

A multiple hierarchical regression was performed for medical students in the 1st and 6th years to test whether the TPB components and additional subjective and moral

norms could predict the intentions to comply with hand hygiene. When student membership of a particular year was taken into account we established that the best behavioural intention predictors for 1st year students were the subjective norm focused on professors as social referents, attitudes and the moral norm emphasizing hand hygiene as the main moral prerogative. This model explained 35% of the variance in intention. Turning to 6th year medical students, their intention to comply was best predicted by the subjective norm focusing on colleagues as social referents, the moral norm emphasizing the moral commitment towards the patient, perceived behavioural control and attitudes. In this case, the model explained around 49% of the variance in intention. The regressions results are reported in Table 5.4.

Table 5.4. Hierarchical multiple regressions coefficients of 1st year (N=121) and 6th year (N=54) medical students' behavioural intention predictors

TPB Predictors	1st Medical Year	6th Medical Year
Attitudes	0.24*	0.18*
Subjective Norm Colleague	0.09	0.43*
Subjective Norm Professor	0.28*	-0.05
Moral Norm Pacient	-0.11	-0.32*
Moral Norm Hygiene	0.22*	0.05
PBC	0.01	0.38*
F	10.22	7.72
R^2	0.35	0.49

** p <.001; * p <.05

5.3.4 Discussion

The results of study III strongly indicate that Portuguese medical students appear to change their social referents and moral prerogatives as they proceed through medical school. This suggests that medical students from the 1st year perceived professors as the most significant role model to disseminate information regarding the importance of hand hygiene as an infection control procedure, while students from the 6th year focused on colleagues as relevant social referents to model their compliance behaviour.

Turning to the role of moral norms, an apparent change was also found according to which year a medical student belonged. In their 1st year students supported a moral prerogative that hand hygiene must be seen as a practice that should be applied in routine and invasive procedures to protect the patient from acquiring an infection.

However, medical students from the 6th year presented a different moral prerogative that despite acknowledging the importance of hand hygiene gives more relevance to their moral commitment towards the patient, therefore not considering this procedure as the most significant. Despite the fact that hand hygiene is a moral behaviour, the suggestion that moral prerogatives may be multi-faceted contributes to explain why compliance may oscillate turning in some occasions into non-compliance.

Medical students from the 6th year may have acquired a differentiated set of moral prerogatives that operate independently and, in a non-compliance event, the violation of a moral behaviour as hand hygiene compliance can be justified with another moral prerogative that allows students to develop a different behaviour that is also considered by them as moral and adequate and therefore justifies non-compliance with hand hygiene. This non-compliance during undergraduate clinical practice may also be explained by the co-existence of different moral norms, in which role models play a significant part. In the 1st year while professors are seen as major social referents, the main moral prerogative among students is the morality underlying hand hygiene compliance. In fact, results highlight a positive correlation between this norm, attitudes and the moral norm emphasizing hand hygiene suggesting a possible relationship among these constructs. This norm with emphasis on hand hygiene may be consistent with the information disseminated during medical curricula by professors contributing to the constitution of positive attitudes towards hand hygiene and infection control procedures.

Yet, as students progress in their medical school education the relevance of hand hygiene compliance appears to be exceeded by the magnitude of patients' needs. This change in the moral norm emphasis appears to be concurrent with the importance given to a different social referent, the colleague, and may represent the documented lack of awareness of the views of healthcare professionals towards the importance of hand hygiene (Jeanes, 2003). According to Hoffman (1983) the moral norm starts with external standards which are subsequently internalized and perceived as being independent and anchored in the self. Thus, one may accept a social cue for the formation of a moral norm, and the inclusion of medical students in healthcare internships in the 6th year of their medical school may contribute to the fact that the relevance given to hand hygiene compliance in the beginning of their medical education becomes supplanted by the weight underlying care-delivery to patients. It also should be

emphasized that this moral norm is positively correlated with the subjective norm, which highlights the importance of colleagues reinforcing the idea that the moral concern of giving importance to patients needs may be increased by the fact that extreme relevance is given to colleagues as social referents.

The importance of colleagues as role models has been documented in the literature. For example, a large cross-sectional study developed by Schneider et al. (2000) indicated that the mere belief of being a role model for other colleagues positively influenced the behaviour of other doctors. The moral norm focusing on patients is negatively correlated with attitudes which may indicate that the more the medical student gives importance to the moral norm focusing on patients; the less positive will be their attitude toward hand hygiene compliance. This may occur because by admitting that there are other moral prerogatives that go beyond the relevance of hand hygiene, medical students will perceive a lack of evidence of hand hygiene in preventing cross-infection. For instance, Erasmus, Brouwer, van Beeck, Oenema, Daha, Richardus et al. (2009) found that medical students despite acknowledging the relevance of hand hygiene for self-protection considered that there was a lack of evidence in the literature that this procedure was able to prevent cross-infection, from professional to patient. This finding may suggest that these students had a moral concern similar to the one identified in our study because a vast literature demonstrates that hand hygiene is the simplest and easiest procedure to prevent cross-contamination (CDC, 2003).

Finally, the fact that the PBC was negatively correlated with the moral norm focusing on patients and positively correlated with the moral norm emphasizing hand hygiene may also depend on the fact that when medical students give more importance to the former which inhibits compliance, they will most often perform hand hygiene after tasks they perceive to be dirty in order to protect themselves, which means that hand hygiene will only be used as a measure of self-protection (Erasmus et al., 2009). To that end, hand hygiene will be applied randomly without being applied only in the situations that are formally required for its implementation. This can result in a decrease in the medical students' sense of control because they will no longer be in a situation where all procedures are specified as hand hygiene required. The need to apply hand hygiene will depend on their evaluation (Erasmus et al., 2009).

Several limitations must be acknowledged, in particular sample size. Future research should consider using more diverse and larger samples in order to compare the

importance of psychosocial factors underlying medical students' compliance with hand hygiene in different socialization stages. Also, it is important to establish whether the social referents presented (professors and colleagues) have the same pattern of moral norms. Moreover, it would be important to verify if these different moral norms remain relevant for junior and senior physicians. Nonetheless, despite limitations, this study illuminates a previously understudied issue and provides valuable exploratory groundwork for the specific perceptions associated with medical students' compliance behaviours.

5.4 Final Conclusions

As far as our knowledge goes, these are the first studies employing and expanding the TPB to explore the motivational processes underlying medical students' intentions to comply with hand hygiene using a sample comprising medical students from different years, and may in this capacity provide novel information for the design of future studies and interventions focused on medical students' compliance behaviour with infection control procedures during their education training.

The research was motivated by the idea that the influence of the TPB components and additional predictors might differ in distinct populations, in this instance medical students from distinct school years. Furthermore, we tried to understand not only the importance that different role models might have during different stages of medical school enrollment; but also attempted to explore the multi-faceted nature of moral prerogatives in reinforcing or inhibiting compliance. A principal component analysis of all the items used to measure the variables in both studies, showed strong support for the discriminant and content validity of the new constructs applied in the current studies.

The results of these two studies confirmed the hypotheses that medical students' norms, both subjective and moral, play a significant role in determining their personal intention to comply. In particular, we confirmed the behavioural implications of distinct components of subjective (professors and colleagues) and moral norms (hand hygiene and commitment towards patient). Again, the significant predictive power of the subjective norm is worth considering since this predictor is usually the weakest of the three TPB theoretical components (Ajzen, 1991; Armitage & Conner, 2001; Godin & Kok, 1996).

One explanation for these results is the way social influence models influence behaviour that is valued for the individual (Bandura & Walters, 1963). In the course of their academic education, medical students will be exposed to different models or mentors that have the ability to model their behaviour. In the beginning of their medical training students will focus their attention primarily on professors (e.g. Schneider et al., 2009). In fact, according to Wright (1996) professors are perceived by medical students as determinant role models due to their clinical excellence, personality and teaching abilities exerting their influence on their knowledge and skills. With the progressive inclusion of these students inside healthcare institutions in order to learn and apply the knowledge and skills acquired during their medical training, the socialization tactics will be even stronger than those experienced inside medical schools (Wright, 1996).

Medical students that participate in clinical training programs and undergraduate internships programs will need to adjust to the rules of the care-delivery teams in which they are included becoming vulnerable to the implemented set of principles that model the behaviour of these students' new colleagues (e.g. Bauer, Morrisson & Callister, 1998). New role models will appear as the extent of social influence processes broadens. It seems possible that the relevance of colleagues increases with the course of medical training. In fact, in a study developed by Paukert & Richards (2000) whose purpose was to examine the medical students' perceptions about characteristics of faculty who had influenced their behaviour and compare those perceptions with first year interns, results indicated that substantial differences were found in medical students perceptions when compared to interns. Young medical students value the role of their professors while more mature learners, like interns who are starting their 1st year of residency, start valuing other referents and responsibilities independent from the professor and as they progress to begin their professional career, colleagues became more valuable (Paukert & Richards, 2000).

In terms of the moral norm, results determined that the norm with an emphasis on a commitment to a patient inhibits compliance and is particularly important for 6th year medical students, while the norm that focuses on hand hygiene predicted the intention of 1st year students. First, we were able to show the multi-faceted nature of the moral norm which was not previously studied in other studies. However, besides that, it seems that there is a change from one norm to another in the course of the medical training. Because we only have a sample of 1st and 6th year medical students it is not possible to

determine when the moral norm with an emphasis on commitment to the patient starts to be a relevant predictor of intention. We can only verify that the relevance of this inhibiting norm is greater in the 6th year when compared with the 1st year. One possible explanation for this fact goes beyond the previously mentioned that focused on the underestimation of the infection control curricula when compared to other medicine themes and relies on the results achieved by Wright, Kern, Kolodner, Howard & Brancati (1998).

In the Wright et al. (1998) study, attributes of excellent attending physician role models were analysed in order to identify the characteristics of doctors who serve as excellent clinical role models and for that are distinguished among colleagues as mentors capable to influence newcomers' and other colleagues' behaviours. Results from this study determined that among the attributes that were associated with being an excellent role model were the importance of the doctor-patient relationship in one's teaching ability and teaching the psychosocial aspects of medicine. The authors also concluded that these role models help young trainees to acquire values, attitudes and behaviours associated with humanism and ethical practice (e.g. Mufson, 1997). To that end, medical students during the course of their education, in particular when they are integrated in undergraduate internships and other clinical training will be exposed to role models that are continuously seen as excellent mentors due to their ability to constitute positive relationships with patients and express to trainees the relevance of a comprehensive approach to patient care embedded by humanism (e.g. Mufson, 1997; Wright et al, 1998). These mentors would benefit the constitution of a moral norm (that after its constitution operates as an internalized norm) able to inhibit compliance because excellence would be associated with those values previously stated which are the primarily values that define the conduct of a doctor and consequently the importance of infection control is not perceived as being as determinant as that core moral assumption.

However, hand hygiene still remains as a moral behaviour. In fact, 1st year students' intention to comply is predicted by this norm. Because Duroy et al. (2010) determined that medical students from different years already had a perception of hand hygiene as less important than other values in medicine, it seems that opposing moral values are being taught by different role models during their academic training, contributing to the fact that each of these students develop internalized norms that

despite having a moral nature, operate with multi-faceted characteristics allowing medical students, depending on their judgment of the clinical situation, to comply or inhibit that compliance.

These studies illustrate a previously understudied issue and provide valuable exploratory groundwork for the specific perceptions associated with compliance behaviours. However, we would also like to focus on medical curricula by arguing that this curricula need to focus not only on theoretical grounds towards hand hygiene but clinical trials as well, given the finding that medical students from the 6th year sustain a moral prerogative that constrains compliance. Specifically, medical curricula and healthcare internships should include marks for hand hygiene in all undergraduate clinical assessment and in teaching quality assessment (Stone, 2001). Trials of behavioural and educational interventions to increase compliance with hand hygiene must be developed to reinforce the moral imperative that hand hygiene does not mean giving less importance to patients' needs and also reinforces the commitment with the patient.

Besides that medical curricula must provide cognitive strategies that require students to develop a critical analysis focused on their practice, in order to make them able to constructively assess themselves (e.g. Cole, 2009). The constitution of critical thinking will be a determinant for these students to understand their performance, seek new information and gain a greater understanding of compliance issues (e.g. Cole, 2009).

Also, because hand hygiene compliance and the constitution of the main predictors of its intention (the moral and the subjective norms) among medical students appear to be intrinsically related with the relevance of role models, and studies reveal that these students comply significantly less when they are integrated into groups where a member does not comply with hand hygiene (e.g. Schneider et al., 2009), it seems that one possible way to increase compliance is: (1) to focus on role models and (2) to develop didactic hand hygiene teaching methods. In these teaching methods, it will be important to focus on technical competence by providing professors and colleagues who have adequate compliance behaviour as target models; and, also to focus on theoretical knowledge, by enhancing the way professors and colleagues disseminate information regarding hand hygiene. In the end, it will be important to reinforce that compliance is a characteristic of excellence that future professionals must have (Cole, 2009). It seems

that medical schools need to reorganize medical curricula to develop a positive culture that reinforces the importance of infection control in order to give adequate emphasis to hand hygiene. The constitution of such environment will contribute to the progressive growth of positive role models capable of influencing future doctors' attitudes, perceptions and practices.

In conclusion, because this is still a theme that requires further investigation future research should survey not only whether hand hygiene education has been included in medical students' curricula and clinical assessment but also how effective it is in challenging the lack of awareness that it seems to prevail regarding moral conceptions about hygiene.

With the end of this fifth chapter, and after exploring the behavioural intention predictors in medical students' and how the norms influenced their personal intention to comply, we will now focus on the relevance that different levels of analysis have on determining HCPs' intention to comply. The findings from this study will be particularly relevant in the next chapter as, one research goal of Study IV will be dedicated to explore the behavioural intention predictors of doctors.

CHAPTER 6

EXPLORING COMPLIANCE: FROM A MULTI-LEVEL MODEL BETWEEN SAFETY CLIMATE AND THE THEORY OF PLANNED BEHAVIOR TO PROFESSIONAL BEHAVIOURAL INTENTION SPECIFICITIES

6.1 General Introduction

Traditionally, literature on hand hygiene has been focused on the impact of individual level variables on HCPs' compliance. However, several authors have argued for the need to go beyond the simple use of those variables in order to better understand the consequences for compliance and intervention through the constitution of multi-level models that reconcile variables from distinct levels of analysis (e.g. Pittet et al., 2000). To accomplish this, recent evidence has suggested the need to focus on the impact that safety climate, measured at the team level, may have on HCPs' attitudes, subjective norm and PBC, which are depicted from the TPB and measured at the individual level (e.g. Fogarty & Shaw, 2010) to explain their personal intention to comply with hand hygiene.

Besides that, literature findings have emphasized that HCPs have distinct compliance rates according to their professional categories. However, little is known about which predictors are the most important for these occupational categories to explain their personal intention to comply (e.g. Pittet, 2004). If their compliance rates differ, then by knowing which are the most relevant behavioural predictors associated with each category will allow for the development of future intervention programs directed to the specificities of each group (e.g. Pittet, 2002)

Finally, due to the fact that doctors are the professional category with more compliance difficulties and previous studies have highlighted that doctor' practices appear to be constrained according to different socialization stages into which doctors are integrated (e.g. Paukert & Richards, 2000), it seems plausible to evaluate whether work experience constrains behavioural intention predictors. In fact, literature findings have suggested that senior doctors wash their hands less times when compared to junior doctors (Bartzokas, Williams, Slade, 1995) but few studies have addressed the relevance of work experience in determining senior and junior doctors behavioural intention predictors to comply with hand hygiene despite the indications that the amount of work experience can play a significant role in determining compliance (e.g. McGovern, Vesley, Kochevar, Gershon, Rhame & Anderson, 2000).

In this chapter, study IV has been developed in order to address the three theoretical points previously stated. This study has three research goals; the first goal focuses on a multi-level model to measure the impact between team safety climate, TPB

behavioural intention predictors, and hand hygiene compliance. Multi-level mediation and moderation analyses will be tested. In the second goal of the study, our aim is to compare the TPB behavioural intention predictors across doctors, nurses and cleaners, in order to identify the different contributions of each variable, and examine the predictive ability of the moral norm. Finally, the third goal of the study addresses the relevance of work experience and examines how this variable constrains senior and junior doctors' intention to comply by changing their behavioural intention predictors.

In the next sections all research goals of the Study IV will be presented.

6.2. Study IV Research Goal I: a multi-level model integrating team safety climate and the Theory of Planned Behavior[11]

6.2.1 The interconnections between safety climate and the Theory of Planned Behavior: a levels approach

Close examination of the existing body of research on HCPs' compliance with hand hygiene shows two types of scientific contribution (1) those concerning the role of isolated variables (e.g. beliefs, attitudes, behaviours) (Ferguson, Waitzkin, Beekman & Doebbeling 2004; Wissen, Siebers & Fnzimls, 1993), and (2) those framed on theoretical models, in particular socio-cognitive (e.g. Theory of Planned Behavior Ajzen, 1991); community (e.g. Precede-Proceed Model, Green & Kreuter, 1991) and organisational (e.g. Safety Climate, Zohar, 1980). According to Godin, Bélanger-Gravel et al.'s (2008) review the TPB is the theoretical framework most used to analyse HCPs' compliance with safety procedures with results reporting 59% and 31% of explained variance in intention and behaviour, respectively. Nonetheless, an analysis of this literature shows that despite these results this theory has not been successfully applied to change behaviour in the field of infection control due to lack of knowledge and consistency about how different predictors are related to intention to comply with hand hygiene of different healthcare professional groups (e.g. WHO, 2005).

[11] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *A multi-level mediation model of safety climate and the Theory of Planned Behavior: exploring hand hygiene intention to comply among healthcare professionals.* (Submitted).

There is also research focused on the potential impact of safety climate to increase compliance with hand hygiene. In fact, the relevance of safety climate perceptions applied to healthcare professionals' compliance with safety procedures has been discussed since the 1990´s (e.g. Cox & Leiter, 1992; White & Berger, 1992) but only for the last decade have these issues started to be addressed in empirical research (e.g. Grosch, Gershon, Murphy & Dejoy, 1999). However, the scarcity of literature in the healthcare domain appears to be consistent with data obtained in the industrial sector, where a prolific literature indicates that safety climate could be a relevant variable in explaining compliance with infection control practices (e.g. Dejoy, Gershon & Murphy, 1998). This supports the need to examine the theoretical and practical value of this construct. Still, several methodological limitations can be pointed out, such as difficulties in the aggregation of safety climate individual scores to measure the cognitive consensus of safety climate perceptions among healthcare professionals (Flin, Burns, Mearns, Yule & Robertson, 2006). According to Zohar (2000) safety climate is a construct developed to reflect group and/ or organisational levels in order to describe particular facets of supervisors' and managements' influence on safety in a given organisation. To that end, an indiscriminate aggregation of safety climate data, unable to translate into group and organisational levels, may constrain full access to the complex environment underlying healthcare organisations.

In summary, the prevailing line of reasoning is that both Theory of Planned Behavior and safety climate are related to healthcare professionals' compliance with infection control procedures; however, safety compliance rates remain difficult to increase suggesting the need for a different approach to the problem. In this sense, it is argued that one major limitation regarding the study of hand hygiene compliance is the propensity to underestimate the explanatory power of compliance that can be achieved within an integrative perspective that reconciles the interconnections between safety climate perceptions, TPB behavioural intention predictors and intention to comply.

The possibility of making these interconnections arises from the fact that TPB behavioural intention predictors, namely attitudes, subjective norm and perceived behavioural control, may reflect a link between safety climate perceptions and intention to comply with infection control procedures. In fact, the safety climate literature appears to have several research results where these TPB predictors may be identified at the individual, group and organisational levels of analysis (Fogarty & Shaw, 2010). In this

sense, the TPB may have theoretical features that can be integrated into safety climate literature, which will contribute to optimize its predictive ability (Fogarty & Neal, 2002). Close examination of the hand hygiene compliance literature shows an implicit assumption that safety climate and TPB as well as their interconnections may play a relevant role in determining a better understanding of healthcare professionals' compliance with infection control procedures.

By proposing an integration of TPB and safety climate characteristics, we assume the need to develop a multi-level framework focused on the relationship between safety climate and TPB behavioural intention predictors. The former, despite being collected at the individual level, emphasize safety features to be aggregated at the group and/ or organisational levels. In healthcare, professionals perceive themselves as working in institutionally based teams due to their inclusion in care delivery and management teams (Oandasan, Baker, Barker, Bosco, D'Amour, Jones et al, 2006). In this sense, it would be interesting to compare the different ways in which team members perceive the priority given to safety in their working base unit, by emphasizing team level safety climate perceptions. TPB, on the other hand, integrates several constructs that have an individual nature, such as attitudes, subjective norm, perceived behavioural control, intention and behaviour.

To our knowledge, this levels approach has been neglected in previous studies of infection control compliance among healthcare professionals thus this study aims to interconnect the team and the individual level by proposing a multi-level framework for exploring the relationship between team safety climate, individual level TPB behavioural intention predictors, and individual intention to comply. The model is demonstrated in Figure 6.1, in which it is highlighted that the relationship between team safety climate and individual intention to comply is mediated by individual level behavioural intention predictors (i.e., attitudes, subjective norm and perceived behavioural control) (e.g. Kompier, 2003). In the next section, we will focus on the discussion of the presented multi-level framework and explain the projected relationships.

6.2.2 The impact of team safety climate on HCPs' intention to comply: a multi-level mediation model

Since Zohar (1980) published his seminal paper about safety climate, there has been a growing interest in the role of this variable in accident prevention and safety compliance behaviours (Hahn & Murphy, 2008). The safety climate construct can be defined as shared employee perceptions of how safety management is being operationalised at the workplace, at a particular moment in time (Zohar & Luria, 2004). These shared employee perceptions, directed to the group and/ or organisational levels, constitute an indication of safety priority given in an organisation in relation to other organisational priorities (Zohar, 2000). This construct is particularly valuable in situations where it is unclear which performance facet or behaviour should be prioritized due to the ambiguities that arise from formally organisational espoused policies and enacted practices (e.g. Zohar, 2000, 2001).

Turning to the individual level variables included in the TPB, Ajzen (1991) determines that human intentions are the immediate predictor of behaviour and will be a function of three antecedents, namely (i) an individual positive or negative evaluation of the behaviour which constitutes its attitude, (ii) an individual perception of how important others expect that the individual should behave which refers to the subjective norm, and (iii) an individual perception of how easy it is to perform the behaviour which results in perceived behavioral control (Azjen, 1991).

In the proposed model all variables are expected to relate to team safety climate. The possibility of making these interconnections arises from the fact that TPB behavioural intention predictors, namely attitudes, subjective norm and perceived behavioural control, may reflect a link between safety climate perceptions and intention to comply with infection control procedures. In the model it is proposed that safety climate perceptions at the team level are related to individual attitudes. High team safety climate perceptions allow individuals to develop a positive evaluation of safety behaviours reinforcing their intention to comply (β_{a1} in Figure 6.1). For instance, most studies focusing on safety climate often measure workers' individual attitudes towards safety (e.g. Mearns, Flin, Gordon & Fleming, 2001) reflecting the degree to which safety behaviour is positively or negatively valued (Ajzen, 1991). We also expect team safety climate to relate to subjective norm and perceived behavioural control. The

subjective norm reveals the perceived social influence that each professional experiences in their decision to perform the behaviour (β_{a2} in Figure 6.1). It is interesting to find that results from several studies highlight the importance of social norms as determinants of behavioural safety practices (e.g. Hofmann & Stetzer, 1996; Zohar, 2000). Indeed, within organisations professionals tend to be included in work teams that develop specific rules of conduct to which workers feel they must comply to get a sense of inclusion and social acceptance within the team.

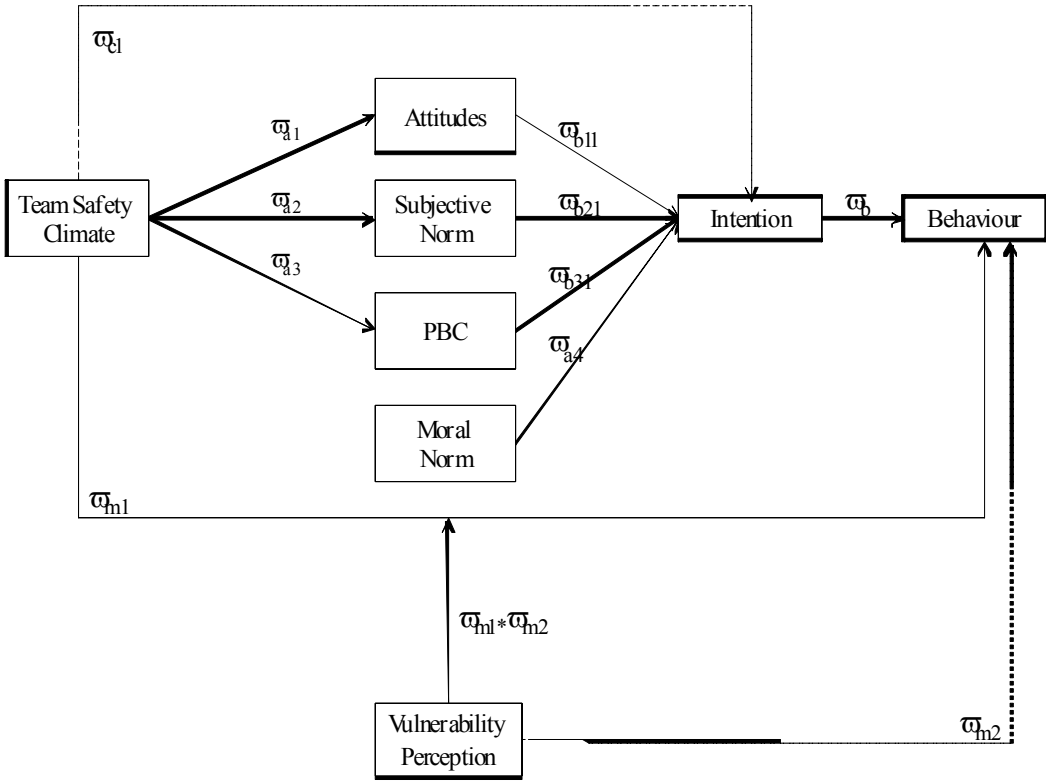


Figure 6.1 Multi-level mediation and moderation model between team safety climate approach and TPB theoretical framework concerning HCPs' compliance with hand hygiene

However, it is important to note that team safety climate and subjective norm are two distinct constructs. Team safety climate refers to the level of the unit, and in its definition has no meaningful existence at the individual level because it reflects employees' shared perceptions. On the other hand, subjective norm exists at the level of the individual by reflecting the professional perception of significant others' influence.

In addition, high team safety climate perceptions also contribute to increasing the individual perception of ease in relation to behavioural performance (β_{a3} in Figure 6.1). In fact, perceived behavioural control can be depicted from safety literature results by representing occupational constraints that inhibit workers' compliance with safety procedures (Fogarty & Shaw, 2010). Several of these constraints are located outside the individual because they are related to characteristics of the workplace (e.g. inadequate personal protective equipment) and their impact on workers perceptions by inhibiting their ability to perform the behaviour (Fogarty & Shaw, 2010).

After evaluating the multi-level mediation link between team safety climate, attitudes, subjective norm and PBC to determine HCPs' intention to comply we also want to explore the role of intention as this professionals' immediate antecedent of hand hygiene behaviour (β_b in Figure 6.1). However, the intention will be not only be based on the previously mentioned predictors included in the multi-level mediation, but will also be determined by an additional predictor, representing the moral dimension of HCPs' compliance behaviours (β_{a4} in Figure 6.1). As being defined as an internalized rule, it is assumed that this norm will not be predicted by team safety climate; however it will have a significant role in the meditational path linking behavioural intention predictors, intention to comply and behaviour. In this sense, attitudes, subjective norm and PBC will be positively related to intention, with the exception of the moral norm whose theoretical proposition determines that the professional, by giving priority to his or her commitment to the patient decreases his personal intention to comply. As Ajzen considers in his work (e.g. 1991) the intention will, then, be the immediate antecedent of behaviour playing as a mediator between its predictors and hand hygiene compliance.

6.2.3 The impact of team safety climate on HCPs' compliance behaviour: the role of the vulnerability perception in a multi-level moderation model

Literature regarding safety climate has been proliferate in referring to the association of this variable with professionals' safety behaviours (e.g. Silva, Lima & Batista, 2004; Zohar, 2003). A strong safety climate where professionals perceive that safety priority is valued in the workplace environment will contribute to professionals' developing more safety behaviours (Clarke, 2006). In this sense, safety climate is an organisational component that promotes employee commitment by increasing their involvement in safety (Clarke, 2006). To that end, organisations must promote

environments able to shape positive safety perceptions in their professionals in order to motivate employees to comply with safe working practices and to participate in safety activities (Griffin & Neal, 2000; Neal & Griffin, 2006).

By taking into account this theoretical assumption in the given model we also expect that team safety climate to be related with individual level hand hygiene compliance. It is expected that this link between climate perceptions and compliance will be expressed by a positive relationship which translates that the higher the perceptions of safety climate, the greater the tendency for professionals' individual compliance increase (β_{m1} in Figure 6.1). According to several studies in the field of infection control, safety climate is positively correlated with infection control compliance. Results indicate that professionals who perceived a strong safety climate in their healthcare organisation were over two and a half times more likely to be fully compliant with infection control procedures when compared to those who did not perceive strong climate perceptions (e.g. DeJoy et al, 2000; Gershon et al., 1994; Gershon et al, 1995; Grosh at al., 1999; Hofmann et al., 2003).

In addition, connected to the safety climate literature and compliance behaviours is the research focused on vulnerability perception. This subjective evaluation that professionals make about the degree of a potential threat occurring may influence the way professionals behave in their workplace (Lima, Barnett, Vala, 2005). In fact, according to Rundmo (1997) vulnerability perception is relevant to safety due to its impact on employees' behaviour (β_{m2} in Figure 6.1); consequently, the behaviour can influence the probability of that employee incur in an accident. However, the prevailing body of literature on vulnerability perception reinforces the idea that the way this variable exerts influence on behaviour can be complex because it can, in some situations, promote risky or non-compliant behaviours (e.g. Lima, Barnett, Vala, 2005; Rundmo, 2000). One possible explanation could be that employees who are continuously exposed to risky daily practices normalize the threat which can contribute to decrease their sense of vulnerability or the likelihood of being exposed to the hazard. In the end, that threat normalization contributes to decrease the employee tendency to comply with safety practices (e.g. Lima, Barnett, Vala, 2005).

Nevertheless, vulnerability perception, besides the complex impact that has on behaviour, is not a unique predictor of behaviour itself as it exerts its influence through a joint action of other variables by constituting mediation and/ or moderation models

that help to explain safety behaviours (e.g. Green & Kreuter, 1999; Rundmo, 1997). In this sense, our theoretical model determines a translevel relationship between team safety climate, vulnerability perception and hand hygiene compliance. This translevel link expresses that the relationship between team safety climate and hand hygiene compliance is moderated by an individual level variable, namely vulnerability perception (β_{m1*2} in Figure 6.1). According to Gilbert, Stafford, Crosby, Fleming & Gaynes (2010) HCPs underestimate their personal vulnerability perception, despite the prevailing workplace risks, developing a sense of perceived invulnerability that contributes to non-compliance with preventive practices such as hand hygiene. Thus, it can be argued that a positive safety climate will promote HCPs' compliance with hand hygiene in particular when these professionals present a higher vulnerability perception that reflects an accurate perception of the likelihood of acquiring and/ or transmitting an infection.

In the next section, the methodological characteristics underlying the study of this multi-level mediation and moderation model are presented providing an empirical analysis of the relationships between team safety climate, the TPB behavioural intention predictors, hand hygiene compliance and vulnerability perception.

6.2.4 Method

6.2.4.1 Participants and procedure

Data for this study was collected in one Portuguese public hospital, which employed team-based workers across medical wards. Teams in this organisation were recognizable work units that cooperate, as a collective, for the care of patients in their specific medical ward, designated as care-delivery teams. Self-administered questionnaires were given to the hospital Infection Control Committee that guaranteed its distribution by healthcare professionals according to their team membership in each ward. Forty-two care delivery teams (550 healthcare professionals) representing 19 medical wards participated in the study. The majority of respondents were female (72.2%) and the average age was 35.4 years. Among healthcare professionals, 42.9% were nurses, 35.5% physicians and only 21.6% were cleaners. All respondents worked in mixed teams composed of all those professional categories. Sixty-seven percent of these professionals had prior training in hand hygiene.

6.2.4.2 Instrument

Individual level TPB variables

Behavioural intention predictors and intention to comply were measured with items derived from the study of Ajzen, Brown & Carvahal (2004). A 7 point-Likert scale anchored by strongly disagree and strongly agree was used. Attitudes were assessed with 3 items asking respondents to evaluate the relevance of performing safety behaviours, for example 'Hand hygiene is a beneficial technique for me and for the patient' (Cronbach's $\alpha = .90$). Subjective norms were assessed with 3 items, asking respondents to analyse the importance of team colleagues for their personal compliance with hand hygiene, for example, 'Team colleagues' approval of my hand hygiene compliance is important to me' (Cronbach's $\alpha = .85$). Perceived behavioural control was assessed with 3 items, asking respondents to indicate the extent to which they consider hand hygiene compliance is an easy behaviour to perform, for example 'I consider that I control hand hygiene technique' (Cronbach's $\alpha = .84$). Intention to comply was assessed with 3 items, asking respondents to indicate their future intention to comply with the required behaviour, for example 'I intend to comply with hand hygiene in every situation where this procedure is required' (Cronbach's $\alpha = .88$). Finally, hand hygiene compliance behaviour was also measured with 3 items, asking respondents to report how they behave after performing routine and invasive procedures, for example 'I always wash my hands with soap and water after performing an invasive procedure' (Cronbach's $\alpha = .87$).

Individual level additional predictors

The moral norm was included as an additional behavioural intention predictor to the TPB normative component and was measured with items derived from the work of Biel & Thogersen (2007) and Godin, Conner & Sheeran (2005). A 7 point-Likert scale anchored by strongly disagree and strongly agree was used. This norm was assessed with 3 items asking respondents to evaluate the importance of giving priority to the HCP commitment to the patient in both routine and invasive procedures despite the relevance of hand hygiene. An item example is 'I consider my personal commitment towards the patient more important than hand hygiene' (Cronbach's $\alpha = .87$).

Vulnerability perception was measured with items adapted from the work of Lima (1998; 1999) and Rundmo (1997). This perception was also assessed with 3 items

asking respondents to evaluate the extent to which they consider hand hygiene protects them from acquiring hospital infections, for example, 'Hand hygiene compliance protects me from acquiring a cross infection' (Cronbach's $\alpha = .87$). A 7 point-Likert scale anchored by strongly disagree and strongly agree was applied.

Team safety climate

This construct was measured by aggregating the individual scores of healthcare professionals about their perception of safety priority given to infection control procedures in their team. According to Chan's (1998) typology of composition models, this method is referred to as a 'direct-consensus model' and its main characteristic is the extent to which team members can be seen as a whole (Chan, 1998). Safety climate perceptions were assessed with 4 items adapted from Zohar (2000). For example, 'In my team we can make suggestions for improving hand hygiene compliance'. A 7-point Likert scale anchored by strongly disagree and strongly agree was used (Cronbach's $\alpha = .84$).

6.2.4.3 Analyses

Documental analyses

In order to characterize the incidence of nosocomial infections and to analyse HCPs' compliance with hand hygiene, official data were considered and the hospital records regarding infection control issues were used to perform a documental analysis. Documental analysis is characterized as a source of data collection limited to documents, written or otherwise, known as primary sources (Lakatos & Marconi, 1991). In this study, we conducted the procedure in order to achieve a contextual understanding of hand hygiene practices among hospital professionals.

Data collection was focused on the documents provided by the hospital Infection Control Committee, whose mission is to help reduce the spread of infectious pathology by increasing compliance with safety procedures, especially hand hygiene. The documents included an audit report of hand hygiene compliance, and a hospital prevalence survey on nosocomial infections. The information reported in these documents was collected by the Infection Control Committee in 2006 and 2009, respectively and was the only information available for analysis.

Content and discriminant validity

To verify whether respondents had been able to differentiate between all constructs under analysis, we first employed Principal Component Analysis (PCA) with varimax rotation as an exploratory tool to uncover unknown trends between components and reduce data dimensionality. An eigenvalue greater than 1 was set as the criterion for selecting components. The PCA produced the hypothesized eight components (KMO = .76, $p < .001$) that explained 78% of the variance in the correlation matrix. However, after analysing items communalities and loadings, the fourth item of safety climate presented some dubious ability to discriminate. The item was 'In my team we pay attention when a colleague violates hand hygiene compliance' and presented a communality value of 0.44 putting at risk safety climate content validity. This result was taken into account while performing Confirmatory Factor Analysis using AMOS 18.0 (see Appendix D)

After analysing the exploratory results, our aim was to identify the specific number of factors and variable loadings in order to understand how well the given factors captured the covariance between the 25 items presented. Also, due to interconnections between items used to measure safety climate perceptions and the subjective norm we intend to focus on whether HCPs were able to differentiate between these two constructs (John & Benet-Martínez, 2000). Since the exploratory analysis carried out by PCA identified that the fourth safety climate item was the least discriminant among the other three, we also examined two sorts of models to test safety climate content validity, one in which safety climate was measured with the original scale items, and a second one, where the fourth item was excluded. Finally, in order to test the discriminant validity paths among the eight constructs we compared a single-factor model with a seven and eight factors solution.

Results presented in Table 6.1 show that the eight-factor model, where the fourth item for safety climate was excluded, fitted our data significantly better than the eight-factor model in which all safety climate items were included (see Appendix E). Furthermore, this model (CFI = 0.96, RMSEA = 0.04, $\chi^2 = 509.29$) also offered a significantly better fit than the seven-factor model (CFI = 0.85, RMSEA = 0.09, $\chi^2 = 1386.7$) and the one-factor solution (CFI = 0.23, RMSEA = 0.19, $\chi^2 = 6108.0$). This confirms that, although related to each other, team safety climate and subjective norm

are conceptually distinct and that respondents were able to differentiate among the proposed eight factors.

Table 6.1. Goodness-of-fit-measures for CFA models

Model	χ^2	*Df*	χ^2/df	ECVI	AIC	RMSEA	RMR	CFI	NFI
1-factor	3205.86**	104	30.83**	5.96	3269.86	0.23	0.19	0.33	0.32
7-factor	983.10**	98	10.03**	1.93	1059.10	0.13	0.12	0.81	0.79
8-factor 4 safety climate items	291.55**	94	3.10**	0.68	375.55	0.06	0.05	0.96	0.94
3 safety climate items	207.39**	80	2.59**	0.52	287.39	0.05	0.04	0.97	0.95

** p < .001; * p < .05

Table 6.2 presents individual and team level scale scores, standard deviations and correlation coefficients for all measures in our study.

Table 6.2. Descriptive statistics for TPB variables, team safety climate and vulnerability perception

	Mean	SD	1	2	3	4	5	6	7
1 Attitudes	5.16	1.01							
2 Subjective Norm	5.10	0.97	0.03						
3 PBC	5.57	0.84	0.12**	0.17**					
4 Moral Norm	5.31	1.15	-0.17**	0.25**	-0.13**				
5 Intention	5.60	0.88	0.42**	0.22**	0.22**	-0.20**			
6 Behaviour	5.38	1.06	0.29**	0.21**	0.18**	-0.22**	0.22**		
7 Team Safety Climate	4.53	0.39	0.11*	0.13**	0.12**	0.02	0.13**	0.10*	
8 Vulnerability Perception	5.61	1.21	- 0.06	0.18**	-0.02	-0.01	-0.06	0.04	0.02

** p <.001; * p <.05

6.2.5 Multi-level

Multi-level models specify the hierarchical structure of the variables presented in a study, determining that units grouped at the individual level will be combined in higher level units (Hox, 1995). For those who work in the organisational field, multi-level modeling offers several benefits because it refers to the relationships between levels of analysis (Heck & Thomas, 2009). In this sense, individuals bring their skills and attitudes to the workplace (individual level), they are clustered in departments or

work units having certain characteristics (group level), and they are also clustered within organisations having particular specificities (organisational level), (Heck & Thomas, 2009). The use of the term "multi-level model" is related to two separate statistical objectives: one concerns inferences made about a model's structural parameters; the other, concerns inferences about unknown variance parameters in the model (Morris, 1995).

The first objective encourages researchers to model variability in means and slope effects across a set of groups or organisations. In a single-level linear model, the coefficients describing the intercept and slope are generally considered as fixed values in the population estimated from the sample data (Heck & Thomas, 2009). Yet, in a multi-level model, both intercept and slope can be defined to vary as probability distributions across the set units (Heck & Thomas, 2009). Turning to the second objective, unlike single-level Ordinary Least Squares regression, where random errors are assumed to be independent, in multi-level formulations random error is more complex (Heck & Thomas, 2009). Actually, in multi-level formulations the individual-level errors are dependent within each unit because they are common to every individual within that unit. Besides that, the errors do not have constant variance because the residual errors components describing intercepts and slopes can also vary across units (Heck & Thomas, 2009; Raudenbush & Bryk, 2002). In other words, the primary difference between traditional regression and multi-level regression is that, in the latter, the researcher conceptualizes the overall data structure differently, acknowledging the existence of higher level units in which lower levels units are nested (Heck & Thomas, 2009).

In its simplest form, the level-1 model is equivalent to a traditional regression model. Rather than estimating parameters across all N cases in the data set, however, the level-1 model is used to produce estimates within each level-2 unit, j, in the data (Heck & Thomas, 2009). As in an ordinary regression, the same model is assumed to be appropriate for all higher level units. However, the multi-level approach yields a potentially different set of estimates for each level-2 unit. The level-1 model appears as:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{1j} + \varepsilon_{ij}$$

In this level-1 equation Y_{ij} is the observation for the *i*th individual in level-2 unit *j,* β_{0j} is the level-1 intercept within unit *j*, β_{1j} is a level-1 slope within unit j, and ε_{ij} is the

error for individual *i* in unit *j* (Heck & Thomas, 2009). If sufficient variation exists within and between the level-2 units, this model can yield a different set of estimates of β_{0j} and β_{1j} for each level-2 unit. Within each level-2 unit, ε_{ij} is supposed to have a mean of 0 and constant variance across all levels of X_{1j}.

Assuming this level-1 model with one predictor, X_1, the level-2 models would appear as:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}Z_j + \upsilon_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}Z_j + \upsilon_{1j}$$

In these equations, β_{oj} is the level-1 intercept in level-2 unit *j*; γ_{00} is the mean value of the level-1 outcome, controlling for the level-2 predictor, Z_j; γ_{01} is the slope for the level-2 variable Z_j; υ_{0j} is the error for the unit *j*; β_{1j} is the level-1 intercept in level-2 unit *j*; γ_{10} is the mean value of the level-1 outcome, controlling for the level-2 predictor, Z_j; γ_{11} is the slope for the level-2 variable Z_j; and, υ_{1j} is the error for unit *j* (Heck & Thomas, 2009).

In contrast with level-1 outcomes, which are based on N individual-level observations, the level-2 estimates are based on *j* unit-level observations. Because the level-2 outcomes β_{oj} and β_{1j} are not observed (but estimated from level-1 data), it is not possible to estimate these level-2 equations directly. In this sense, this single system of equations is integrated in one global equation:

$$Y_{ij} = (\gamma_{00} + \gamma_{01}Z_j + \upsilon_{0j}) + (\gamma_{10} + \gamma_{11}Z_j + \upsilon_{1j})\, X_{1j} + \varepsilon_{ij}$$

$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{1j} + \gamma_{01}Z_j + \gamma_{11}Z_j\, X_{1j} + \upsilon_{1j}\, X_{1j} + \upsilon_{0j} + \varepsilon_{ij}$$

By taking into account these two equations representing level-2 it is possible to identify the term $\gamma_{11}Z_j\, X_{1j}$ which represents a cross-level interaction between level-1 and level-2 variables. Finally, it is possible to identify a more complex error term $\upsilon_{1j}\, X_{1j} + \upsilon_{0j} + \varepsilon_{ij}$. This error term accommodates the relationship between υ_{1j} and υ_{0j} which are common to every level-1 observation within each level-2 unit (Heck & Thomas, 2009).

6.2.5.1 The lower level mediation models

According to Bauer, Preacher & Gil, 2006 our model aims to test two types of mediations designed of lower level mediations (the mediator is located at level 1), one of upper level effect (the predictor is located at level 2) representing the multi-level link

between team safety climate and TPB behavioural intention predictors; and another one of lower level effect (the predictor is located at level 1), focusing on the path between behavioural intention predictors and hand hygiene behaviour.

Because the first lower level mediation of upper level effect focus on two levels of analysis, team and individual level data could not be adequately addressed by single-level analyses. Moreover, traditional single-level mediation analyses (Baron & Kenny, 1986) on nested data might produce biased standard errors (Krull & MacKinnon, 2001). Therefore, in order to estimate this first lower level mediation we used multi-level regression procedures for assessing mediated relationships. The multi-level model for our study is displayed in Figure 6.1. In the figure, the coefficients representing the relationship between team safety climate and the mediators are marked with the subscript 'a', those representing the relationship between mediators and intention with 'b' and the direct relationship between team safety climate and intention is marked with 'c'.

The mediated relationships were estimated with several regression equations, based on the procedure proposed by Krull & Mackinnon (2001). The regression equations were estimated using LISREL 8.8, a specialized statistical package for multi-level modeling.

Krull & MacKinnon (2001) described a method to perform multi-level mediations derived from the traditional mediation regression equations (Baron & Kenny, 1986) in order to provide information on the relative contribution of multiple mediators on the mediated effect, which is problematic due to our proposed model. This method involves a first equation in which the mediator for the individual *i* (M_i) is regressed on the independent variable, and a second equation where the dependent variable (Y_i) is predicted by the independent variable and the mediator. The mediation will be confirmed if β_a and β_b are significant, and the mediated effect is defined as the product of β_a, β_b and $\beta_{c'}$.

Krull & MacKinnon (2001) demonstrated that these equations may be used as multi-level equations and can estimate the mediated effects of attitudes, subjective norms and perceived behavioral control. The β_a and β_b mediated effects were obtained by the partial regression coefficients, i.e., by controlling the effects of other mediators in the dependent variable (Cohen & Cohen, 1983). The multi-level mediation in our study is represented by X_j referring to team safety climate; M_{1ij}, M_{2ij} and M_{3ij} represent our

individual-level mediators, namely attitudes, subjective norm and perceived behavioural control; finally, Y_{ij} refers to healthcare professionals' intention to comply with hand hygiene. The indices *i* and *j* refer to individuals and teams, respectively. Three multi-level regressions were computed to verify if mediators are predicted by team safety climate. The equations that predicted the subjective norm and perceived behavioural control were estimated twice, the second time controlling for attitudes (M_{1ij}).

Turning into intention, this dependent variable was regressed on team safety climate and its mediators. The difference between a traditional mediation model and this multi-level one arises from the presence of the random model, meaning that with this method, the direct link between team safety climate and the dependent variable is not estimated separately (Mierlo, Rutte, Vermunt, Kompier, Doorewaard, 2007).

In our second mediation model, the one of lower level effect, like in any other lower level mediation the causal effects can be random. In the first case some predictors reside at level 1 (the effect of the mediators on the outcome), but in this lower level mediation of lower level effect all three level effects can be random because they are all located at level 1 which represents heterogeneity (Bauer, Preacher & Gil, 2006). Despite the fact that it symbolizes a causal chain at level 1 it still indicates a multi-level phenomenon because the sample consists of HCPs from several care-delivery teams (i.e. level-2 units) and the unit-level relationships may be distinct from the given individual level relationships (Klein & Kozlowski, 2000). In the end, this mediation mechanism is represented by the effect of individual level behavioural intention predictors (a level-1 antecedent) on HCPs' hand hygiene compliance behaviour (a level-1 outcome) through intention to comply (a level-1 mediator) in a sample of multiple care-delivery teams expected to be different among each other.

According to Kenny, Korchmaros & Bolger (2003) the randomness of the lower level effects of 1-1-1 models is particularly important and must be taken into account when integrated in a multi-level random coefficient regression framework (Raudenbush, 2001a, 2001b). Due to the fact that we are dealing with a different type of mediation where we only have one mediator and all variables are located at level-1, in this particular case we applied the method developed by Kenny et al. (2003) which is an extended application of the Baron & Kenny (1986) procedure and is described in four statistical criteria in order to establish the mediation.

This method is a specific procedure applied in the multi-level framework to a lower level mediation of lower level effect (Kenny, Korchmaros & Bolger, 2003). Here, we first tested the predictor variable in the mediator (path *a*). This first path will be already given by the path *b* of the previous mediation model. However, we decided to compute this path again because on the first occasion attitudes, subjective norm and PBC are going to be the mediators (and are now the predictors) and will be simultaneously regressed with the level-2 predictor which is team safety climate. To that end, the value of their β coefficients will also take into account the variance emerging from a predictor located at a different level of analysis, which is not what we are trying to test in this second mediation model.

Obviously, if the lower level mediation of upper level effect is confirmed that will signify that the role of the intention predictors will have a predictive weight arising from both levels, as well as intention. Nevertheless, we intend to present both results, with and without the indirect influence of level-2 predictors in order to be faithful to the sense of a mediation of lower level effect where all variables are located at level-1. The second step was to test the predictor in the outcome (path *c*). In the third step the outcome is simultaneously regressed on the predictor and the mediator, and the mediator must be significantly related to the outcome (path *b*). Finally, in the fourth step the relationship between the predictor and the outcome with the mediator in the regression equation (path *c'*) must be significantly attenuated compared to when the outcome was regressed only on the predictor (path *c*) (Kenny, Korchmaros & Bolger, 2003).

The main difference of this procedure from the previous one referring to the mediation model is the fact that *a* and *b* coefficients can vary only at level-1 units, which means that the *a* and *b* coefficients may covary and the estimate of the indirect effect will no longer reflect the product of *a x b* but instead the $a \times b + \tau_{a,b}$ where $\tau_{a,b}$ is the level-2 covariance between the two random effects. This covariance term needs to be added to *a x b* when both *a* and *b* slopes are random. In this sense, the total effect of the mediation will be given by the formula: total effect = *ab* + *c'* + the covariance between *a* and *b* (Preacher & Selig, 2010). This was not necessary in the first mediation model because the predictor accounted for an upper level effect and had brought into consideration the within and between group relationship (e.g. Bauer et al, 2006; Preacher & Selig, 2010).

Finally, it should also be mentioned that in both cases grand-mean centering was applied to all variables. This type of centering produces an intercept that provides an adjustment to the cluster means for the relevant explanatory variable and tends to reduce the correlation between intercept and slope estimates across groups, reducing the presence of multicollinearity (Thomas & Heck, 2009).

6.2.5.2 Cross-level interaction model

A cross-level interaction model reports the modification of the strength of a causal link between two variables by a moderator particularly located in distinct levels of analysis (Klein & Kozlowski, 2000). Cross-level effects increase, decrease or do not affect the strength of the within-group slope coefficient (Heck & Thomas, pp. 146, 2009). According to Hoffman & Gravin (1998) when a cross-level interaction is tested, the best centering choice for the level-1 variable, in this case, vulnerability perception, is group-mean because it provides the most reliable estimate of the within-group slope, which means that contrary to grand-mean centering that is acceptable for meditational models, group-mean centered variables have any between-group effects removed. In this sense, group-mean puts the attention on how particular group contexts may afford relational advantages to some individuals because focus on individuals' relational positions within their particular cluster, or group (Heck & Thomas, 2009).

In order to test the cross-level interaction model we took into account Bryk & Raudenbush (2002) and Bryk, Raudenbush, & Congdon (1996) work about multi-level moderation levels. In this sense, we performed three multi-level regression models to take into consideration the effects of the team safety climate, vulnerability perception and the interaction term between team safety climate and vulnerability perception in order to evaluate its impact on hand hygiene compliance. *Model 1* depicts the impact of team safety climate only. *Model 2* includes vulnerability perception as an additional predictor of hand hygiene compliance. *Model 3* differs from *Model 2* in that it includes the interaction term at both the individual (vulnerability perception) and group levels (team safety climate) and analyses its impact on hand hygiene compliance. For moderation to occur the causal link between team safety climate and hand hygiene compliance will decrease and the moderation term will reach a significant value, meaning that the effect of team safety climate on hand hygiene compliance changes

when vulnerability perception has a particular value (Bryk et al, 1996; Baron & Kenny, 1986).

6.2.6 Hypotheses

Based on the mediation and cross-level models depicted in Figure 6.1 we are able to establish several hypotheses. Turning into the proposed relationships we expect that a positive safety climate will be related to attitudes, subjective norm and perceived behavioural control. A positive team safety climate allows their professionals to develop positive attitudes towards safety, to support each other when compliance is needed and to overcome workplace constraints, which will result in increased intention to comply with hand hygiene. With TPB behavioural intention predictors as mediators, we expect that the larger the extent to which team safety climate is transferred to HCPs' attitudes, subjective norms and perceived behavioural control, the more these professionals will intend to perform hand hygiene.

The meditational model of lower level effect represents a group of relationships that tries to establish the significance of the intention as an immediate antecedent of hand hygiene behaviour. To that end, we expect that positive attitudes towards hand hygiene, a favourable perception of support of relevant social referents and the ease of performing this procedure will not only be positively related to HCPs' intention to comply but also predict intention to perform this behaviour. However, because we extended the TPB normative component with the inclusion of the moral norm as an internalized moral rule, we expect that this norm will be negatively associated with intention, in that the higher its manifestation, the lower the intention to comply. The influence of these predictors on intention will contribute to strengthen its ability to become a mediator between them and hand hygiene behaviour.

Finally, the model also presents the cross-level relationship where it is possible to identify moderation between team safety climate, vulnerability perception and hand hygiene behaviour. In this particular case, our hypothesis is that a strong, positive safety climate will enhance HCPs' compliance with hand hygiene. This relationship will be expressed by a positive association between both variables. However, we add to this link an effect provoked by vulnerability perception. Here, we expect that the association between team safety climate and hand hygiene compliance will be particularly stronger when vulnerability perception is high among HCPs. The fact that these professionals

have an accurate sense of vulnerability towards the possibility of acquiring or transmitting an infection will contribute to strengthen the causal link previously established by safety climate perceptions and compliance.

6.2.7 Results

6.2.7.1 Documental analysis

In 2006 the hospital Infection Control Committee performed an audit of hand hygiene compliance, whose sample comprised 973 HCPs, of whom 52.3% were nurses, 24.7% were cleaners, 14.9% were physicians and 7.8% were technicians. Around 80.6% were female and 17.9% were male. Approximately 38.4% were aged between 23 and 33 years. Sixty-four percent work in shifts and 43.5% have from 2 to 10 years of work experience. Finally, 65.3% of the respondents confirmed that they have received hand hygiene training within the institution; conversely, 33.5% referred to the fact that they had no training at all.

Turning to these professionals' knowledge about hand hygiene practices, the results of this survey highlighted that 98% of the participants considered that their hands were the most common vehicle of nosocomial transmission, and that hand hygiene was the simplest precaution for the prevention of these infections. In fact, approximately 84.8% of the HCPs' stated that the main reason for the practice of good hand hygiene is to prevent infections that patients acquire in the hospital facilities.

Regarding the frequency of self-reported compliance with hand hygiene, 44.8% of the respondents considered that they usually wash their hands after touching a patient's skin; while, only 30.7% of their colleagues were seen as usual compliers after touching a patient or a contaminated surface. However, 69.7% of participants did not know when to use the antiseptic solution. Observational data was also collected and results were incongruent with the self-reported compliance behaviour. In general, compliance rates were only around 35%.

Turning into the equipment availability, 89.5% of respondents considered the infection control equipment appropriate to their clinical needs. Also, 83.7% stated that there was no disruption in the material.

Finally, several questions covered the Infection Control Committee policies regarding hand hygiene. For instance, 54.1% knew the Committee policy of antiseptics and disinfectants, but only 50% of the professionals considered that this policy has been

discussed with them. In fact, 44% respondents referred to the fact that the existing protocol procedure for hand cleansing was not debated by professionals. Similarly, 48.1% reported that they were not aware of the development of complementary measures on hand hygiene by the Infection Control Committee.

In 2009, a hospital prevalence survey on nosocomial infections analysed 544 patients, of whom 53% were female and 47% were male (mean age 53 years). The results identified 52 nosocomial infections, which corresponded to a prevalence rate of 9.5%. Hospital wards with higher nosocomial incidence were the Intensive Care Unit (39.1%) and the Medicine Unit (15.4%), while the Emergency Room and other hospital services (e.g. psychiatry) presented low rates of nosocomial infections (4.5%). The most frequent infections were urinary tract infections (36.5%) and respiratory infections (30.8%). Also, the most affected patients were those who were at least 50 years (6.8%); although there were other important peaks of incidence with different age groups, such as patients of 10-19 years (0.18%) and 30-39 years (1.1%). Finally, the longer the length of stay of patients, the greater their chances of acquiring a nosocomial infection, particularly for patients with a hospital stay between 8 and 30 days (4.4%).

In conclusion, these results demonstrated that the HCPs surveyed were aware of the main reasons leading to the need for hand hygiene; nevertheless, most professionals did not understand the specific situations where it was necessary to use anti-septic solutions to clean hands. This is an interesting point, even more when the majority of respondents admitted having had hand hygiene training. Furthermore, professionals overestimated their self-reported compliance when compared to observational data. Finally, the data collected in the hospital prevalence survey on nosocomial infections is consistent with the information provided by the WHO concerning nosocomial infections.

6.2.7.2 Data aggregation: within group consistency and between group differences

In order to verify if team members in the sample agreed to a substantial extent on safety climate perceptions of their team, we examined several indicators of within group consensus: the R_{wg} index of within-group agreement (James, Demaree, & Wolf, 1984) and the intra-class correlation coefficients ICC1 (Bliese, 2000; Bryk & Raudenbush, 1992) and ICC2 (Bartko, 1976; Bliese, 2000). The R_{wg} values for our measure of team

safety climate were high ranging from a minimum of .73 and a maximum of .98, with an average value of .89 indicating substantial agreement among team members. Dunlap, Burke & Smith-Crowe (2003) proposed critical values for R_{wg} index for combinations of units sample size and number of scale categories. In our sample, the Likert scale we used to measure respondents' level of agreement had 7 categories which combined to each team dimension allowed us to verify that observed values were all greater than those proposed by Dunlap et al. (2003), therefore, reaching a 5% level of statistical significance. With this result, we can conclude that it is possible to aggregate the individual perceptions of healthcare professionals regarding safety climate in an indicator that reflects a team level perception due to the presence of a high degree of consensus among respondents.

In order to estimate ICC coefficients we, first, calculated an ANOVA, in which the variable *"Team"* was included as an independent variable and individual *"Safety Climate"* perceptions as the dependent one. The result obtained F (41, 508) = 3.279, p <.001 was significant and denotes that group membership has an impact on the way safety climate perceptions are expressed by healthcare professionals. Next, we calculated the ICC (1), which results from comparing the between and within-groups variance. ICC1 was .15, indicating that group membership explained a relative part of the variance in the responses; in this case, it may be concluded that 15% of the proportion of total variance was found due to the differences between teams (Bliese, 2000). ICC (2) was .69, indicating an acceptable reliability of the group means (Klein & Kozlowski, 2000). Together, these indices provided sufficient justification for aggregation of individual safety climate responses to the team level.

6.2.7.3 Lower level mediation of upper level effect

To estimate the mediated relationships in the model, we first regressed each mediator (M_{ij}) separately on team safety climate (X_j) (e.g. $M_{1ij} = \beta_{01} + \beta_{a1}X_j + r_{ij1} + u_{0j1}$). Next, we regressed the criterion variable (Y_{ij}) on team safety climate and the three mediators simultaneously ($Y_{ij} = \beta_{1oY} + \beta_{c1}X_j + \beta_{b11}M_{1ij} + \beta_{b21}M_{2ij} + \beta_{b31}M_{3ij} + r_{1ijY} + u_{1oYj}$). Mediation is implied if both β_a and β_b are significant, that is, if team safety climate is significantly related to the mediator and the mediators are significantly related to intention. The mediated contribution is defined as the product of β_a, β_b and $\beta_{c'}$. Table 6.3 displays standardized β-coefficients and ICC for our complete research model. The

ICC or Intraclass Correlation represents a measure of within-level-2-unit dependence and is calculated by taking into account the variance components (error) from level-1 and level-2. The value given by the ICC represents the percentage of the total variance in the outcome variable that is associated with teams as opposed to individuals.

The first step, regressing each mediator separately and directly on team safety climate, yielded standardized β_a estimates of 0.55 ($p < .001$) for attitudes, 0.29 ($p < .001$) for subjective norm and 0.22 ($p < .001$) for perceived behavioural control (unidirectional tests). As we expected, these results suggest that team safety climate was positively related to all TPB behavioural intention predictors. Next, in a single regression equation, we estimated the relationship between attitudes, subjective norm and perceived behavioural control on the one hand and intention on the other hand with the inclusion of team safety climate to the multi-level equation regression. Estimates for the standardized β_b coefficients were 0.23 ($p < .001$) for attitudes, 0.08 ($p < .05$) subjective norm and 0.08 ($p < .05$) for perceived behavioural control. As proposed, these results also suggest a positive relationship between the mediators and intention to comply.

Table 6.3. Standardized coefficients and ICC values for lower level mediation of upper level effect

		Criterion Variables			
Predictor Variables	*N*	Attitudes	Subjective Norm	PBC	Intention
Team Safety Climate	42	0.55**	0.29**	0.22**	0.27** (0.45**)
Attitudes	550				0.23**
Subjective Norm	550				0.08*
PBC	550				0.08*
ICC		19%	7%	8%	4%

** p <.001; * p <.05

As can be seen in Figure 6.2, the relationship between team safety climate and intention to comply with hand hygiene was mediated by attitudes, subjective norm and perceived behavioural control, however, despite the fact that the absolute size of the direct effect between team safety climate and intention to comply is reduced after controlling for the three mediator variables, it remains significantly different from zero

(Cohen & Cohen, 1983). This means that the direct relationship between team safety climate and intention to comply shows that, after introducing the mediators into the model, team safety climate remained significant but with a lower standardized contribution suggesting that TPB variables partially mediated the relationship between team safety climate and intention.

We can now estimate the total mediated contribution by multiplying all β-estimates involved in each mediated relationship and then summing the products over all mediated relationships. With regard to intention, the total mediated contribution equaled $(\beta_{a1} * \beta_{b1}) + (\beta_{a2} * \beta_{b2}) + (\beta_{a3} * \beta_{b3}) + (\beta_{c'})$ yielding a mediated contribution of 0.44. In this sense, the multi-level mediation model explains around 44% of the variance in healthcare professionals' intention to comply with hand hygiene.

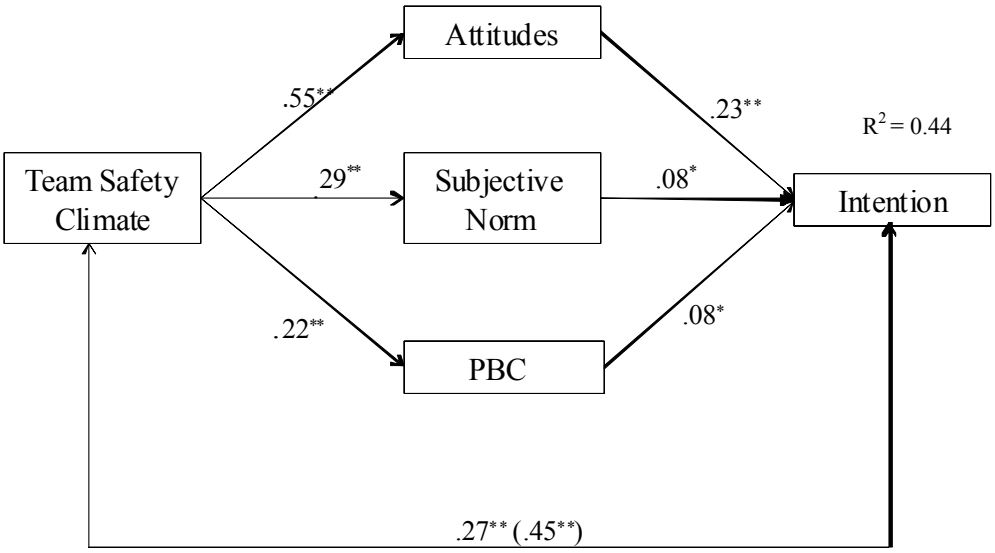


Figure 6.2 Lower level mediation of upper level effect

6.2.7.4 Lower level mediation of lower level effect

In order to test this mediation model we computed two types of regression. First, we regressed the mediator (i.e. intention) on the predictors (i.e. attitudes, subjective norm, PBC and moral norm) which corresponds to the given equation $M_{ij} = \beta_{Mj} + \beta_{1j}X_{ij1} + \beta_{2j}X_{ij2} + \beta_{3j}X_{ij3} + \beta_{4j}X_{ij4} + e_{Mij1} + e_{Mij2} + e_{Mij3} + e_{Mij4}$. After that, we estimated the relationship of the predictors and the mediator on hand hygiene behaviour corresponding to the equation $Y_{ij} = \beta_{Yj} + \beta_{j1Mij1} + \beta_{j2Mij2} + \beta_{j3Mij3} + \beta_{j4Mij4} + c'_j X_{ij} + e_{Yij}$.. In this case, the terms e_{Mij} and e_{Yij} correspond to level-1 residuals for the mediator and

the outcome variables respectively. The other terms can be interpreted in a similar way to the intercepts and slopes of any traditional regression model, with the exception that each coefficient is random, meaning that the value of the coefficient varies across level 2 units. That is indicated by the fact that the *j* subscript is included in all the terms. The intercepts for M and Y are designated β_{Mj} and β_{Yj} respectively, while the effect of X on M is designated $\beta_{j,}$ the effect of M on Y is designated $\beta_{j,}$ and the direct effect of X on Y is designated c'_j. The fact that we are looking into random effects of the model allows heterogeneity in the causal effects (Bauer et al. 2006, pp. 144).

The first step, regressing the intention to comply directly on its predictors, yielded standardized β_a estimates of 0.35 ($p < .001$) for attitudes, 0.16 ($p < .001$) for subjective norm, 0.14 ($p < .001$) for perceived behavioural control, and - 0.02 for moral norm. As we hypothesized, these results suggest that traditional TPB behavioural intention predictors are all positively related with intention to comply. However, the moral norm, contrary to our expectations was not a significant predictor of intention. In this model the explained variance is 24%. If we compare these results with those given by the path b from the first mediation model, we can verify that the predictive ability of each variable increased slightly without taking into account the simultaneous impact of team safety climate. This means that having attitudes, subjective norm and PBC as mediators between team safety climate and intention decreases its level-1 impact, when compared to an analysis where these variables are solely contributing to intention. Notwithstanding, results are similar and the relevance of the variables as main contributors continues as was previously stated. Table 6.4 presents the results.

In the next step, we performed a single regression equation to estimate the relationship between intention and hand hygiene compliance with the inclusion of attitudes, subjective norm, PBC and moral norm to the multi-level equation regression. Estimates for the standardized β_b coefficient was 0.05 for intention, while $\beta_{c'}$ estimates presented values of 0.26 ($p < .001$) for attitudes, 0.17 ($p < .001$) for subjective norm, 0.11 ($p < .05$) for PBC and - 0.12 ($p < .05$) for moral norm.

Contrary to our hypotheses, these results indicate that the intention to comply is not the immediate antecedent of hand hygiene behaviour in the proposed model despite the fact that it is predicted by attitudes, subjective norm and PBC. However, all behavioural intention predictors including the moral norm have an impact on hand hygiene compliance, with the moral norm exerting a negative influence on it. In this

model the explained variance is 15%. In this case, the lower level mediation model of lower level effect was not confirmed due to the fact that the β_b coefficient representing the link between the mediator and the behaviour was not significant.

Table 6.4. Standardized coefficients and explained variance for lower level mediation of lower level effect

Predictor Variables	*N*	Intention	Behaviour
Teams	42		
Attitudes	550	0.35**	0.26**
Subjective Norm	550	0.16**	0.17**
PBC	550	0.14**	0.11*
Moral Norm	550	-0.02	-0.12*
Intention	550		0.05 (0.09)
R^2		0.24	0.15

** p <.001; * p <.05

6.2.7.5 Cross-level model

To estimate the multi-level moderation, we formulated two hypotheses, namely, that the vulnerability perception was going to moderate the positive relationship between team safety climate and hand hygiene compliance in a way that this relationship will become stronger, the higher the individual vulnerability perception will become.

The regression equation that translates the level-1 model is represented by $Y_{ij} = \beta_{0j} + \beta_1 X_{ij} + e_{ij}$ while the regression that focus on level-2 is represented by $\beta_{0j} = \gamma_{00} + \gamma_{01} X_{j1} + \gamma_{02} Z_{ij2} + \upsilon_{0j} + r_{ij.}$ Finally, the single equation model results in $Y_{ij} = \gamma_{00} + \gamma_{10} X_{1j} + \gamma_{01} Z_{ij} + \gamma_{11} Z_j X_{1ij} + \upsilon_{1j} X_{1j} + \upsilon_{0j} + e_{ij.}$ At the individual level, we developed a linear model established to predict hand hygiene compliance based on the individual perceptions of safety climate (i.e. X_{ij}). At the group level, another linear model was designed to relate the intercept parameters as well as the aggregated ratings of the HCPs' climate perceptions and vulnerability perception. The model presented two residuals or errors: the individual level residual (e_{ij}) which measured the difference between actual hand hygiene compliance and expected compliance based on the individual-level model; and, the group level residual υ_{0j} which measured the difference

between the teams' rating of safety climate of members and the teams' expected safety climate rating based on the group-level model.

Because this model reflects a cross-level hypothesis, if the term $\gamma_{10}X_{1j}$ (the impact of the predictor on the outcome) and the term $\gamma_{11}Z_j X_{1ij}$ (the impact of the association between the predictor and the moderator on the outcome) present a significant result we will have a moderation between variables from distinct levels of analysis. Results are presented in Table 6.5 and contrary to our expectations vulnerability perception does not moderates the relationship between team safety climate and hand hygiene compliance. Moreover, vulnerability perception does not have a significant impact on hand hygiene compliance. Notwithstanding, team safety climate appears to influence HCPs' compliance with hand hygiene procedures, corroborating a result consistent with the literature (e.g. Zohar & Luria, 2004). In fact, 24% of the total variance in hand hygiene compliance scores is associated with teams as opposed to individuals.

Table 6.5. Standardized β coefficients and explained variance for cross-level moderation model

		Criterion Variable
Predictor Variables	*N*	Hand Hygiene Compliance
Team Safety Climate	42	0.28**
Vulnerability perception	550	-0.02
Team safety climate*Vulnerability perception		0.04
R^2		0.24

**p <.001; p * <.05

6.2.8 Discussion

The first research goal of this study attempted to examine the interconnections between team safety climate and TPB behavioural intention predictors in order to bridge the gap between the approaches traditionally used to study compliance with infection control procedures. It also tried to analyse the role of intention as immediate antecedent of hand hygiene compliance applying an extended version of the TPB with the inclusion of the moral norm as additional predictor. Finally, it also attempted to provide a clearer picture of the complex contribution that the vulnerability perception has in the literature of compliance behaviours by testing its contribution in a cross-level model as a level-1 moderator variable.

According to the first part of our model, we analysed the proposition that team safety climate has an indirect relationship with HCPs' intention to comply due to the mediated path proposed by attitudes, subjective norm and perceived behavioural control. Attitudes appeared to be the central mediator in this relationship between team safety climate and intention, while subjective norm and perceived behavioural control accounted for a small, yet significant, contribution in the mediation model.

In this sense, these results provide preliminary support to our prediction that safety climate and TPB theoretical assumptions may present specificities that can be integrated in order to study infection control compliance. The hypothesized relationships were all positive indicating that a favourable safety climate reinforces HCPs' compliance, by developing positive evaluations towards safety, by focusing on social referents that reinforce compliance and by overcoming physical barriers that put hand hygiene performance at risk. Statistically, these relationships represented a partial mediation because the indirect effect between team safety climate and intention remained significant.

The second part of our model reported a lower level mediation of lower level effect that despite having all variables at level-1 it also represented a multi-level meditational path due to the fact that these professionals were still nested in teams, meaning that their personal ratings for each value continues to vary across level-2 units. New β paths were computed in order to compare the results with and without the influence of team safety climate, in order to test all predictors at level-1. In this mediation, our aim was to evaluate the role of the intention as an antecedent of the behaviour, in order to test the theoretical assumptions of the TPB (Ajzen, 1991). We expanded the normative component of this theory with the purpose of having a construct representing the moral dimension of hand hygiene compliance identified in previous studies (e.g. Ferguson et al., 2004). Results determined that attitudes, subjective norm and PBC predict HCPs' intention to comply, while the moral norm had no significant influence. Attitudes were the strongest predictor explaining 24% of the variance in intention. Findings indicated that the level-1 contribution of the behavioural intention predictors, without taking into account the influence of team safety climate, was marginally higher. However, the meditational path was not confirmed because the relationship between intention and hand hygiene compliance was not significant. Nonetheless, all behavioural intention predictors had a direct impact on compliance,

including the moral norm. In this particular case, the contribution was negative indicating that the existence of this norm may be translated into a decrease of HCPs' compliance because priority is given to other moral issues perceived as more relevant than hand hygiene. Among hand hygiene predictors, attitudes were the best followed by the subjective norm and the moral norm. The PBC was the least predictive variable. The model explained 15% of the variance in behaviour.

Finally, the third part of the theoretical framework presented enhances a cross-level model where a moderation is projected involving team safety climate, vulnerability perception and hand hygiene compliance. As expected, team safety climate has a positive impact on hand hygiene compliance demonstrating that when the workplace promotes an environment where professionals can perceive that priority is given to safety issues, it becomes easier to adhere to the implemented rules, such as hand hygiene. Nonetheless, it was hypothesized that this relationship would be stronger when HCPs had an accurate vulnerability perception because if a professional understands the risks and how vulnerable he and/ or she is towards that risk then all safety actions will be performed. However, this link was not identified. In fact, vulnerability perception was not inclusively a predictor of hand hygiene compliance which reinforces the idea that prevails in the literature that this variable has a complex influence on safety behaviours (e.g. Rundmo, 2000). All relationships tested can be verified in Figure 6.6.

From these patterns of relationships established by our multi-level meditational and cross-level models we are able to determine several other conclusions and implications. The present findings enhance the importance of both team safety climate and TPB behavioural intention predictors for intention to comply occur, as both had main effects on intention. However, these different level variables work better in orchestration, meaning that team safety climate perceptions are translated into HCPs' intention to comply by attitudes, subjective norm and PBC (mediation). Thus, team safety climate perceptions affect intention via two pathways (a) directly, as indicated by a main effect on intention, and (2) indirectly via the mediation path. In this sense, our lower level mediation model of upper level effect depicted from the multi-level model presents a partial mediation, in which personal attitudes are constituted as the strongest mediator of the relationship between team safety climate and intention, followed by subjective norm and perceived behavioural control, whose predictive relevance is equal.

The relevance presented by healthcare professionals' attitudes towards hand hygiene compliance is congruent with several studies that have obtained a range of factor solutions, incorporating constructs such as individual attitudes to safety (Cox & Cox, 1991; Hayes, Perander, Smecko, & Trask, 1998). In fact, Cox & Flin (1998) considered that safety climate is a manifestation of safety culture expressed through workers' attitudes.

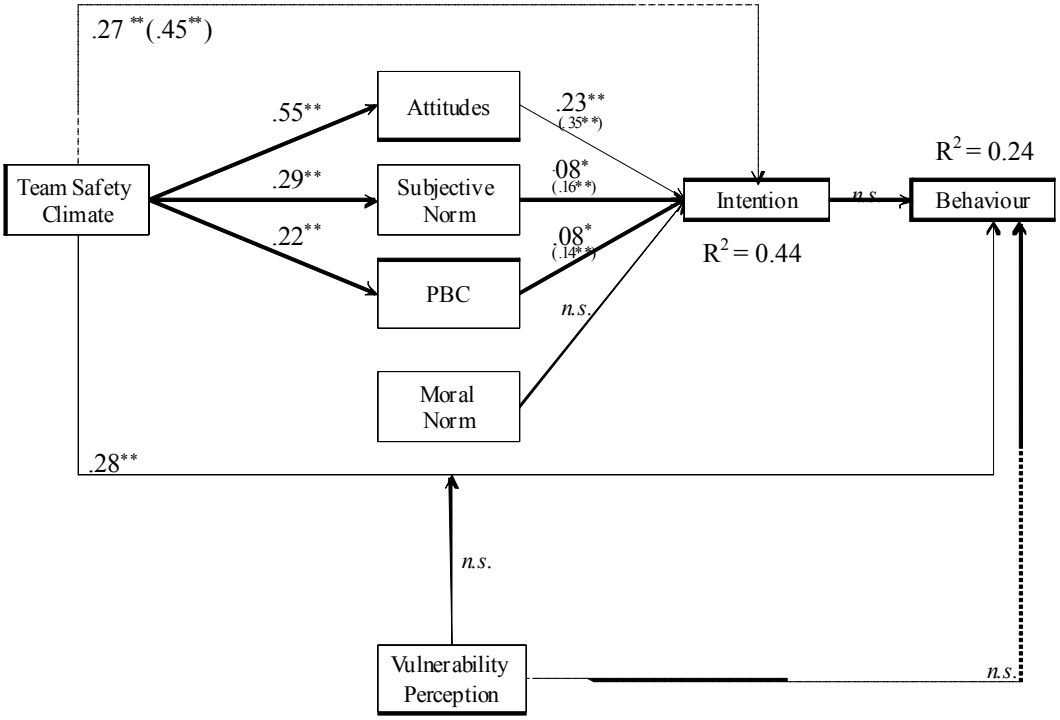


Figure 6.3 Multi-level path model of lower level mediations and cross-level moderation

Despite the fact that the relationship between behavioural intention predictors and hand hygiene compliance was not mediated, as hypothesized, by intention, the second multi-level mediation path estimated also contributed to provide interesting contributions to the results. In this particular situation, attitudes, subjective norm and PBC exert influence not only on intentions, but also on behaviour. These direct main effects on hand hygiene compliance, after serving as powerful mediators in the relationship between team safety climate and intention, enhances an additional pathway of how safety perceptions can exert an indirect influence on behaviour. Furthermore, it was possible to verify that the moral norm has only an impact on behaviour, a negative one. This may suggest that this variable can have the expression of the feeling of

obligation directed to the action, instead of mostly reflecting an intention to comply (Parker et al., 1995).

The cross-level model provides two general conclusions, namely the direct path between team safety climate and hand hygiene compliance and also the complexity underlying the nature of the vulnerability perception as predictor of safety behaviours.

The findings have several implications, namely theory building might gain from consideration of such an integrative perspective that assumes a multi-level mediation model between team safety climate and the TPB, helping to explain how indirect effects at different levels of analysis are manifested. These theoretical considerations may also be translated into interventions. In fact, interventions based on these multi-level mediation paths would promote team safety climate perceptions which would increase the predictive ability of attitudes, subjective norm and perceived behavioural control regarding healthcare professionals' intention to comply. In particular, it would lead to more positive individual attitudes towards safety and, thus, to higher intention to comply since attitudes were the strongest mediator. In this sense, interventions regarding compliance with hand hygiene might work best if they target team safety climate perceptions as precondition or in combination with TPB behavioural intention predictors, because team safety climate perceptions, as an independent variable, not only promote attitudes, subjective norms and perceived behavioural control, but also establish a direct link to intention to comply. Furthermore, it was also identified that TPB behavioural intention predictors are able to establish a direct link with hand hygiene compliance, which indirectly reinforces the positivity that team safety climate perceptions can exert.

Apparently, we can suggest that a positive team safety climate incites individual characteristics presented by healthcare professionals, encouraging team members to adopt a positive intention towards compliance with hand hygiene with further benefits on hand hygiene compliance. In this scenario, team members would feel motivated by the presence of supervisor's safety enforcement regarding compliance which would increase their personal responsibility towards hand hygiene by developing (1) a positive evaluation of safety compliance, by seeing (2) others applying safety rules and by acquiring (3) the ability to be able to overcome institutional and contextual barriers that might put compliance at risk. With a strong team safety climate it seems less likely that team members would decrease their intention to comply, because safety climate

perceptions would be translated into individual level factors that are of direct relevance and concern to the healthcare professional.

In other words, TPB behavioural intention predictors emerged as key individual level factors with regard to both the intention to comply and hand hygiene compliance itself of healthcare professionals in a team context. This means that for team safety climate to affect intention to comply of team members through increased individual attitudes, subjective norm and perceived behavioural control, these shared safety climate perceptions would need to be incorporated into the daily practices of team members. Moreover, with a direct link to hand hygiene compliance, a strong, positive climate will not only contribute to promote a deeper change in HCPs by changing their attitudinal and perceptual mechanisms but also directly influence their behaviour. In this sense, such orchestration between team safety climate and the TPB aims to intervene in both individuals and units in a broader way, aiming to address a behavioural and an organisational change.

In addition, if there is a reason to believe that this hand hygiene behaviour has a moral concern underlying its expression that goes beyond the morality of complying with hand hygiene thus inhibiting compliance, than that will have severe implications for the population under analysis. Because HCPs' may attribute more value to a given action, such as non-compliance when they share this norm, interventions may promote the need to emphasize the morality underlying hand hygiene compliance in order to promote aligned attitudes that will increase the felt obligation to act and, consequently, be able to reduce the interference caused by the inhibiting pressure of the moral imperatives of prioritizing their personal commitment to the patient.

However, despite these encouraging results, our study has several limitations. First, the present findings are based on cross-sectional data collected with self-reported questionnaires that only give a snapshot of what is occurring in this particular hospital at a specific moment in time. Furthermore, the sample comprises data from one Portuguese hospital and a significant majority of respondents were female. We should therefore be cautious in making causal inferences from our data and results should not be automatically generalized to other health organisations. Also, findings provide a modest to moderate multi-level mediation effect. This is not surprising, due to the fact that subjective norm and perceived behavioural control were two mediation indicators with a modest contribution to the strength of the mediated relationship. As such, more

research is needed beyond the mere investigation of this mediation path by taking possible interaction effects into account. Furthermore, the team safety climate-intention relation was only partially mediated by TPB behavioural intention predictors, which reinforces the need to test the existence of additional mediators or the possibility of a moderator. In fact, moderators can influence the mediation process in distinct ways. For example, it would be interesting to understand if the mediation between team safety climate and intention by attitudes, subjective norm and perceived behavioural control is influenced by further moderators, for instance team safety climate strength or safety leadership, which would provide additional evidence that the proposed mediation effects may not be constant across different levels of team safety climate.

Besides that, despite the fact that the literature has indicated instability between intention and behaviour (e.g. Fishbein & Ajzen, 2005) it was not possible to determine the mediator role of intention in the relationship between its predictors and hand hygiene compliance. It would be interesting to find out if there are other variables that can bridge the gap between intention and compliance, in particular the moral norm. The results highlighted that this variable was not a predictor of intention, yet it contributed to explain behaviour. Due to the fact that the moral norm may have a multi-faceted nature, enabling or hindering compliance according to the moral emphasis giving to the situation, those who are more aligned with a moral emphasis on hand hygiene will be more likely to comply with hand hygiene when compared to those who emphasize their commitment to the patient, leading to a decrease in their compliance.

Finally, in terms of the cross-level model also it is considered that despite the complexity underlying the predictive influence of the vulnerability perception on safety behaviours, the impossibility of the moderation can be due to the fact that in the cross-level theoretical models, relationships that are traditionally described are those between top-down impact of higher-level constructs on lower-level constructs. Despite the fact that theory often conceptualizes the potential impacts of lower-level constructs on higher levels, such as the impact of vulnerability perception on team safety climate, this bottom-up cross-level modeling is rare in the empirical literature and requires several statistical and theoretical refinements in order to expand its potentialities and explore the true influences generated at the lowest levels of analysis (Klein et al., 2000).

However, it is possible to specify several positive points in this research. For instance, we were able to achieve a large sample size with data representing three

different categories of healthcare professionals nested in care-delivery teams. Moreover, this study is to our knowledge, the first in the domain of healthcare professionals' compliance with infection control procedures to develop a multi-level analysis of a lower level mediation paths and an additional cross-level model (Bauer, Preacher & Gil, 2006) that reconciles two distinct theoretical approaches namely, safety climate and the TPB and also includes additional predictors such as the moral norm and the vulnerability perception. In our proposed model we argue that an isolated study of either team or individual facets related to healthcare professionals' compliance with hand hygiene is insufficient to fully understand how team level constructs may affect individual intention.

In sum, to gain insight into compliance with safety behaviours requires an ability to move from individual to group and organisational facets by integrating different theoretical perspectives that are important to explain human behaviour and promote its change. It is important that such factors and relationships identified in our exploratory study may contribute to future research that will elaborate on the need to conciliate different levels of analysis to identify the meaning of behavioural compliance, focusing on teams and individuals to enhance safety in healthcare organisations translated into team quality practices and professionals' compliance.

6.3 Study IV Research Goal II: differences in behavioural intention predictors among healthcare professionals' categories[12]

6.3.1 Introduction

Literature on infection control is clear in stating that nurses have the highest compliance rates of hand hygiene when compared to doctors and other allied professionals such as cleaners (e.g. Mensah, Murdoch, Binstead, Rotheram & Franks, 2005). However, other studies have highlighted that cleaners also have a relevant role in compliance. For example, in a study developed by Askarian, Khalooee & Nakhaee (2006) nurses and doctors were less compliant in personal hand hygiene than cleaners. This result was also replicated by Suchitra & Devi (2007) whose observational study

[12] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *How to comply with hand hygiene? Different behavioural intention predictors among doctors, nurses and cleaners.* (Submitted).

demonstrated that hand hygiene practices in spite of the development of an educational program revealed that nurses presented a high compliance rate, but cleaners were the professional category who complied the best. Again, doctors achieved the lowest compliance rates. One of the reasons given for these unexpected results for cleaners' compliance was the fact that they worked under direct supervision which could contribute to increase compliance due to social influence processes (Suchitra & Devi, 2007).

By taking into account these results that reinforce the assumption that there are differences among professionals, one major limitation that can be attributed to this literature is the fact that most research is focused on quantitative observational studies that only documented poor compliance rates with hand hygiene among HCPs. These studies also identified several reasons for non-compliance such as discomfort with the soap, the lack of working conditions or risk-taking personality (e.g. Godin et al., 2000) but this only provided an incomplete picture of the problem of compliance in this area related to HCPs. In fact, the literature in this field was not able to determine the predictive processes underlying HCPs' intention to comply with hand hygiene. Because few HCPs are non-compliant in every situation, it would be interesting to understand the impact that attitudes, subjective norm and PBC have on each HCP intention, according to their main professional category (i.e. doctors, nurses and cleaners). To contextualize the specificities of these professionals' compliance will not only contribute to complement the prevailing body of research, but it will also help to give a more clearer understanding of the predictive mechanisms behind poor-compliance.

Furthermore, and by taking into account the empirical grounds demonstrated in Lymer, Richt & Isaksson's (2003) study in which they discussed the role of values and moral norms among different HCP categories as determinant factors to solve personal dilemmas in their daily clinical practice that could undermine compliance, it is expected to overcome another literature void by analysing the predictive value of a moral norm that expresses the need of a HCP giving priority to their personal commitment to the patient. This norm will explore how moral prerogatives can also contribute to non-compliance due to HCPs' convictions of what is considered as the best practice for the patient in a given situation (Lymer et al., 2003). In addition, quantitative studies that have directed attention to the moral norm have tested this norm as a rule that reinforces compliance by seeing hand hygiene as a moral obligation. By adding this additional

predictor to the normative component of the TPB, our purpose is to verify how this distinctive norm conceptualization influences each HCP category.

6.3.2 Objectives and hypotheses

The second research goal of the current study examined the predictors of intention to comply with hand hygiene in a sample of doctors, nurses and cleaners. The TPB was used to derive predictors of intention and behaviour along with the additional predictor of intention that we included in the normative component (i.e. moral norm). We also examined the role of intention as a mediator in the relationship between its behavioural predictors and hand hygiene compliance.

By taking into account the literature that shows there are differences in doctors', nurses' and cleaners' compliance rates, we expect that attitudes, subjective norm and PBC will have a distinctive pattern across these professionals categories regarding their regression weight on personal intention to comply. Furthermore, we also expect that the moral norm will be the only behavioural intention predictor to have a negative impact on these professionals' intention to comply and its manifestation will be particular important in doctors and nurses. We consider that the moral norm will not be a relevant predictor for cleaners due to the fact that the nature of their job is not intrinsically related to giving priority to their relationship with the patient. In fact, according to Askarian et al. (2006) cleaners deal mostly with the cleaning of wards and other hospital sites, which limits their personal contact with patients.

In the next section we will focus on the results due to the fact that the methodology, in particular the participants and the instrument (i.e. TPB individual variables and moral norm) were conducted in the same way that was already presented in the previous methodological section of study IV.

6.3.3 Results

Due to our specific aim of analyzing and comparing the three categories of health professionals, results will be presented by focusing on each specific work group.

6.3.3.1 Doctors

The correlation matrix and the descriptive statistics are presented in Table 6.6. The descriptive results demonstrate that the variables express means with, on average

high agreement, particularly the moral norm and the intention. In addition, the standard-deviation values, ranging between 0.69 and 0.97 indicate some amount of disagreement between the professional respondents.

In terms of the correlation coefficients, all variables are correlated with the intention to comply. Correlations between behavioural intention predictors and intention are low and positive with the exception of the correlation coefficient of the moral norm, which is negative. Regarding the correlations with the behaviour, these are also low and positive. Again, the only coefficient with a negative value is the one attributed to the moral norm. Attitudes and intention were not correlated with behaviour. The remaining variables did not correlate.

Table 6.6. *Doctors' descriptive statistics and correlation matrix (N=195)*

	Mean	SD	1	2	3	4	5
1 Attitudes	5.80	0.82					
2 Subjective Norm	5.39	0.97	-0.03				
3 PBC	5.82	0.69	0.13	0.07			
4 Moral Norm	6.35	0.77	-0.07	0.09	-0.15		
5 Intention	6.04	0.79	0.26**	0.16*	0.22**	-0.29**	
6 Behaviour	5.89	0.82	0.02	0.34**	0.22**	-0.28**	0.10

** $p < .001$; * $p < .05$

To identify the intention predictors a hierarchical linear regression of the TPB main variables was performed. Attitudes, subjective norm, perceived behavioural control and moral norm were entered into the model. The model explained 18% of the variance in intention. The main significant predictors were both the attitudes and the moral norm, followed by the perceived behavioural control and the subjective norm. The moral norm added an additional contribution to the model of 7%. The regressions results are reported in Table 6.7.

Table 6.7. Hierarchical multiple regression coefficients of doctors'(N = 195), nurses' (N = 236) and cleaners' (N = 119) intention to comply with hand hygiene

	Professional Categories		
	Doctors	**Nurses**	**Cleaners**
TPB Predictors	**β**	**β**	**β**
Attitudes	0.25**	0.21**	0.18*
Subjective Norm	0.12*	0.22*	0.40**
PBC	0.17*	0.08	0.25**
Moral Norm	-0.26**	-0.06	-0.03
F	11.97	17.31	14.98
R^2	0.18	0.22	0.32

** p < .001; * p < .05

The mediator role of intention was also tested. Results indicated that intention was not a significant mediator between its predictors and hand hygiene compliance. However, in this particular case, both the moral norm ($\beta = -0.28 < .001$) and the subjective norm ($\beta = 0.27 < .001$) had a direct effect on behaviour. The moral norm was the strongest predictor of behaviour with a negative impact on it, demonstrating that when doctors emphasize this rule, there is a tendency to decrease their compliance. Also, the impact of relevant social referents and the way they constrain individual practices have a direct impact on doctors' compliance.

6.3.3.2 Nurses

Table 6.8 presents the correlation matrix and the descriptive statistics. According to the descriptive statistics the nurses' level of agreement is, on average, lower than the one presented by doctors. Attitudes are the variable that had the lowest level of agreement. Also the moral norm presents a decrease in their average mean point when compared to doctors' results. However, there remains a tendency to agree with the intention to comply with this behaviour when its application is required. Standard-deviation values are higher than those presented by doctors, ranging between 0.70 and 1.11, which indicates that these professionals may have quite a low consensus among their responses. Again, all variables are correlated with intention. Correlations are low and positive with the exception of the moral norm presenting a negative correlation. Only attitudes are correlated with behaviour. The coefficient is low and positive. Other

important correlations were identified, namely the negative correlation between the moral norm and the PBC with a moderate strength, indicating a result previously discussed in this project for medical students where the higher the importance given to the moral norm the lower the perceived ease in performing hand hygiene.

The moral norm is also correlated with the subjective norm which may show that the social referents may be relevant in the way moral norms are disseminated in the healthcare environment. The PBC and the subjective norm present a low positive correlation which is also interesting because professionals who perceived good practices being developed by relevant social referents may develop a high sense of control towards this practice. Finally, the subjective norm presents a negative correlation with attitudes. Again, a positive attitude towards hand hygiene may lead to a decrease in the influence of social referents.

Table 6.8. *Nurses' descriptive statistics and correlation matrix (N=236)*

	Mean	SD	1	2	3	4	5
1 Attitudes	4.65	1.00					
2 Subjective Norm	5.09	1.04	-0.22**				
3 PBC	5.47	0.98	0.01	0.16*			
4 Moral Norm	5.04	0.99	-0.03	0.39**	-0.35**		
5 Intention	5.01	0.70	0.24**	0.31**	0.18*	-0.27**	
6 Behaviour	5.89	1.11	0.15*	0.10	0.10	- 0.12	0.04

** $p < .001$; * $p < .05$

After performing a hierarchical linear regression with TPB variables plus the additional variable which was the moral norm, we achieved a model that explained 22% of the variance in intention. The main significant predictors were both the subjective norm and nurses' attitudes. In this particular case, the moral norm did not constitute itself as a predictor. The same occurred to the perceived behavioural control. Regressions results are reported in Table 6.7. In the case of nurses, after testing the role of intention as mediator results indicated that only attitudes ($\beta = 0.22 < .05$) had a significant impact on behaviour. The other predictors, including intention had non-significant effects.

6.3.3.3 Cleaners

The correlation matrix and the descriptive statistics are presented in Table 6.9. Descriptive statistics presented for cleaners indicate that mean values are diverse ranging from 4.65 for the subjective norm to 6.05 for intention to comply. Standard-deviation values are also high ranging from 0.63 to 1.50 determining the existence of discordance among respondents. Turning to the Pearson coefficients, with the exception of the moral norm all the other variables were correlated with intention. The correlations were low to moderate and positive. Only attitudes had a significant moderate and positive correlation with behaviour. The moral norm was negatively correlated with attitudes. The correlation was low. The subjective norm had a positive correlation with attitudes. The correlation presented a moderate coefficient.

Table 6.9 *Cleaners' descriptive statistics and correlation matrix (N=119)*

	Mean	SD	1	2	3	4	5
1 Attitudes	5.11	0.71					
2 Subjective Norm	4.65	0.63	0.36**				
3 PBC	5.35	0.69	-0.11	0.11			
4 Moral Norm	4.59	1.50	-0.25**	0.03	-0.16		
5 Intention	6.05	0.63	0.32**	0.50**	0.29**	-0.06	
6 Behaviour	5.24	0.99	0.35**	0.05	0.03	-0.07	0.14

** p < .001; * p < .05

To evaluate the TPB behavioural intention predictors a hierarchical multiple regression was performed. The model explained 32% of the variance in intention. The main significant predictors were both the subjective norm and perceived behavioural control, followed by cleaners' attitudes. The moral norm did not constitute itself as a significant predictor. Results are reported in Table 6.7. Also, cleaners' intention failed to act as a mediator between its predictors and behaviour and like nurses' attitudes ($\beta = 0.54 < .001$) had a direct effect on hand hygiene compliance.

6.3.4 Discussion

This second research goal of study IV enhances the role that different behavioural intention predictors have among doctors, nurses and cleaners in their intention and hand

hygiene compliance. These results give particular relevance to the subjective norm which predicted doctors', nurses' and cleaners' intentions to comply. However, all predictors had a particular contribution according to the professional category.

For doctors, moral norms, attitudes, PBC and subjective norm were significant predictors of intention. The moral norm was the strongest predictor indicating that those who were determined to give more importance to their commitment to the patient were most likely to decrease their intention to comply with hand hygiene. In addition, the moral and the subjective norms had direct effects on behaviour because the intention was not identified as a significant predictor of hand hygiene compliance. In this sense, doctors were less likely to report complying with hand hygiene if they held the moral norm that underestimates the relevance of hand hygiene when compared to other moral prerogatives valued by these professionals. In turn, the subjective norm was another variable that contributed to understanding doctors' behaviours. Positive social referents developing adequate hand hygiene practices contribute to influence other doctors' behaviours leading to more compliance. The model explained 18% of the variance in intention.

Nurses' results highlighted the relevance of the subjective norm and attitudes as main predictors of intention, respectively. The moral norm despite being correlated with the intention did not achieve a significant value. In this case, the importance of others was also emphasized through the relevance of co-workers as main social referents. Also, having a positive evaluation of the benefits of hand hygiene appeared to contribute not only to influence nurses intention to comply, but also their personal compliance as attitudes were the only behaviour predictor with a relevant impact on hand hygiene compliance. Around 22% of the variance in intention was explained.

Finally, cleaners' intention was mostly predicted by the subjective norm, the PBC and attitudes. As identified in the previous professional groups, social influence processes appear to have a relevant role in determining cleaners' intention to comply. It is important to mention that the PBC is particularly relevant in the case of cleaners as it stands as the second most relevant predictor. This result may be explained by the fact that cleaners may be determined to comply with hand hygiene if they feel that they could control the application of the hand hygiene technique. The development of this procedure can be particularly complicated in this group due to the fact that it requires a specific technical knowledge that most doctors and nurses learn during their academic

curricula and cleaners need to learn on the job. In some sense, that can constrain their perception of control when facing some environmental barriers. Maybe the fact that attitudes are the least significant predictor in this group can also be explained by the fact that in the cleaners group the cognitive support related to the understanding of the determinants of hand hygiene are minor when compared to those presented by doctors and nurses. Doctors and nurses have years of training in hand hygiene based on theoretical and practical knowledge, while cleaners need to develop a different sort of learning to acquire sufficient information to be able to develop a positive evaluation about hand hygiene and be confident in their ability to perform the procedure. To that end, the relevance of significant others will be of great importance. Also, the greater the positive evaluation of hand hygiene, the greater the compliance with the technique, since attitudes were the only predictor of behaviour. The model explained 32% of the variance in intention.

Results of the second part of the study appear to indicate that social influence processes, translated by the subjective norm are relevant for all professionals' intention to comply, in particular for nurses and cleaners. In the healthcare sector, the ongoing process of interaction between professionals is teamwork as they work together to provide care for patients (Clements, Dault, Priest, 2007). The fact that hand hygiene compliance is a behaviour that operates within a social context where normative pressures are exerted contributes to enhance the power of social rules inside teams and between co-workers (Barker, 1993). This adds to the literature supporting the usefulness of the subjective norm as a determinant predictor of intentions in the field of infection control which can be considered as an unexpected result in the findings of the TPB because the subjective norm is constantly seen as the weakest predictor of this theory (e.g. Armitage & Conner, 2001).

The present study also found support for the relevance of the moral norm as an important additional behavioural predictor but only for doctors. We did not find support for the role of this norm for nurses as we expected. This is somewhat surprising given the fact that nurses are also health professionals that deal with both the necessity of establishing a commitment to the patient which is a moral prerogative and the moral need to comply with hand hygiene. Despite having a negative significant correlation between their moral norm and intention this was not a significant predictor. One possible explanation for this result can be the fact that several comparative studies that

have been made between nurses and doctors have not only highlighted that the former have higher compliance rates, but also that nurses give more importance to infection control issues when compared to doctors (e.g. Mensah et al, 2005). Even if nurses have both moral norms, one enabling compliance and the other one inhibiting hand hygiene, if they attribute a considerable amount of significance to infection control, in situations where compliance is required it may be easier for them to give priority to the norm that enables compliance.

Also, in a study developed by Racine (2008) which focused on doctors ethical conduct, results indicated that the value or prioritizing the patient is intrinsically related to the nature of the doctors' professional work and despite the fact that it is also related to the nature of the nurses' practices it is just more salient to the former when compared to the latter. Furthermore, Racine (2008) develops the idea that while doctors' may have a perception of a moral judgment where the life of the patient is at risk, nurses may highlight the perception of the importance of taking care of patients. In this sense, if a doctor develops his moral concerns underlying the conceptual idea of life and death of a patient no matter what, then compliance with hand hygiene and other infection control procedures will constantly be perceived as less significant because the doctor will be focused on overcoming the disease to treat the patient; consequently, if nurses develop a perception where their main aim is to take care of the patient, then the conceptualisation of a norm that contributes to compliance will reinforce the adherence to hand hygiene because nurses will be focused on directing their attention to the well-being of the patient. In fact, there is evidence in the literature that the quality of patient care increases with the presence of skilled, educated nurses in the workplace (Laschinger & Finegan, 2005).

Turning to cleaners two interesting findings must be taken into account apart from the relevance of the subjective norm as previously stated. First, and according to expectations, the moral norm did not predict their intention to comply. According to Yamazhan, Tasbakan, Çalik, PullukÇu, Sipahi & Ulusoy (2009) hospital cleaners consider themselves as the most vulnerable health group inside the hospital to acquire an infection from the environment and concentrate their knowledge and practice in order to decrease the possibility of acquiring an infection. In this sense, it was plausible that this group would feel a greater tendency to focus on their own safety instead despite acknowledging the relevance of hand hygiene as a practice that also contributes to

protect the patient. Because of this sense of vulnerability, cleaners tend to feel more difficulties to comply when facing a physical barrier that they need to overcome which negatively affect their sense of control and performance (Yamazhan et al., 2009). This importance of control leads to the second interesting result, related to the significance of PBC as relevant predictor for cleaners' intention. Because the level of knowledge and attitude among cleaners toward prevention of infections is commonly low (Yamazhan et al., 2009), these professionals rely on their sense of control and on the influence of significant others to determine their compliance.

The idea that each professional category has a pattern of behavioural predictors was successfully explored in the second objective of the study with several practical implications. In terms of the relevance of the subjective norm, it seems important that intervention programs focus on the development of strategies that enable the constitution of role models who can play a pivotal role in changing these professionals' compliance behaviours (Eggimann, Harbarth, Constantin, Touveneau, Chevrolet & Pittet, 2000) because negative mentors can contribute to poor compliance (Stone, Teare & Cookson, 2001). When it comes to the moral norm, one effective way of influencing doctors would be to develop training sessions directly focused on demonstrating the consequences of non-compliance. If doctors perceive their actions as based on life and death judgments (Racine, 2008), then it could be important to invite doctors to consider how they would feel if after not complying with hand hygiene in a particular situation a patient acquired an infection capable of putting his or her life at risk (e.g. O'Keefe, 2002). This type of strategy may induce doctors to think about their feelings which can contribute them to give more relevance to hand hygiene.

Finally it would be important to develop specific hand hygiene training directed to cleaners' needs, not only with a theoretical basis to provide them with all the required knowledge they need, but also with the full practical explanations regarding hand hygiene procedures.

Despite these results, several limitations can be pointed out in the analyses. These three groups are heterogeneous concerning experience time, socialization stages and wards. Due to standard deviation values indicating low consensus among respondents it seems reasonable that it will be possible to obtain intra-group differences, which will be translated into distinctions in the relevance of the behavioural intention predictors. In the particular case of doctors, the literature shows that not only does their compliance

vary according to specialities and wards, but also varies due to their work experience (e.g. Limbert & Lamb, 2003; Pittet et al, 1999). Also, nurses' and cleaners' compliance in teaching hospitals is better than in non-teaching hospitals (Askarian et al., 2006) suggesting that compliance can be contextual and, consequently, behavioural intention predictors can be different according to several other specificities.

It will be important to explore not only inter-group differences related to healthcare organisations' characteristics (e.g. type of hospital, type of ward, type of team) but also to investigate the potential dissimilarities that can also be encountered inside each professional category in order to clarify hand hygiene compliance and to state theoretical and practical contributions to increase adherence to this important infection control procedure.

6.4 Study IV Research Goal III: doctors' intention to comply with hand hygiene according to differences in work experience[13]

6.4.1 Introduction

Being a doctor is a risk factor for non-compliance (e.g. CDC, 2003) and, as this project has demonstrated in study two and three, medical students have specificities in their intention to comply according to their socialization stages. To that end, in the third and final objective of the fourth study, it appears interesting to focus exclusively on the doctors' sample. The literature on doctors' compliance with infection control procedures has stated that there are behavioural differences between senior and junior doctors. According to Bartzokas, Williams & Slade (1995) senior doctors tend to wash their hands few times when compared to junior doctors. This difference between physicians may suggest that the amount of work experience can play a significant role in determining compliance rates with hand cleansing procedures (e.g. McGovern, Vesley, Kochevar, Gershon, Rhame & Anderson, 2000). Furthermore, it can suggest that professional experience, despite being correlated with increased knowledge, may not be translated into hand hygiene compliance because senior clinical staff members

[13] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Does work experience constrain physicians' intention to comply with hand hygiene? An extended application of the Theory of Planned Behavior.* (Submitted).

tend to present higher rates of incorrect practices (Kampf, 2004; Sushistra & Lakshmi, 2007).

One possible explanation for this empirical evidence may be due to the fact that, despite acknowledging that work experience may be an important variable, no study has specifically focused on how the amount of work experience among physicians constrains their intention to comply with hand hygiene. That information can identify different behavioural intention predictors among senior and junior doctors, which can contribute to the development of future intervention programmes. In fact, few studies have specifically addressed this question related to the relevance of work experience in doctors' compliance and when this variable was taken into account, the nature of the studies was mostly observational. The problem with observational studies relies on the fact that it only provided information on the compliance rates of junior and senior doctors underestimating the importance of exploring the constituents of their intention to comply (e.g. Sushistra & Lakshmi, 2007).

The only study that exists in the literature that was able to identify junior and senior doctors' behavioural intention predictors by taking into account the TPB framework was developed by Limbert & Lamb (2004). However, it was not applied to the field of infection control. While applying the TPB to doctors' intention to comply with antibiotic prescription guidelines, results determined that junior doctors' intentions to comply, as opposed to more senior ones, were predicted by subjective norms; while, attitudes predicted senior physicians' compliance. This particular finding suggested a link between compliance with clinical guidelines and different intention predictors according to distinct levels of physicians' experience.

In conclusion, more research is needed to understand the possible inter-relationships between doctors' work experience and the socio-cognitive variables that underlie their behavioural intention to comply with hand hygiene.

6.4.2 Objectives and hypotheses

In general, our aim is to contribute to a better understanding of hand hygiene compliance among doctors, who represent the professional health category with the lowest compliance rates. After examining medical students' behavioural intention predictors, our aim is to continue to expand the knowledge regarding doctors compliance by focusing on the socio-cognitive predictors of doctors' intention to

comply with hand hygiene by taking into account their level of work experience. Moreover, the study intends to analyse the contribution of the moral norm and verify if its predictive weight differs across doctors who have more or less experience.

According to our theoretical framework we suggest that doctors' intention to comply with hand hygiene will be predicted by attitudes, subjective and moral norms, and perceived behavioral control. Considering previous research it is suggested that the growth of work experience may give relevance to different behavioural predictors. According to Nilsson & Pilhammar (2009), junior and senior doctors have different clinical experiences which contribute to different professional approaches. In this sense, senior doctors base their decisions in long term experience based on their expertise and reasoning, enhancing their beliefs and attitudes, while junior doctors' focus their attention on what they are familiar with and actively search for credible sources of useful information, which means they rely on their colleagues' practices (Nilsson & Pilhammar, 2009). Hence, it is hypothesized that senior doctors' intentions will be fundamentally predicted by attitudes, while, junior doctors' behavioural intention will have subjective norms as its strongest predictor. Finally, and according to the results presented for doctors and medical students in the previous studies, it is expected that both senior and junior doctors' intentions will be predicted by the moral norm that will have a negative impact on intention.

6.4.3 Method

6.4.3.1 Participants

The study was conducted in one Portuguese public hospital and included 195 physicians. Around 66.2% of participants were females, while 32.8% were males. Respondents were on average 35.7 years old. Participants' experience ranged between 1 to 20 years with an average work experience of 14.3 years. The sample was divided according to doctors' professional hierarchy, i.e. *"junior doctors"* included physicians with less than 10 years of clinical practice. This time range was chosen considering the Portuguese Medical Education System and evolution in the physician profession, namely it covers internship and residency which requires around 8 years training depending on the medical specialty selected; while the *"senior doctors"* category

included professionals with at least 10 years of practice, known as specialists, who are doctors with advanced education and training in one specific medical area.

6.4.4 Results

6.4.4.1 Descriptive statistics and correlations

Mean scores, standard deviations and correlations among the TPB variables are presented in Table 6.6 (pp. 202).

6.4.4.2 Predicting doctors' intentions to comply with hand hygiene

A hierarchical multiple regression analysis was performed to indicate the ability of TPB components to predict intention. It can be seen from Table 6.10 that the subjective and the moral norms were the main significant predictors for junior doctors. Subjective norm was the strongest predictor, followed by the moral norms. TPB components accounted for 24% of the variance in intentions to comply with hand hygiene. Also Table 6.10 highlights that attitudes, PBC and the moral norms were the main significant predictors for senior doctors. Subjective norms did not reach the level of significance. Attitudes were the strongest TPB predictor. The model explained 27% of the variance in intention.

Table 6.10 Hierarchical multiple regression coefficients predicting junior (N = 114) and senior (N = 81) doctor's intentions to comply with hand hygiene

	Doctors' work experience	
	Junior Doctors	**Senior Doctors**
TPB Predictors	**β**	**β**
Attitudes	0.12	0.35**
Subjective Norm	0.32**	-0.03
PBC	0.12	0.27**
Moral Norm	-0.23**	-0.22**
F	9.83	8.32
R^2	0.24	0.27

** $p < .001$; ** $p < .05$

6.4.5 Discussion

Overall, this study enhances the role of subjective norms as the main predictor of junior doctors' and attitudes and PBC as the most significant predictors of senior doctors' intentions to comply with hand hygiene procedures. Both groups of doctors attributed importance to the moral norm as an additional predictor of their intention. These indicators not only support the need for TPB to expand the normative component by including a variable able to measure the moral facets of this behaviour, but also highlights the impact that attitudes, control and social and internalized norms may have among medical professionals' in the field of hand hygiene compliance.

The first result that should be stressed is the fact that the subjective norm, as hypothesized, was the main intention predictor among junior doctors but not a significant predictor for senior doctors. In fact, as expected, in the case of senior doctors, attitudes were their main behavioural intention predictor. This result suggests that the number of years of clinical experience may be related to these professionals' intention to comply with hand hygiene by changing the role that the each predictor has on their intention to comply. Senior doctors' intention was also predicted by PBC which did not occur in the case of junior doctors. Thus it appears that the more junior doctors intend to comply with hand hygiene the more they perceive their colleagues develop this procedure during their daily activities. In the case of senior doctors their intention to comply will increase, the more positive their personal evaluation towards hand hygiene become and also the more control they perceive they have in performing hand hygiene.

However, the results also indicate that the moral norm is an important predictor among junior and senior doctors to predict their behavioural intention to comply, in this particular case, contribute to explain their personal non-compliance. Therefore, despite the fact of having positive predictors influencing their intention to comply, the normative component expresses the possible existence of an internalized norm that is negatively associated with their personal intention to comply, and determines that each doctor deals with opposing predictors that distinctively contribute to compliance or non-compliance.

Junior and senior doctors' professional approaches are different from each other mostly because their work experience is not the same. While the former are still building their knowledge, the latter reveal a consistent personal maturity. But in both

cases the characteristics they possess shape their attitudes, skills and behaviours leading to specific clinical judgments (Nilsson et al., 2009).

In this study work experience was directly studied in order to understand how junior and senior doctors' behavioural intention predictors change their relevance according to their professional experience. Results revealed that the time a doctor spends in developing their personal career modifies the relevance attributed to their intention predictors. For instance, junior doctors attribute higher importance to peer pressure as a significant factor in their intention to comply with hand hygiene. This result is supported by the literature. Limbert & Lamb (2002) studied doctors' intention to prescribe antibiotics and found that junior doctors, contrary to senior doctors, are more willing to accept social pressures from their peers because they need to report their clinical practice to their superiors. However, the importance of the subjective norm in the case of junior doctors may go beyond the need to report their clinical judgment to those who evaluate them. In fact, it may rely on the fact that these professionals have less experience and actively search for information about what to do in a specific situation, in order to find someone with more experience to serve as the best mentor (e.g. Nilsson et al., 2009). Taking this into account, it seems feasible that junior doctors will feel during their early years as professionals a strong social influence from peers and supervisors who are more experienced. This may also contribute to explain why attitudes did not predict the junior doctors' behavioural intention.

In terms of senior doctors, Limbert & Lamb (2002) also found that these professionals' intention to prescribe antibiotics was mostly predicted by their personal attitudes. When doctors achieve a significant level of seniority, personal prerequisites and experience are the main features of their clinical practice. With a high level of expertise, decisions are framed on their opinion and the need to seek for relevant information decreases substantially due to a high level of experience (Nilsson et al., 2009). In this sense, their attitudes will constitute the most relevant way of expressing the knowledge that was acquired during the years of experience and exert a strong pressure on their intention to comply. The role of social referents will have little impact on a professional with a significant past experience in clinical practice (e.g. Limbert & Lamb, 2002; Nilsson et al., 2009). Turning to the role of PBC as a predictor of senior doctors' intentions, one possible explanation is that these doctors have more experience and are more familiar with hand hygiene behaviour and all the required procedures

related with the behaviour to be adopted, which indicates that they might have high levels of past behaviour related to hand hygiene experience. PBC may express a more accurate sense of control, meaning that their perception may reflect more actual control when compared to younger doctors who have less experience (e.g. Ajzen, 1988; Amireault, Godin, Vohl & Pérusse, 2008).

The significance of the moral norm was not an unexpected result as its importance has been documented in the studies of medical students previously presented in this thesis, and it was also a significant predictor of the doctor sample when analysed as a whole without taking into account the amount of experience. Despite the fact that we have not hypothesized any difference in the predictive weight of the moral norm according to professional experience, it could be argued that doctors with more experience would be more familiar with this internalized norm and consequently express it with a more acute intensity. Nevertheless, junior doctors despite having less experience appear to develop this norm early in their medical educational training. In this initial stage of their professional career, junior doctors will build up multiple work relevant commitments; develop several connections with distinct mentors who can contribute to enhance the relevance of their moral norm too (e.g. Meyer & Herscovitch, 2001). The possibility of both groups of doctors' having reasons to give relevance to the moral norm may have contributed to the fact that junior and senior doctors' presented similar regression weights for the moral norm.

According to the third objective of study IV, the two generational groups of doctors presented social influences and personal characteristics that were able to determine the way they intend to comply with hand hygiene. These results provide useful indications that can contribute to develop interventions. Because both groups are determinant to clinical education serving as actual and future role models, the differences outlined in these analyses must be explored to elucidate medical students' of how work experience can contribute to differentiate behavioural intention predictors. With excellent role models able to positively influence the practices of junior doctors and students, as the amount of experience increases and the influence of others decreases the capacity of these future senior doctors to become more compliant will increase. With more experience their intention will rely more on their attitudes and be less influenced by others, which decreases the possibility of being influenced by inadequate practices. As a senior doctor, that professional will become a reference in

clinical education. Consequently, with a career defined by compliance there will be a tendency to develop strong, positive attitudes that will make that doctor (once a junior doctor) an excellent role model. This commitment to compliance by the development of positive role models may be the key to reinforce hand hygiene and to use the benefits of work experience over time.

However, these analyses present several limitations that may constrain the results obtained. First, the doctors' sample size was small which did not allow other statistical analyses to be performed (e.g. Structural Equation Modeling), that could may be more reliable than Hierarchical Multiple Regressions. Also, the sample comprised professionals who came from the same healthcare organisation which makes it difficult to generalize these findings to all medical professionals.

Another limitation is the low explained variance of the models. Even with the inclusion of the moral norm which incremented the explained variance by 6%, a result consistent with the literature findings (Conner & Armitage, 1998), the models only explained from 24% to 27% of these professionals' intention to comply with hand hygiene. If, in one way, this can be due to the fact that not all TPB predictors had a significant predictive role; it can also indicate the need to include additional predictors that might have a significant contribution, such as past behaviour. Past behaviour, as it was stated previously, may have an important contribution, in particular for senior doctors who are familiarized with hand hygiene practices and this is a possibility to explore in future research. However, the non-significance of attitudes and perceived behavioural control for junior doctors was an intriguing finding that should be analysed. Among the possible explanations for that is the fact that hand hygiene behaviour has a strong social desirability component so that the expression of attitudes and perceived control would be translated by socially desirable responses. The second possibility is that the subjective norm and the moral norm can both act as moderator variables to explain those effects of attitudes and control concerning these junior doctors' intention to comply. Future research focusing on this behaviour should take these considerations into account.

Nevertheless, despite these limitations, these findings enhance understanding of potential indicators suggesting that attitudes and norms play a key role in doctors' intentions to comply with hand hygiene according to their work experience. Because doctors with less experience learn from their peers and supervisors it will be important

that care-delivery teams and healthcare organisations conceive their intervention plans acknowledging that: (1) HCPs' hands are one of the main sources of nosocomial infection; (2) by decontaminating their hands there is a significant reduction of HAIs; (3) colleagues and other experienced peers can serve as excellent sources of information to help model appropriate behaviour and develop adequate practices; and (4) there is not an incompatibility between HCPs' compliance with hand hygiene and their norm of prioritizing their personal commitment to patients.

6.5 Final Conclusions

In this chapter our intention was to expand the knowledge on hand hygiene compliance by analysing several aspects of HCPs' intentions to comply. Structurally, one study with three distinct objectives has been presented. In the first part, the aim was to focus on the interconnections of safety climate and the TPB by presenting a multi-level proposal with two mediations and one moderation. In the meditational path, it was assumed that team safety climate would exert influence on HCPs' intention to comply through the impact of its predictors; attitudes, subjective norm and PBC. This lower level mediation of upper level effect was confirmed. In fact, team safety climate not only influences intention using this meditational path, in particular by the impact of attitudes which was the strongest mediator, but also by having a relevant direct contribution on intention. The second meditational path determined that attitudes, subjective norm, PBC and the moral norm, as additional predictors, would influence hand hygiene compliance through intention, whose role would be the immediate antecedent of behaviour. However, it was not be possible to find support for this lower level mediation of lower level effect and only the moral and the subjective norms had a direct impact on behaviour. Finally, the moderation expected to establish a cross-level interaction where team safety climate would have an even stronger impact on hand hygiene compliance when HCPs' vulnerability perception was higher. Despite the fact that team safety climate presented a positive impact on hand hygiene, the moderation effect was not confirmed.

In this first part of the study relevant conclusions were made. First, a multi-level framework in the field of safety literature was constituted that integrated an organisational approach, team safety climate, with a theoretical framework traditional in the health literature, namely the TPB with a socio-cognitive approach. Second, it

determines the relevance of studying hand hygiene as behaviour that to be fully understood requires an approach that focuses on a perspective that takes into account how professionals are organised inside the healthcare system. Patient safety is a problem that occurs inside units, specifically inside care-delivery teams, and therefore compliance will be better explained in a framework that takes into account the interplay between lower and upper level phenomena with theories reflecting both individual characteristics and organisational facets. Third, interventions must address safety climate and develop strong and positive perceptions within the workplace, in order to not only have a direct impact on HCPs' behaviour but also to change their personal attributes (e.g. attitudes).

In the second part of the study we decided to focus on three groups of HCPs due to the fact that few studies have compared doctors, nurses and cleaners' intentions to comply with hand hygiene. Because there is evidence in the literature (e.g. CDC, 2003) that each one of these professional groups have distinct compliance rates, we considered that it would beneficial for future intervention programs to explore which were the most relevant predictors of intentions to comply. Results indicated that doctors' best intention predictor was the moral norm. In fact, this norm was only a significant predictor for doctors, determining that the higher the expression of the norm the less their intention to comply with hand hygiene. In the case of nurses and cleaners the subjective norm was the best predictor, enhancing the role of social influence processes and how peers can contribute to shape professionals' compliance. One thing that must be mentioned, and that is consistent with the results obtained in the medical student studies, is the fact that the subjective norm continues to have a significant predictive role in the field of infection control, which is not a common result in other research fields where the TPB is used (Armitage & Conner, 2001). The differences attributed to each predictor according to their professional group and the fact that only the doctors' group gave relevance to the moral norm were important results that must be taken into account when interventions are planned. Despite the fact that all these professionals work inside the same care-delivery teams, and are submitted to the same hand hygiene intervention programmes does not mean that these groups require the same sort of intervention measures. In fact, in the specific case of cleaners, apart from giving relevance to the subjective norm, they were the only group attributing where PBC acquired a relevant significant contribution which, in accordance with the results from the first study that

we developed where cleaners attributed importance to control perceptions, can indicate that, for cleaners, interventions may be focused on hand hygiene training.

Finally, the third goal of the study was directed to the doctors' sample. We decided to focus only on this part of the sample because we already had the results from medical students, which gave an idea of the role of the behavioural intention predictors on students from the 1st and 6th years, so we wanted to have an additional overview of how junior doctors and senior doctors intentions can be expressed towards hand hygiene by taking into account their work experience. Results indicated that junior doctors' best intention predictor was the subjective norm, while senior doctors' attitudes were their main behavioural intention predictor. Junior doctors are quite dependent on peers and supervisors to develop their opinions and practices. On the other hand, senior doctors due to their experience learned to rely on their knowledge and abilities. In both cases the moral norm was a relevant predictor. These differences may have quite an impact on future interventions on hand hygiene, mostly because the relevance of mentors and role models acquire even more significance. An interventive model based on the excellence of role models may help to develop senior doctors capable of pursuing a clinical practice based on compliance in the future.

In conclusion, this study adds several significant contributions to the literature on infection control, from a multi-level perspective that reconciles safety climate with the TPB from the specificities of HCP groups, hand hygiene compliance seems to be a problem where different levels of analyses come together to catalyze socio-cognitive and organisational influences. In the next chapter we will continue to explore compliance with hand hygiene by including a new sort of data into the analysis, observational records of compliance. With the inclusion of this variable we hope to extend the findings we have already achieved, and focus on the consistency between self-report measures and observed compliance.

CHAPTER 7

MEASURING HAND HYGIENE USING SELF-ASSESSMENT METHODS AND DIRECT OBSERVATION: EVALUATING CONSISTENCY AMONG TEAMS

7.1. Introduction

Hand hygiene is a simple, yet fundamental technique, to prevent the spread of HAIs (Centers for Disease Control (CDC), 2003). The hands of HCPs are one of the main vehicles for bacterial transmission; however, compliance with this infection control technique remains at less than 50% (WHO), 2007). HCPs' hand hygiene compliance varies according to several factors. Distinctions are encountered between wards, professional categories and working conditions (e.g. number of patients in the room, time of day, intensity of patient care) (Pittet, 2001). For instance, non-compliance is higher in ICUs when compared with internal medicine wards (e.g. Pittet, Mourouga & Perneger, 1999). Also, factors influencing compliance highlights that non-compliance is higher among physicians than nurses; being male rather than female; working during days rather than nights; and having many opportunities for hand hygiene per hour of patient care (Pittet, 2001; Jarvis, 1994; Dubbert, Dolce, Richter, Miller & Chapman, 1990).

Despite the implementation of interventions, the literature suggests that these compliance rates among HCPs are difficult to change which leads to the need for further in research in this area (Creedon, 2003).

7.1.1 Precede Model: planning hand hygiene education

One theoretical approach designed to study health behaviours is the Precede-Proceed model proposed by Green and Kreuter (1991). This model has its origins in the health belief model and is particularly useful in analysing both individual and contextual variables because it takes into account the influence of environmental factors that may influence the behaviour under analysis. Precede phase encompasses five diagnostic phases: (1) social diagnosis to define the target community members' quality of life and associated problems; (2) epidemiological diagnosis focusing on priorities for the health problems in the community; (3) behavioural and environmental diagnosis that defines priorities for the known risk factors contributing to the health problem; and, (4) educational and organisational diagnosis that identifies the factors that predispose, enable and reinforce the behaviour (Green & Kreuter, 1999). This fourth phase is the most relevant one because it focuses on the specific factors that can affect and change health behaviours. For instance, predisposing factors are antecedents of the behaviour and include beliefs, attitudes and knowledge; enabling factors are those that allow the

behaviour to be performed such as supportive organisational features; finally, reinforcing factors include the rewards and feedback received from others after the adoption of the behaviour that may encourage or not the continuation of the behaviour (e.g. social support) (Green & Kreuter, 1999). Because we are particularly interested in understanding hand hygiene compliance among HCPs and how it can be changed we focused on variables that were able to reflect the educational and environmental diagnosis phase from the Precede model, namely attitudes and perceived behavioural control as predisposing factors, safety climate perceptions as an enabling factor and norms as a reinforcing factor.

Attitudes, subjective norms and perceived behavioural control were constructs imported from the TPB (Ajzen, 1991). According to this theory, attitudes reflect an individual evaluation of the behaviour; the subjective norm refers to the perception of how relevant social referents expect the individual to behave; and the perceived behavioural control focuses on the perceived ease associated with performing the behaviour (Azjen, 1991).

The moral norm enhances an altruistic facet that despite having a social etiology constitutes itself as an internalized norm that can be activated solely by the individual assuming its prescriptive nature, when the individual believes that relevant moral values are being threatened (Stern, Dietz, Aberl, Guagno & Kalof, 1999). In fact, hand hygiene may be seen as a moral behaviour because it contributes to a known decrease in the prevalence of HAIs, but the expression of this norm can also be associated with non-compliance. For instance, it is possible that several concurrent moral norms may be activated by HCPs, thus interfering with their personal compliance. To that end, the sense of doing what is right may be ambiguous because HCPs may have distinct moral motivations that express an incompatibility between the moral norm of prioritizing the personal commitment to the patient and their compliance with hand hygiene (Bell, Trevino, Atkinson, Carlson, 2003).

Finally, in the literature, safety climate can be defined as shared employee perceptions about the relevance given to safety in an organisation (Zohar, 2000). Considering the existing body of research, a strong safety climate contributes to increase employee compliance with safety behaviours (e.g. Hoffman & Stetzer, 1996), and reinforces the way safety information flows within the organisation (e.g. Navon, Naveh & Stern, 2005). In this sense, safety climate has been related to several outcomes

such as perceived workplace safety and perceived ability to maintain safety in the workplace (e.g. DeJoy, Searcy, Murphy & Gershon, 2000; Gershon, Karkashian, & Felknor, 1994).

Hand hygiene is a health and safety behaviour with which HCPs need to comply in order to decrease HAIs, however, the investigation of their compliance with this infection control technique has been limited to observational studies that only document compliance rates. These studies provide little insight into the mechanisms through which individual and organisational factors are associated with hand hygiene compliance of HPs.

7.1.2 Self-reported and direct observation of hand hygiene behaviour

The literature reveals that hand hygiene behaviour is mostly analysed using self-report measures and direct observation of practices. However, the degree of concordance between both methods and how well they capture the constructs under analysis are still limited (e.g. Creedon, 2005). Both self-report and direct observation measures have several strengths and limitations. For instance, the use of self-reported measures involves a quick and easy way to gather information regarding a large number of HCPs (e.g. Creedon, 2005); yet, it may contribute to these professionals overestimating their personal compliance with hand hygiene because their responses to items in self-report questionnaires may not be a true reflection of their actual behaviour (e.g. Larson, Bryan, Adler & Blane, 1997). On the other hand, direct observation is considered a more objective measure because it reflects the observation of actual behaviour providing a clear image of the problem in real space (e.g. Salemi, Canola & Eck, 2002). However, observations are only made in a limited number of settings and HCPs may also react to being observed. Furthermore, this is a procedure that requires time, extensive planning and training of specialized observers contributing to additional costs (e.g. Salemi, Canola & Eck, 2002).

7.2 Study V: assessing compliance and consistency in care-delivery teams[14]

7.2.1 Objectives

In this study, the first aim is to contribute to knowledge development by investigating the relationship between observations of HCPs' hand hygiene compliance and their perceived hand hygiene performance by analysing data collected through direct observation and a self-reported questionnaire. We intend to examine the relationships between self-reported and observed compliance by assessing the level of agreement between self-report and direct observation measures. However, our purpose is not only to express the correlations between self-reported and direct observations, in terms of behaviour but also to compare how those variables are correlated across team wards and what are the correlations for reported and observed behaviour by taking into account each Precede variable.

The third aim of this study is to analyse HCPs' compliance with hand hygiene according to their care-delivery team membership in several wards of a Portuguese public hospital. In the fourth aim the purpose is to evaluate the consistency that each team presents towards their reported and direct measures, in order to analyse the ability to constitute group-level indicators that may reflect the teams' dynamics of within-group consensus.

The fifth aim of the study is to analyse the group level associations between observed and reported compliance and predisposing, enabling and reinforcing factors in order to verify the level of agreement between all these variables..

In the end, we expect that the results of this study could contribute to the design of effective intervention strategies that improve compliance with hand hygiene among HCPs'.

7.2.2 Method

7.2.1.1 Samples

[14] Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Measuring hand hygiene compliance using self-assessment and direct observation methods: analysing consensus in care-delivery teams.* (Submitted).

Self-assessment. Self-reported questionnaires were filled prior to the hand hygiene audit and included 550 HCPs (42.9% nurses, 35.5% doctors and 21.6% cleaners). These questionnaires were given to the hospital Infection Control Committee, who guaranteed its distribution to HCPs according to their team membership in each ward.

Direct observation. An observational audit was conducted in 32 wards after respondents completed their questionnaires. The audit was developed as part of a hand hygiene campaign, where training sessions on infection control techniques were promoted by the hospital Infection Control Committee. Observations were made for 30 minute periods totaling 34 hours. The sample was comprised of 206 HCPs representing the hospital's four main services, pediatric/ obstetric (e.g. Pediatric Emergency Room, Gynecology), medicine (e.g. Neurology, Cardiology), surgery (e.g. Trauma, Intensive Care Units) and ambulatory (e.g. Hemodialysis, External Consultations); of these, 72 were doctors, 86 were nurses and 48 were cleaners.

7.2.1.2 Instrument

In this study, two research instruments were used, namely a structured observation checklist designed to collect data on HCPs' compliance with hand hygiene; and a self-report questionnaire designed to focus on these professionals' safety climate perceptions and their perceived adherence to handwashing recommendations.

Self-assessment

The aim was to survey HCPs' self-reported compliance with hand hygiene and also their predisposing (attitudes and perceived behavioural control), enabling (safety climate perceptions) and reinforcing factors (social and moral norms). Because attitudes, social norms, perceived behavioural control and behaviour were consistent with the Theory of Planned Behaviour framework the constructs were measured with items based on the study of Ajzen, Brown & Carvahal (2004). A 7 point-Likert scale anchored by strongly disagree and strongly agree was used.

Attitudes were measured with three items asking respondents to evaluate the relevance of performing hand hygiene, for example 'Hand hygiene is a beneficial technique for me and for the patient' (Cronbach's $\alpha = .91$). *Subjective norms* were also assessed with 3 items, asking respondents to analyse the importance of team colleagues for their personal compliance with hand hygiene, for example, 'My team colleagues comply with

hand hygiene' (Cronbach's $\alpha = .85$). *Perceived behavioural control* was assessed with 3 items, asking respondents to indicate the extent to which they consider hand hygiene compliance is an easy behaviour to perform, for example "I consider that I control hand hygiene technique" (Cronbach's $\alpha = .88$). *Hand hygiene compliance* was assessed with 3 items, asking respondents to evaluate the extent to which they consider they comply with this procedure. An item example is "I always wash my hands before and after performing a significant procedure" (Cronbach's $\alpha = .87$).

Safety climate perceptions were assessed with 3 items adapted from Zohar (2000) asking respondents to evaluate the importance given to safety and hand hygiene compliance in their care-delivery teams. For example, 'In my ward there's a concern with hand hygiene routine problems". A 7-point Likert scale anchored by strongly disagree and strongly agree was used (Cronbach's $\alpha = .83$).

Finally, the *moral norm* was assessed with 3 items adapted from the work of Biel & Thogersen (2007) and Godin, Conner & Sheeran (2005) asking respondents to characterize the role of moral issues as justification for non-compliance. An item example is "I consider my personal commitment towards the patient more important than hand hygiene". A 7-point Likert scale anchored by strongly disagree and strongly agree was used (Cronbach's $\alpha = .89$). A Principal Component Analysis with varimax rotation was performed achieving a 6 component solution that explained 81% of the variance consistent with the 6 variables under analysis (KMO = .74, $p < .000$), (see Appendix F).

The self-report questionnaire also included several socio-demographic questions in order to characterize the sample (e.g. gender, age, professional category, ward team, training in hand hygiene, record of accidents in the past three months, years as healthcare professional).

Direct observation

Observations were made during the whole patient care episode. HCPs knew that a hand hygiene audit was going to occur. Observations were made by HCPs who represented the Infection Control Committee at each ward. Because the observers worked in the same wards they were observing, their presence was less noticeable. In this study a direct observation technique was used, with HCPs knowing that they were being observed. In order to control social desirability, time allocation was used and the

Infection Control Committee randomly selected wards with observations being made at different times.

Observers had previous training, given by the Infection Control Committee, to become familiarized with observational techniques and fill out the observational checklist. Doctors, nurses and cleaners who had contact with patients were observed. Recorded data included some demographic variables such as types of personnel, wards, number of patients per room and care-delivery team membership. For each observed contact, hand hygiene was recorded according to patient contact opportunities that implied the use of hand decontamination and the number of times that HCPs washed their hands. Compliance was defined as the ratio of the number of times a healthcare professional washed his hands to the number of opportunities observed (Moret, Tequi, Lombrail, 2004). Also, observations of hand hygiene with soap and water and with alcohol-based rub were recorded separately. The observers registered hand hygiene techniques using a checklist focusing on the required hand hygiene compliance behaviours on the day shifts of weekdays.

The structured observation checklist consisted of five required hand hygiene behaviours and was based on CDC guidelines (Pellowe, Pratt, Harper, Loveday, Robinson, Jones et al., 2003). In this sense, observations were recorded (i) between contact with patients; (ii) before and after invasive procedures; (iii) before and after touching wounds; (iv) before and after touching body substances; and, (v) before and after touching materials and environment followed by a patient care activity.

7.2.1.3 Data analysis

The data analysis was developed through three steps. First, we identified hand hygiene compliance rates with regard to healthcare professional categories and team membership. Second, we aimed to verify the consistency between self-reported and observed behaviour and we also took into account reported and observed differences between professional categories and care-delivery teams. Data, both observational and self-report, were analysed using SPSS 18.0. It was only possible to pair data of 13 care-delivery teams because most participants differed in the two periods of data collection. Pediatric, obstetric, medicine and ambulatory wards were represented with two teams each and surgery wards had seven teams. Therefore, data analysis will only focus on the sets of data that were possible to match up according to team membership.

Hand hygiene compliance

In order to provide descriptive statistics for hand hygiene compliance rates, observations of actual compliance were tabulated with compliance rates being expressed as percentages. However, because our aim was also to analyse the relationship between self-reported behaviour and observations, the percentage scores obtained from direct observations were transformed into a Likert scale ranging from (1) Never to (7) Always to express the frequency of HCPs' compliance where 0 was evaluated as "Never"; 10-29 was evaluated as "Very Rarely"; 30-49 was evaluated as "Rarely"; 50-59 was evaluated as "Occasionally"; 60-79 represented "Frequently"; 80-99 was evaluated as "Very Frequently"; and, 100 represented "Always".

Aggregation of hand hygiene compliance individual scores to the team level

Aggregation of HCPs' hand hygiene compliance scores to the team level is justifiable because in healthcare organisations professionals interact on a daily basis in integrated care-delivery teams and their personal behaviour is shaped by social and organisational constraints (Snijders, Boudewijn, Kollen, Lingen, Fetter, Molendijk, 2009). In this sense, hand hygiene behaviour variables were formed by aggregating individual perceptions and observations to express their common experience and shared perceptions of their working units. However, aggregation requires statistical justification, in particular a minimum degree of consensus among the members of the team (e.g. Bliese, 2000).

First, we computed R_{wg} and ICC values for each scale to determine whether the aggregation of the variables to the unit level was justifiable. R_{wg} is a measure of inter-rater agreement that compares the observed pattern of responses in a group to a random response pattern. Values for R_{wg} must represent a minimum of .70 (James, Demaree, & Wolf, 1984). Turning to ICC, ICC1 is an intra-class correlation that expresses within-group consensus, where the minimum value is typically .12 (James, 1982); finally, ICC2 refers to the reliability of the group mean that is formed when individual scores are aggregated. The literature suggests a value equal to or greater than .70 is acceptable (Klein et al., 2000).

7.2.3 Results

7.2.3.1 Samples and variables aggregation

After pairing the data, the final sample comprised 166 HCPs integrated into 13 care-delivery teams. The distribution by occupation was: 56 doctors, 71 nurses and 39 cleaners. Seventy-seven percent of the sample was female and mean age was 36.5 years. Also, on average these professionals had 13.1 years of experience. The majority of them had previous training in hand hygiene (72%) and around 66% reported that they had suffered a workplace accident during the last three months. A total of 18 hours of observation were made allowing the identification of 2006 opportunities for hand hygiene compliance overall.

The R_{wg} values for self-reported (ranging between 0.81 to 0.97) and observed behaviour (ranging between 0.58 to 0.89) as well as the ICC1 and ICC2 values are presented in Table 7.1 and they all exceed the required lower bounds related to each statistical procedure. Based on these results the aggregation of individual behaviours (self-reported and observed) to the team level is statistically justifiable.

Table 7.1 R_{wg} and ICC values for reported and observed compliance

	R_{wg} Mean Average	ICC 1	ICC 2
Self-Reported Compliance	0.91	0.23	0.70
Observed Compliance	0.78	0.22	0.77

Turning to the Precede variables R_{wg} values for self-reported (ranging between 0.39 to 0.94) and the ICC 1 and 2 are presented in Table 7.2. Results demonstrate that, as in the case of hand hygiene behaviours it is possible to aggregate self-reported perceptions of Precede variables to the team level; however, some considerations must be made. First, despite the fact that the lowest R_{wg} had a value of 0.39 the team to which this value was attributed had 18 HCPs. According to the critical values of the R_{wg} at the 5% level of statistical significance given by Dunlap et al. (2003), a team comprising 18 professionals, with a Likert scale having 7 categories determines a minimal critical value of 0.36. To that end, the R_{wg} value was still significant.

In terms of ICC 1, values attributed to attitudes and the moral norm are low and are not close to the cut-off point traditionally applied in the literature of .12. However,

according to Bliese (2000) this value attributed by James is an overestimation of the ICC and it was suggested that values ranging from .05 and .20 should also be accepted as adequate. With the results from R_{wg} and ICC 1 there is justification to aggregate the measures to the team level of analysis. Nevertheless, ICC 2 values indicate that after aggregating the variables to the unit level, the group means we will obtain may not present an adequate reliability as most values (excluding the subjective and the safety climate variables whose values are closer to .70) are not near the cut-off point of .70 (Klein et al., 2000). This indicates that, despite the possibility of aggregating the individual level perceptions, there is a large proportion of individual level differences inside each team, which can be evidently identified by the fact that ICC 1 values are rather low. Results are presented in Table 7.2.

Table 7.2 R_{wg} and ICC values for reported Precede variables

	R_{wg} Mean Average	ICC 1	ICC 2
Attitudes	0.83	0.09	0.57
Subjective Norm	0.91	0.14	0.67
PBC	0.80	0.11	0.62
Moral Norm	0.73	0.07	0.51
Safety Climate	0.94	0.13	0.66

7.2.3.2 Hand hygiene compliance rates

Overall hand hygiene compliance was similar to results obtained in the literature (54.9%). Among HCPs, cleaners were the group that showed a higher rate of compliance (64.9%), followed by nurses (54.2%) and doctors (50.3%). However, despite these differences, chi-square value does not reach significance, indicating that the proportion of compliance with hand hygiene is equal for the three healthcare professional categories (Table 7.3).

Table 7.3 Compliance rates for professional categories and team wards

Factor	Nº Hand Hygiene Opportunities	Compliance (%)	χ^2
Professional Category			23.241
Doctors	724	364 (50.3)	
Nurses	880	477 (54.2)	
Cleaners	402	261 (64.9)	
Ward Teams			55.960*
Pediatric/ Obstetric	349	194 (55.6)	
Medicine	379	146 (38.5)	
Surgery	995	594 (59.6)	
Ambulatory	283	168 (59.4)	
Total	2006	1102 (54.9)	

** $p < .000$; * $p < .05$

Turning to ward teams, it can be seen that the greatest number of opportunities for hand hygiene occurs on surgical ward teams. Teams in these wards also have the highest compliance rate (59.6%), followed by teams in ambulatory wards (59.4%). Teams in pediatrics and obstetrics have a compliance rate of 55.6% and, finally, teams in medicine wards are those with the lowest compliance rate (38.5). By taking into account the significance of the chi-square value, it is possible to assume that the observed compliance among teams in the four groups of medical services is not identical.

7.2.3.3 Consistency between self-reported, direct observation measures and Precede variables

After computing percentages to report HCPs' compliance with hand hygiene, the scores obtained from direct observations were transformed to a Likert scale to analyse the relationship between self-reported behaviour, observations and Precede variables. Descriptive statistics are presented in Table 7.4. Mean values for reported compliance are, as expected, higher than those presented by direct observation, revealing the tendency to overestimate reported behaviours. Means indicate that, on average, HCPs agree with the constructs under analysis. With the exception of the standard deviation

for the reported compliance, the others demonstrate that there is no consensus among the mean values.

Table 7.4 Descriptive statistics for group level Precede variables and hand hygiene compliance (means and standard deviations) (N = 13)

	Mean	SD
Reported Compliance	5.54	0.46
Observed Compliance	4.13	1.01
Attitudes	4.40	0.99
Subjective Norm	4.65	0.80
PBC	4.93	0.92
Moral Norm	4.47	0.95
Safety Climate	4.20	0.73

Pearson's coefficients and Spearman's rho between self-reported compliance, the frequency of direct observations and Precede variables were computed to test the association between variables at team level (see Appendix G). Both coefficients were computed because in cases where the sample comprises distinct subgroups and we intend to measure the association between variables, Pearson´s r correlation may understate the strength of the relationship between the given variables. An alternative is to compute the Spearman's rho, which represents Pearson's r correlation computed not on the original variables, but on the variables transformed into rank-orders producing more accurate results (Cohen et al., 2003). Results illustrate that the Pearson coefficient between self-reported and observed behaviour was 0.42 indicating a significant moderate positive correlation, while the Spearman's rho was 0.40. This result indicates reasonable consistency between self-reported and observed behaviour.

Attitudes were only correlated with reported compliance. Correlations were positive but low. In the case of the subjective norm, this variable has a positive correlation with both types of behaviour. The correlations between subjective norm and these variables reinforce the idea that social influence processes are particularly important in the study of this behaviour. In terms of the moral norm, it is particularly interesting to see that despite the fact that this norm is negatively related to the reported behaviour as was found in our previous studies, it is also negatively correlated with the observed behaviour, indicating that this norm may in fact be a relevant norm

contribution to non-compliance and appears to be associated with behavioural practices. Furthermore, it is negatively correlated with attitudes.

The PBC is correlated with the reported behaviour and negatively correlated with the moral norm which demonstrates that the perception of control may be affected when the professional presents a norm that enhances a commitment towards the patient inhibiting compliance. Finally, safety climate was only positively correlated with behaviours, both reported and observed. All correlations were low to moderate.

After analysing the consistency between the behavioural measures and Precede measures, a comparison was made between self-reported and observed compliance by taking into account professional category and ward team. Results indicate that mean values reported by HCPs were overestimated in relation to their observed compliance. In particular, professionals strongly agree that they comply with hand hygiene at all times required, but in their daily practices the observed frequency of adherence demonstrates that compliance is only occasional. On average, doctors are the professional group with a higher rate of reported compliance; however, the observational results indicate that doctors are the category with lower compliance, while cleaners were the group with higher observed adherence. Nevertheless, after computing One-Way ANOVA the mean differences that existed between the three professional categories were not statistically significant for the self-reported, or the observed behaviour (Table 7.5).

Mean differences were only significant when we analysed the professional teams by taking into account their ward membership. Through the homogenous subsets attempts it was possible to combine groups according to their similarity. These Post-Hoc tests demonstrated that it was possible to create three homogenous groups (see Appendix H). The results for the homogenous subsets for direct observation compliance where ambulatory and surgery groups were not different from each other as they present the highest compliance rates but each is different from pediatric and obstetric and medicine wards. In fact, medicine wards were integrated into their own group indicating their lower compliance rates. If we take into consideration the self-reported behaviour, the only difference would be that the medicine ward is integrated into the same homogenous group as the pediatric and obstetric one; but both are still distinct from ambulatory and surgery wards.

Table 7.5 Self-reported and observed hand hygiene compliance among professional categories and ward teams

Factor	Team Self-Reported Compliance		F	Team Observed Compliance		F
	Mean	SD		Mean	SD	
Professional Category			0.22			1.25
Doctors	6.24	0.33		4.06	0.60	
Nurses	6.21	0.30		4.15	0.55	
Cleaners	6.23	0.32		4.24	0.50	
Ward Teams			29.83**			132.82**
Pediatric/ Obstetric	6.32[b]	0.16		4.07	0.21	
Medicine	5.91[a]	0.03		3.14	0.17	
Surgery	6.37[c]	0.35		4.42	0.38	
Ambulatory	6.03[c]	0.02		4.41	0.22	

** $p < .001$; * $p < .05$

a) b) c) significant mean differences representing Post-Hoc homogenous subsets

7.2.4 Discussion

Despite the significant role of hand hygiene as a fundamental practice in providing safe care to both patients and professionals, adherence to this technique remains unstable and difficult to sustain. This study was an attempt to reconcile both self-reported and direct observational measures to provide a better understanding of how HCPs integrated into ward care-delivery teams comply with hand hygiene. Our aim was not only to assess overall compliance rates but to investigate the possibility of achieving consensus among ward team members in reported and observed variables in order to verify how social influence processes might constrain professionals such that their personal perceptions and observed behaviours become more homogenous. In addition, we wanted to verify the consistency between reported and observed behaviour measures, and explore how these variables are correlated not only with Precede variables, but also to team wards in order to look at the pattern of possible associations between all these team level variables. Both Pearson coefficients and Spearman's rho correlations were computed to analyse correlations between variables at team level.

We analyzed 13 teams divided into four medical wards: pediatrics/ obstetrics, medicine, surgery and ambulatory. The overall compliance rate was 54.9%, which is consistent with HCPs' international baseline handwashing compliance (e.g. Pittet et al. 2000). However, unlike other results presented in the literature where nurses were seen as the group with higher compliance rates (e.g. Sharir, Teitler, Lavi & Raz, 2001), in this study it was not possible to identify significant differences in compliance rates between professional categories. This could be due to the fact that the sample only comprised 166 professionals among doctors, nurses and cleaners compromising the possibility of achieving a significance level among them. Nevertheless, significant differences were found between ward care-delivery teams. In this particular case, teams with greater compliance were those that belonged to surgery and ambulatory wards, followed by pediatric/ obstetric teams, and, finally teams with lower compliance rates were those integrated into medicine wards.

According to the other purpose of the study, it was possible to aggregate all variables to the team level. R_{wg} and ICC values were particularly high for self-reported and observed compliance, suggesting an elevated level of consensus among the team members. In terms of the Precede variables, despite the fact that results from R_{wg} and ICC 1 allowed constitution of the individual perceptions into team level perceptions, the results from ICC 2 indicated that for some variables, in particular attitudes and the moral norm, the mean group reliability may not be the most adequate as the values were quite a bit above the cut-off point of .70. In our previous studies we were able to identify that the moral norm was not a significant predictor for nurses and cleaners, which may contribute to explain that within teams composed by doctors, nurses and cleaners, the personal positions regarding this norm may vary greatly. The same applies for the case of attitudes, where our research demonstrated that, for instance, cleaners attribute less predictive importance to attitudes.

So, in a general way, these groups may share some common ground regarding these variables, but not determinant in a way that allows the constitution of a reliable group mean. Nevertheless, the possibility of aggregating all these variables to the team level reinforces the idea that social influence processes play a significant role in hand hygiene behaviour, where members from the same team share common feature related to their self-reported perceptions and to their observed practices that defined them as part of a unit.

In this study, it was also possible to analyse the consistency between self-reported and direct observation measures. Results indicated that HCPs overestimate their personal compliance while using the self-reported measure, when compared to the direct observation of their hand hygiene compliance behaviour. This corroborates other findings in the field of infection control. For example, in a study developed by O'Boyle and Henly (2001) recommendations were made not to use self-report measures due to an overestimation of compliance. However, results show a moderate positive correlation between both measures, which is an indicator that provides some support of the consistency between them. To reinforce the possibility of applying self-assessment measures in the field of infection control, the correlations between both types of behaviour and Precede variables were also analysed. Results determined that despite the fact that all significant correlations were low to moderate some interesting findings and associations were made.

In the particular case of norms, the subjective norm is also positively correlated with both types of behaviour, enhancing the role of social influence processes, while the moral norm, is negatively correlated not only with the reported compliance, which is a result consistent with the previous findings we have presented, but also has a negative correlation with the observed compliance. This finding is particularly important because it reinforces the idea that this norm that inhibits compliance appears to be associated with behavioural practices. In this sense, it is not only a case of a reported association between variables. As expected, safety climate was positively correlated with both behaviours. In a general way, these results contribute to support the idea that despite the fact that HCPs overestimate their self-reported compliance; it appears to be a possible way to collect data without constraining the results. Furthermore, this pattern of associations reinforces the results that were presented in the four studies of this thesis, not only because it emphasizes the importance that social influence processes have on observed compliance, but also due to the fact that the moral norm, integrated as an additional behavioural intention predictor in the theoretical model underlying this project, appears to be associated with a negative impact on observed compliance.

In addition, self-report and direct observation measures were compared by taking into account professional categories and ward teams. Findings indicated that they were similar to each other, reinforcing the idea that despite differences in compliance estimates between the two measures, there are shared communalities between them.

However, despite the results achieved, this is an exploratory quantitative data analysis with several limitations that can be pointed out. Nevertheless, there is still some merit in these data. For instance, it was possible to pair some quantitative and observational data, aggregate individual level perceptions and observations to the team level and make comparisons between self-report and direct observation measures.

To our knowledge, this is the first study that made this comparison by taking into account the three main categories of HCPs. Although the sample size is relatively small, the results obtained with respect to the direct observation were similar to those obtained internationally, which indicates that despite sample limitations there is some consistency in the current results. There remains much to be done in the field of infection control to link HCPs and their social space within a healthcare organisation, and how their personal compliance is perceived and represented in such space. Future studies should try to fully examine the experience of professionals located in distinct wards and professional categories by focusing on other variables. In particular, it would be interesting to focus on visualizations of the social space of professionals before and after an intervention and try to understand how representations change, or not, according to implemented measures.

CHAPTER 8
FINAL CONCLUSIONS

8.1 General conclusions and contributions

In the first part of this thesis the purpose was to address the challenges of HCPs' compliance with hand hygiene by presenting the evolution of the problem of compliance since the XIXth century. From the discoveries of Semmelweis until the contemporary world, the technological advances in medicine and the little importance given to simple measures such as hand hygiene have contributed to increase the significance of infectious pathology throughout the decades, contributing to the emergence of the concept of HAIs. HAIs are a major burden in both developed and developing countries accounting for a large proportion of patient mortality and morbidity which increases the costs to national health systems (e.g. CDC, 2005). Health professionals' behaviours are intrinsically related with an infection acquired within a hospital facility because this infection only occurs due to the fact that an inadequate treatment was given to the patient (e.g. WHO, 2005). Non-compliance with hand hygiene is seen as the first route to inadequate treatment as it enables infection transmission to occur. Despite the relevance of this procedure as a significant infection control technique, HCPs' compliance with hand hygiene is below average and difficult to increase and sustain through time even after intervention programmes (e.g. CDC, 2003).

After analysing the problem of infections inside the healthcare sector, the purpose was to explore the theoretical frameworks used in the infection control literature to explain HCPs' compliance behaviours with hand hygiene. By taking that review into account we presented the three main approaches that were applied in the study of this problem and that also served as background for this project as they sustain the theoretical objectives of this thesis. In this sense, we outlined the importance of the Theory of Planned Behavior, the Precede-Proceed model and the safety climate approach.

With the literature review we were able to outline the relevant findings achieved with these models when applied in the healthcare sector, but mostly we were able to identify the main limitations of the prevailing body of research related to the application of these models to the study of HCPs' compliance with infection control. According to the identified limitations we started to delineate our expectations of developing a model with a multi-level nature able to connect bottom-up and top-level phenomena.

In the second part of this thesis we focused directly on the specificities of the theoretical model that we aimed to analyse with this project. We determined that the model was developed in order to try to overcome theoretical and methodological limitations of all approaches. Particularly, in the case of the TPB our purpose was to identify how behavioural intention predictors are related to intention according to different HCP categories. We also aimed to explore the normative component of the TPB by analysing the relevance of the subjective norm in hand hygiene compliance behaviours and expand it with the inclusion of a new additional predictor able to reflect the moral concerns underlying this behaviour, the moral norm of prioritizing the commitment with the patient. Methodologically, our objective was to operationalise all TPB constructs according to Ajzen's guidelines and to increase consistency among attitudes and behaviour by focusing on a specific attitude compatible with a specific behaviour, i.e. hand hygiene.

In the Precede-Proceed model, generically, the purpose was to develop a bottom-up perspective that allowed HCPs to determine their personal reasons for non-compliance in order to identify the factors that they consider will predispose, enable and reinforce compliance. Methodologically, we expected to have the opportunity to be able to define with more precision the role of each variable as predisposing, enabling and reinforcing variables. The development of a qualitative study, in the very beginning of this research project, was important to develop these basic assumptions underlying the Precede-Proceed model.

Finally, we established the importance of safety climate at the team level because patient safety can only be considered as a function of healthcare micro-systems, such as care-delivery systems (e.g. Snijders et al., 2009). The care is not due to just one person and is determined by the orchestration of a full range of professionals inside a team. Besides that, a major theoretical aim was to constitute a multi-level model able to reconcile team safety climate and the TPB through a meditational path where attitudes, subjective norm and PBC would serve as mediators. Methodologically, it was important to operationalise safety climate at the unit level by aggregating professionals' shared perceptions of safety related to their teams using several consensus statistics.

Six general tenets were presented as determinants of this thesis: (1) the importance of constituting a bottom-up perspective where HCPs would be able to determine the factors that in their opinion predispose, reinforce and enable hand hygiene

compliance; (2) to explore the assumption that doctors are a risk-factor for non-compliance by starting to analyse medical students behavioural intention predictors to comply with hand hygiene taking into account how different socialization stages in their medical training change their behavioural intention predictors; (3) the need to recognize the importance of a multi-level framework where HCPs' perceptions are influenced by organisational characteristics due to the fact that their practices are embedded in micro-systems, such as care-delivery teams, but also, individual processes are able to exert influence in top-down courses of action; (4) to focus on the characteristics that are specific to each HCP group, namely doctors, nurses and cleaners in order to identify the different factors that each group attribute more relevance to when considering their intention to comply; (5) to make a transition from a medical students' sample to a doctors' sample where junior and senior doctors intentions to comply are analysed according to their different socialization stages; (6) to explore how self-reported measures and direct observation can be associated to reflect HCPs' compliance in order to verify how adequate it is to utilize this sort of measure in the study of infection control.

In the second part of this thesis we analysed how each one of this general tenets associated with several specific objectives were explored throughout five empirical studies, which corresponded to chapters 4, 5, 6 and 7. In the first study (chapter 4) we reconciled an exploratory design with a qualitative and a quantitative methodology with the aim of implementing the principle of participation required in the Precede-Proceed model as a major determinant to start studying any specific health problem.

This study was designed to explore the factors that doctors, nurses and cleaners considered that predispose, enable and reinforce their compliance. The study clarified the relevance of the moral norm, namely that the moral imperatives regarding this type of compliance can assume a multi-faceted nature, contributing to both non-compliance and compliance. Furthermore, this was a study that gave us the possibility to analyse the characteristics of different groups of professionals that need to comply with hand hygiene. It was interesting to understand the differences and the common points that healthcare, educational and food professionals have. This was the starting point to diagnose that among HCPs there were distinctions among doctors, nurses and cleaners (e.g. moral concerns were only identified in the narratives of doctors and nurses) and that social influence processes were also particularly relevant for these professionals.

In chapter 5, we turned our attention to the study of medical students. Studies II and III are also integrated into this chapter as exploratory studies since the samples were not large enough and we were not able to replicate the results. In these studies we examined the behavioural intention predictors of medical students from different medical school years. In study II we only focused on students from the 6th year and we explored the TPB behavioural intention predictors with the inclusion of the moral norm in the TPB normative component as an additional predictor. The results determined that the subjective and the moral norm were the best predictors of these students' intention to comply. The moral norm, as expected, had a negative impact on intention.

Due to the importance of these norms, study III expanded the social referents and the moral emphasis of both constructs. To that end, we analysed the role that professors and colleagues had as relevant referents in the subjective norm and the emphasis given to hand hygiene or to a commitment to the patient as a moral norm. The relevance of these predictors, as additional behavioural predictors in the field of the TPB was tested using a sample of medical students from the 1st and the 6th years. The results appear to have some consistency with the literature, namely in the case of the importance given to social referents. The results indicated that younger students (1st year) give particular importance to professors as social referents while older students (6th year) attribute more relevance to colleagues. According to Schneider et al. (2009) medical students in their early stages of education are particularly influenced by professors in their beliefs, attitudes, and clinical choices, however, when they become more independent, older colleagues start to be more valuable (Paukert & Richards, 2000).

In terms of the moral norm, the results of the study determined that students from the 1st year emphasized the "hand hygiene moral norm" as a greater predictor of their intention to comply, while students from the 6th year determined that the "patient moral norm" was the best predictor of their intention. In the literature, it is possible to find possible explanations to sustain these results. For instance, according to Mortel et al. (2010) infection control topics are mostly taught in the first years of medical curricula which can contribute to the fact that students from the 1st year were able to direct their attention to this norm. Also Duray et al. (2010) argue that infection control topics are underestimated in medical school curricula because they are perceived as themes with less importance when compared to other medical topics. To that end, it will be

conceivable that students from the last year would focus more on their commitment to the patient as a moral concern.

Both studies expanded knowledge in the field of infection control by addressing a sample that is constantly under researched. It is believed that more research is needed to explore the questions that were raised in our results which express how different socialization stages can shape the intention predictors of these students. However, we consider that the studies contributed to raise more awareness of the importance of internalised and social norms in medical students by suggesting that behavioural intention predictors are constrained during different stages of socialization which can contribute to possible implications in their compliance practices.

After developing these exploratory studies, first addressing the Precede factors and implementing the principle of participation and then exploring the medical students' behavioural intention predictors, before focusing on the doctors group, attention was directed to HCPs as a whole and to the main features of our thesis that account for the test of our multi-level mediational model with a cross level moderation.

Chapter 6 consisted of a large study; study IV, with three distinct research goals. In the first part the theoretical model that underlies this thesis was tested. Two mediations and one moderation were tested. All of these interconnections had a multi-level nature. Team safety climate was assumed to have an impact on HCPs' intention to comply through an indirect influence exerted by attitudes, subjective norm and PBC. This was a lower level mediation of an upper level effect because the predictor was at level-2. The results determined that this partial mediational path was verified and that attitudes were the stronger mediator. This pattern of results that emphasize the relevance of attitudes in the field of safety climate are consistent with the literature because according to Cox & Flin (1998) safety climate is a manifestation of safety culture expressed through professionals' attitudes.

A second mediational path was tested in order to verify if intention was the immediate antecedent of behaviour. Results identified that with the exception of the intention, all behavioural intention predictors including the moral norm had a direct impact on hand hygiene compliance. The gap between intention and behaviour is discussed in the TPB literature and to that end our result is not inconsistent with other literature findings that were not able to establish a link between these two elements (e.g. Ajzen & Fishbein, 2005). Finally, a cross level moderation was tested where a bottom-

up feature, the vulnerability perception, was a moderator in the relationship between a top-down feature, team safety climate and HCPs' hand hygiene compliance. As expected it was possible to verify that team safety climate had an impact on compliance which is consistent with the literature findings, in which the stronger the climate the greater the possibility of increasing compliance (Zohar & Luria, 2004). However, this relationship was not stronger when the professionals' vulnerability perception was higher. This result determines that it is necessary to continue to test the impact of bottom-up variables on top-down characteristics; nevertheless, the mechanisms underlying this type of relationship require a higher level of refinement in procedures. Probably, these relationships exist but are also influenced by other variables, indicating that bottom-up/ top-down interchanges are more complicated.

From this part of study IV it is important to acknowledge that theory building is a major contribution that might arise from these results due to the interconnection between team safety climate and the TPB in the field of safety compliance behaviours, through an integrative perspective that arises from a multi-level approach where a mediation model emerges to explain how indirect effects at group and individual level are manifested. Another contribution is in the practical field where interventions may be developed by targeting this mediational path knowing that by promoting team safety climate perceptions will contribute to reinforce professionals positive attitudes towards hand hygiene, increase the perception of positive influence of relevant referents and develop a higher sense of control. By doing that, professionals will reinforce their intention to comply, but also increase their actual behaviour not only because climate has a direct influence on behaviour but also because behavioural intention predictors appear to have a significant impact on behaviour too.

The second goal of study IV was directed to the differences in behavioural intention predictors among HCPs. In this part, the sample was the same as from the first part of the study, professionals were considered without take into account their inclusion in the care-delivery teams. The results showed that each group gave importance to a specific behavioural intention predictor. For instance, doctors were the only group giving relevance to the moral norm as an important predictor. This result was unexpected because in the first study this norm was present in the narratives of doctors and nurses. Perhaps nurses despite acknowledging the existence of this norm attribute more importance to hand hygiene. This is a topic that requires more research.

Nurses and cleaners had the best intention predictor on the subjective norm which contributed to the idea that social influence processes have a really important role in hand hygiene compliance behaviours. To that end, role modelling may be seen as one intervention strategy that must be implemented continuously in order to increase compliance.

Finally, the third goal of study IV focused only on the sample comprising doctors. After analysing medical students' behavioural intention predictors and having considered their socialization stages, this professional group was investigated a bit further as compliance issues are particularly relevant in this group. By taking into account years' experience the sample of junior and senior doctors was differentiated. Results emphasized that junior doctors attributed particular importance to subjective norms while senior doctors emphasized attitudes as the main predictor of their intention. Research by Limbert & Lamb (2002) and Nilsson et al. (2009) support these results. For instance, junior doctors actively seek for information on peers to develop their practice due to the fact that they have less experience and they also have a greater need to report their behaviours to colleagues and supervisors due to the hierarchical structure into which they are integrated (Limbert & Lamb, 2002); while senior doctors because of their higher level of expertise rely on their knowledge to establish their personal decisions (Nilsson et al., 2009). In both cases the moral norm was a significant predictor with a negative impact on intention. This pattern of results determines that professional experience must be explored as a relevant variable to predict these professionals' compliance. Furthermore, these results reinforce the importance of role models and mentors in determining compliance of junior professionals.

In Chapter 7, Study V focused on self-reported compliance and direct observation of hand hygiene. Data were collected using self-report questionnaires and were analysed for hand hygiene behaviour and behavioural intention predictors grouped according to predisposing, enabling and reinforcing factors. Observations were made across team wards. In the end, it was possible to match the data of 13 teams. Results indicated that both self-report and observational measures presented a high level of consensus among professionals inside their care-delivery teams, allowing to aggregate their individual indicators to the team level. Furthermore, it was possible to aggregate Precede variables to team level, indicating that attitudes, norms and PBC apart from safety climate can be indicators of consensus within these teams. This fact determines that social influence

processes carry a significant level of importance in the manifestation not only of these professionals' behaviour, but also of their perceptions.

Secondly, the results indicated that compliance rates were higher among nurses, followed by doctors and cleaners. Values were around 50% but differences among professional categories were not statistically different. In terms of ward teams, it was possible to identify that teams with higher compliance rates were those belonging to surgery wards, followed by ambulatory teams, pediatric/ obstetric and medicine. In this case, differences between compliance rates were significant.

In addition, correlations were tested between self-reported and observed compliance, ward teams and Precede variables. Results highlighted interesting findings, particularly those related to social influence processes. First, we were able to verify that self-reported and direct observation measures presented a positive moderate correlation which reinforced the idea that both measures express share some common consistency. Then, ward teams also presented a positive correlation with both types of behaviour. Besides that, in the particular case of norms, the subjective norm was correlated with self-reported behaviour, observed behaviour and ward teams. The correlation was positive reinforcing the importance of social referents in determining behavioural practices; while, the moral norm was negatively correlated with both behaviours and team wards, enhancing the idea that this moral concern can be associated with observed non-compliance.

Several aspects can be explored with these results, namely (1) how social influence processes have a major role in hand hygiene compliance; in this study, individual level perceptions and behaviours were aggregated to the team level which demonstrated that social influence plays an important part in shaping these professionals' practices and perceptions; and (2) specificities of hand hygiene compliance. The fact that surgery teams were the care-delivery teams with higher compliance rates raises a question that can contribute to clarify the terms of intention to comply and hand hygiene compliance. In Godin et al.'s (2008) literature review time constraints was a relevant predictor for non-compliance and most studies that used the moral norm demonstrated that this variable was able to predict these professionals' intention to comply, as a norm that expresses their need to adhere as a way to save patients' lives, reinforcing that compliance may not occur in life and death situations (e.g. Ferguson, 2004). For example, if professionals consider that time constrains their

compliance, and non-compliance can occur in life and death situations, then care-delivery teams in which time constraints are not perceived as a major problem must comply no matter what because they rarely deal with life and death situations, and they will have the moral prerogative of complying with hand hygiene in order to save lives. However, these results also indicate that in wards where time was not a major problem, such as medicine wards, compliance rates were no higher than 54%.

Turning to the other side of the question, the same can be said about not complying only when the patients´ life is at risk. In this case, compliance rates in surgery services where all ICU units are included would require compliance rates higher than 54%. In these situations, time constraints can contribute to non-compliance, but do not define this practice exclusively because compliance rates are similar in wards with different time constraints. Furthermore, moral norms that support compliance with hand hygiene, where this practice is seen as a way to save patients' lives, appears not to be the most important adhere to, as services where there are higher possibilities of infections and deaths caused by inadequate HCPs' treatment, such as surgery services (e.g. CDC; 2005) do not exclusively comply to this imperative norm; (3) also, the consistency among self-reported and direct measures indicated that despite the fact that professionals tend to overestimate compliance in questionnaires, results achieved using this methodology to collect data are a good indicator of what can be expected when observations are made inside a hospital facility. However, the best approach is always to develop studies with both measures; and (4) the definition of three profiles consistent with the existing professional groups reinforces the idea that inside the healthcare sector doctors, nurses and cleaners perceive compliance in a different way and interventions must focus on their specificities in order to obtain adequate and sustainable results.

Globally, this thesis main contributions to explain HCPs' intention to comply with hand hygiene are: From a *theoretical perspective,* (1) the interconnections between safety climate and the TPB among HCPs where attitudes, subjective norm and PBC were mediators of this multi-level relationship, challenging a view that was mostly focused at the individual level and exclusively used socio-cognitive perspectives to analyse compliance; (2) all studies emphasized the role of the subjective norm as an important individual level variable which is a very unusual result in the field of the TPB research framework; (3) some light was shed on the possibility of these HCPs having a multi-faceted moral norm that may contribute to non-compliance particularly among

doctors, being acquired within medical students socialization stages. This norm may be important as a way to explain why compliance does not change according to the critical-state of the patient, in fact, some studies document that the higher the need for hygiene the lower the compliance (e.g. Baraff & Talon, 1989, Pittet, 1999); From *a methodological perspective,* (1) the ability to develop a multi-level approach of safety climate using a consistent operationalisation of the construct; (2) the attempt to go beyond self-reported measures of compliance by including a direct observation methodology where within team consensus was analysed for observed and reported variables. In cross-sectional studies such as the ones we presented here, these types of methodological characteristics contribute to strengthen the results achieved; In this particular case, the results from the final study contribute to strengthen the findings achieved in previous studies, mostly because it was possible to identify social influence processes by aggregating individual level perceptions and behaviours at the team level. This fact contributes to reinforce the importance that safety climate, indeed, needs to be addressed as a multi-level construct being aggregated at the unit level, as these teams appeared to be strongly influenced by normative influences approved by others (Cialdini, 2003). Furthermore, we were able to verify that all variables presented correlations with observed compliance and team wards, particularly, subjective and moral norms, which reinforces the idea that both types of these norms can, in fact, be identified in practices; and *from a practical perspective*, this thesis aims to contribute (1) to improve the understanding of how to develop future interventions towards hand hygiene in healthcare organisations not only with HCPs but also with medical students in order to decrease the prevalence of infections acquired within these facilities whose origin is attributed to those who are responsible for taking care of patients.

8.2 Practical implications

One of the main objectives at the start of the thesis was to have the opportunity to apply the full Precede-Proceed model. Unfortunately, it was not possible to develop the Proceed phase of this model in a healthcare organisation to establish an intervention programme based on the results found. Nevertheless, there is now sufficient information to delineate intervention guidelines that must be taken into consideration when interventions are intended to be applied in medical wards or in the whole health facility.

The first question the intervention needs to address is if doctors, nurses and other allied health professionals such as cleaners care enough about the hand hygiene compliance problem, in terms of being fully commitment to the preventive measures that the hospital decides to develop (e.g. Green & Kreuter, 1999). Questions such as *"Does the professional believe that it is acceptable to continue with non-compliance even if compliance is being recommended?", "Does the professional believe the problems related with failure to comply with hand hygiene are severe?"* or *"Does the professional perceive the benefits of adopting the recommended behaviour to be greater than the perceived side effects?"* are examples of ways to examine the professionals' motivation to comply (e.g. Green & Kreuter, 1999).

This triage of HCPs' predisposing factors must go beyond their motivation, as shown from the results. At their predisposing level the problem can be identified as directed to their beliefs, attitudes and control perception. In terms of beliefs these professionals appear to have multi-faceted moral concerns that contribute to the constitution of distinct moral norms that depending on their emphasis enable or inhibit compliance. One thing that must be done, in particular for doctors, is to change the strength of their moral beliefs by reinforcing the idea that hand hygiene and other infection control issues are also very important moral prerogatives that contribute to negative outcomes that can affect their personal relationship with the patient. Focus groups and other sort of measures that contribute to discuss this topic can help to influence the beliefs that should be changed.

However, the problem goes beyond this moral concern. In fact, it relies on an attitudinal problem common to all professionals. In the particular case of doctors and nurses some of them seem to doubt the importance of some behavioural risk factors which can contribute to non-compliance and also elicit the inhibiting moral norm in the case of doctors (e.g. Battista, Williams & MacFarlane, 1986). For instance, in a study developed by Weschler, Levine, Idelson, Rothman & Taylor (1983), less than half of HCPs considered that several behaviours that have a negative impact on patients' health (e.g. alcohol use, saturated fats) should be moderated or eliminated from the patient diet. However, in general, all these professionals considered that reducing smoking was important. The fact is that HCPs' attitudes are mostly determined by the weight and general acceptance of scientific evidence (Wecshler, et al., 1983).

In the particular case of hand hygiene, it is indeed determined that this procedure contributes to decrease HAIs but several studies have demonstrated that despite the importance of this technique low levels of evidence were demonstrated for the efforts to control infection with hand hygiene (Silvestri, Petros, Sarginson, Cal, Murray & Saene, 2005). This procedure does not abolish but only reduces transmission of infections determining that poor compliance may not be considered for the failure of hand hygiene to control infection (Silvestri et al, 2005). Due to the fact that this apparent lack of evidence base is particularly important to constrain doctors´ compliance, it will be necessary to address their set of beliefs and attitudes in order to modify them. HCPs may consider that hand hygiene is a relevant procedure but little time is devoted to infection control because they do not consider that compliance will contribute to a greater change in the field of infection control (Silvestri et al., 2005). One measure that can be applied in terms of demonstrating the relevance of hand hygiene is to develop a surveillance system. Due to the difficulties of implementing a full surveillance system inside a hospital, it would be possible to start with a small medical ward, in which during a period of time, hand hygiene compliance rates are monitored, infection rates are identified and, infection control measures are applied in order to decrease the incidence of HAIs. In the end, comparative results should be disclosed, those before the surveillance system was implemented and those after its implementation. The literature has shown that the constitution of small surveillance systems, where hand hygiene is implemented, has a great impact in the reduction of HAIs (e.g. Pittet, 2004). With the evidence that in their local ward, due to their own compliance practices, a great proportion of HAIs decreased can contribute to reinforce HCPs' attitudinal position.

Turning to cleaners their attitudinal issues are mostly related to a need to increase the awareness about the importance of compliance by changing the negative attitudes towards this behaviour. In order to strengthen their attitudes towards hand hygiene they need to be fully aware of the characteristics of this technique. In fact, the more the knowledge they acquire about hand hygiene, the higher the possibility of increasing their perceived behavioural control. Control was particularly relevant for cleaners and senior doctors. In the case of senior doctors it was found that the greater the experience the more the control and the higher the importance given to attitudes. It is therefore conceivable that in the case of cleaners, reinforcing their attitudinal component will contribute to enlarge their ability to deal with the daily barriers of compliance that may

undermine their ability to adhere. With more knowledge and a strong attitude, cleaners will feel more prepared to practice hand hygiene in the most distinct situations and will be able to apply the procedure according to the type of contact they make with the patient or with the environment. Theoretical and practical training is a determinant in the case of cleaners. Also a small booklet with the most relevant guidelines must be given to all cleaners during training in order to give them a simple way to quickly search for the correct information; while, when they start working posters and flyers should be placed throughout the workplace in order for them to have an easy way to look for additional information if they are in a situation where they don't know what do.

By focusing on the enabling factors we are taking into consideration that compliance sometimes fails due to inadequate resources to do so. Safety climate has been seen, in the literature, as a contextual factor, exerting its influence as a reinforcing factor. However, in the thesis, despite the fact that the role of safety climate is not excluded as a reinforcing factor, the possibility of safety climate as an enabling factor is also considered. Several studies focusing on HCPs' compliance issues, including the exploratory study, highlighted the importance of unclear recommendations and priority towards compliance as an obstacle to adherence.

Professionals' substantial perception that adequate priority is given to hand hygiene in their medical units and care-delivery teams, with available space in patients' rooms being given to sinks, materials being properly distributed and constant reminders being made towards the need to comply every time hand hygiene is required functions as an enabling factor by promising that the HCPs' investment of time and effort in compliance will not be wasted. Because safety climate was identified as an approach able to be interconnected with TPB socio-cognitive variables, it seems feasible that team safety climate enables these factors to occur, in particular enables the attitudinal predisposing factor to be expressed, as attitudes were the strongest mediator between team safety climate and intention to comply. HCPs will have more positive attitudes towards compliance and team safety climate will enable those attitudes to influence HCPs' intention to comply. To that end, interventions must focus on the need to attribute importance to hand hygiene, not only by creating a physical environment that promotes compliance (e.g. adequate material), but also by exerting its influence by including visible results, support from colleagues and adequate feedback from supervisors.

In this sense, safety climate due to its interconnections with the subjective norm can also express itself as a reinforcing factor. Support from colleagues was identified in the several studies of this thesis as one major predictor of HCPs' intention to comply. The subjective norm acquired a relevant role for all professional groups, in particular for those in learning socialization stages such as medical students and junior doctors. In fact, the subjective norm was only unable to predict senior doctors' intention to comply. In sum, social influence processes do matter. Because compliance with hand hygiene does not provide an immediate result, positive or negative, the absence of visible results can constrain preventive behaviours.

For instance, if a professional does not comply with hand hygiene, therefore the effect of that behaviour is immediately perceived. Due to the possible negative outcomes arising from that noncompliance behaviour perceived by other professionals, this sort of behaviours would be more easily and effectively changed if role models and mentors played an active role in supporting the prescribed behaviour by giving the example and by providing feedback to the "followers". To that end, there is a need to identify those among care-delivery teams and medical unit professionals who are seen as compliers. Each team must have a role model able to remind them of the need to comply. Furthermore, medical unit supervisors must also be seen as examples in the field of infection control. In addition, best practices must be reinforced and receive a positive feedback from both role models and supervisors. If a supervisor is perceived as non-compliant it will increase the possibility of other professionals neglecting their need to adhere to hand hygiene as less priority is being given to hand hygiene. An environment where safety is a priority is, simultaneously, an environment that is rewarding compliance behaviours. As a reinforcing factor, safety climate assures its expression by the impact that it exerts on social influence processes: (1) how significant others support the professional in terms of their compliance behaviours; (2) how significant others reunite in order to develop measures to increase compliance; (3) how significant others develop strategies to overcome the barriers that hinder compliance.

The last interconnection between safety climate and the subjective norm, as reinforcing factors are of extreme importance if we take into consideration the medical students sample. To choose the best role models in order to guide these students during their medical training and to support the importance of those role models with the constitution of a medical school climate that also gives priority to infection control will

provide the support they need to develop adequate practices. After all, role models behaviour supported by a positive climate may not only serve as reinforcing factor, but it can also contribute to eventually predispose HCPs' behaviour and trigger their motivation to act.

In general, to develop an intervention using a Precede-Proceed framework and applying the results we achieved incorporates the idea that interventions must be aligned, in order to focus on the predisposing, enabling and reinforcing factors (e.g. Green & Kreuter, 1999). All factors must be addressed simultaneously and in all circumstances. Education, training, providing adequate resources, giving feedback and ensuring behavioural rewards are relevant determinants that must be developed. It will not matter to train cleaners' skills to enable the behaviour if there is a lack of prior motivation. Also, if doctors' do not understand that hand hygiene is also a relevant moral concern; little can be done even with a designed reinforced system of role models. First, they need to be educated regarding their moral beliefs. Finally, in order for compliance to become consistent over time a continuous series of learning experiences need to be planned. Behaviour will arise from the cumulative learning of those experiences determining that behavioural change programs must be continuously addressed (e.g. Green & Kreuter, 1999).

8.3 Methodological limitations

As with all empirical research, several methodological considerations need to be made, since they may have specific implications for several findings presented in the five studies throughout this thesis, which can constrain their interpretation.

First we will focus on the samples used in the studies developed in the thesis. Overall, we have (1) a sample group with different occupational categories to which hand hygiene is a very important behaviour in their daily practices (healthcare, educational and food professionals); (2) a sample group comprising three different types of healthcare professionals (doctors, nurses and cleaners); and (3) a group of medical students and doctors in different stages of their academic and professionals training and socialization (from the 1st and 6th years of their medical school to junior and senior doctors). Although, we were able to achieve a very diverse and adequate group of participants to be included in the samples, there are still several limitations that must be pointed out.

However, one question still arises: in what sense are these professionals representative only for these organisations? For instance, Study I was an integrated qualitative/ quantitative approach where health, educational and food professionals were taken from hospital and clinics, schools and nursery schools, restaurants and cafes. These small to medium size organisations contributed to the constitution of a purposive sample. Despite the fact that we were able to represent all major occupational categories included in these groups, and we also achieved thematic saturation, several topics, particularly in the case of healthcare professionals would be better understood with the inclusion of professionals from non-teaching and teaching hospitals. Is there any possibility that the coding system that was achieved in this exploratory sample, mostly comprising HCPs' from non-teaching hospitals has the same categories that professionals from a teaching hospital would have identified? In the particular case of study II and III data were collected from two different medical schools.

Unfortunately, it was not possible to collect a large sample for both studies. In study II it was only possible to gather data from 6th year students. The data from this study were collected during an examination period, which contributed to a decrease in the number of participants and may have influenced the results by increasing the possibility of socially desirable responses. In study III the sample size was small because this is a new medical school and there are still few students in the 6th year. The fact that it was not possible to compare students' from the 1st and 6th years in both medical schools in relation to the role of the different social referents and moral norms does not allow for generalization of the relations between the variables from Study III to Study II. To that end, are the characteristics that were highlighted by 1st and 6th year students specific from their school environment? Or is it possible that in a different school we would find the same importance given by students from those years to those social referents and moral norm emphasis?

Turning to the sample from study IV and V comprising doctors, nurses and cleaners from a Portuguese public hospital several considerations can be made. The data was collected during a time of expected organisational change, meaning that a hand hygiene campaign was going to be implemented. This may have constrained results in several ways. First, vulnerability perceptions, hand hygiene knowledge and even hand hygiene compliance may have been affected due to the fact that several training sessions with theoretical and practical components were developed. In this sense, the results

achieved in this sample may be representative of a hand hygiene environment that is better than the other environments where these types of campaigns are not developed. In fact, if we were able to collect these data after the constitution of the campaign we might have achieved some differences mostly on hand hygiene compliance rates.

Nevertheless, despite these characteristics that may contribute to limit the external validity of the results the work of Sverke et al., (2000) determines that HCPs are a group of employees that have intrinsic motivations and also share specific characteristics related to their professions that allow them to express a high level of similarities across employment forms and patterns which decrease the differences that might exist nationwide or across other sectors. Furthermore, samples were collected from different organisations, aiming to focus on specific objectives. Yet, results appear to be consistent across studies which can also contribute to reinforce the external validity of the research presented in this thesis. Nevertheless, some studies must be replicated, in particular the medical students' study using a population based-sample, which may be useful to test and strengthen its validity and also to explore other relevant theoretical objectives.

A second consideration is related to the fact that this was mostly a thesis based upon self-reported research, with measures being mostly collected from a single source. In this sense, common method variance (CMV) becomes a concern. According to Buckley et al. (1990) CMV refers to the amount of spurious covariance that variables share due to a common method applied in the data collection. In studies I (quantitative part), II, III and IV data was reported by the focal person. However, in study V by using direct observation to collect data related to hand hygiene compliance from a knowledgeable infection control professional we attempted to reduce the common method bias at least by obtaining the information about behaviours. We also attempted to analyse the correlation among reported and observed behaviours and compared them with the other variables under analysis in study V in order to decrease the interferences of this bias. However, this was not possible to do for previous studies which constrain the results. Besides that, we also developed other procedures according to Podsakoff, MacKenzie, Lee & Podsakoff (2003) such as changing the right or wrong answers.

Social desirability in self-reported measures, in particular when considering social desirable behaviours such as hand hygiene is a highly potential threat to internal validity. In this sense, we do believe that trying to rely solely on self-report measures is

a methodological strength of this thesis, which would have been greater if we had the opportunity to expand it to other studies of our research project. In the future, research must try to develop studies where less contaminated measures are developed, in particular when focusing on topics such as compliance and safety using several methods and sources and relying on self-report questionnaires, direct observations, supervisors ratings, and so on.

Another point that must be taken into account is the fact that this thesis did not focus on the role of gender, although some literature results enhance the fact that men are more likely to take risks when compared to women (Waldron, 1997) and that women develop more safety compliance behaviours than men (Waldron, 1997). However, this was not a balanced sample to address the gender effect. Women were mostly represented in the samples. In the future, some effort must be made to better understand the relation of gender with HCPs' hand hygiene compliance, which can be a particular challenge in the nurses group where there is a significant proportion of women. More research is needed to investigate if this pattern of distinct compliance exists across healthcare settings and professionals. It would be particularly interesting to investigate if doctors, and also medical students, have differences in their moral norm due to the role of gender. Comparative analyses of this variable are needed to explore its potential impact.

A restriction that can be identified in all studies is the fact that all of them have at least one part that is based on a cross-sectional design. This means that the presented causal relationships between the behavioural intention predictors and intention and also the multi-level models do not identify, in fact, a tested causal link between variables. Moreover, as cross-sectional studies it means that we only have an idea of what is occurring with those professionals and medical students in that specific moment in time. We only apprehend a snapshot from an environment that is constantly changing. Nothing guarantees that the results achieved in this particular moment of time will be replicated later.

Nevertheless, important associations were made between the theoretical constructs under analysis. According to Bollen (1989) the need to study an association is relevant and worthwhile since the evidence of discovering an association between two or more indicators is on the required conditions that need to be met for establishing future causality. To that end, in a cross-sectional study relevant considerations can be

made and it will be an important step to take before planning other studies that require a large amount of resources to identify the mechanisms that, for instance, link the team safety climate and the TPB. Nonetheless, longitudinal studies must be considered as the next step to replicate these results, in particular the multi-level meditational model, in order to determine that the study of compliance requires the interconnections of socio-cognitive and organisational theoretical approaches.

8.4 Suggestions for future research

Despite the reviewed limitations, this thesis presents findings that are able to stimulate new questions and further research on hand hygiene compliance and its consequences. Some of the questions that may be of particular interest are presented in more detail below.

The results of this thesis imply that a differentiation among medical students' behavioural intention predictors in relation to the importance attributed to social referents and moral norms emphasis may be one key feature contributing to explain why doctors are the professional group with most difficulties in complying. However, despite the results it is clear that more efforts are needed in order to clarify when and why medical students in different socializations stages during their medical curricula appear to show different relevance, in particular to norms. When and why these shifts occur in medical students' perceptions is very important to understand regarding the relevance of hand hygiene and infection control. Some scholars have noted that one major problem inside the education of medical students' is the lack of enthusiasm that this topic receives in the medical curricula contributing to decrease its impact when applied by medical students in their internships (Duroy et al., 2010). Since there is a the lack of studies using medical students as a sample, it would be interesting to develop a qualitative framework to explore not only the role of norms both moral and subjective, but also to understand how medical students consider that priority is given to infection control in their medical curricula.

The need to comprehend the priority given to infection control is determinant in order to explore the possibility of medical schools having specific organisational cultures and climates that can contribute to develop norms, such as the moral norm that contributes to hinder compliance identified in the thesis. Besides that, more advanced methods, with higher complexity, such as longitudinal or cohort designs may be used to

develop comparative analyses among medical students from all years to investigate how the changes in the behavioural intention predictors occur and also to explore their ability to determine the long-term knowledge retention of hand hygiene training.

Since the intention failed as an immediate antecedent of hand hygiene compliance in this thesis across the studies focused on the TPB, more scientific attention should be directed to this relationship in order to try to identify some factors that can contribute to bridge this gap. In the literature, one variable that has an interconnection with compliance behaviours is role definition. Role definition can be defined as a subjective assessment made about the broadness of the behaviours that professionals are expected to perform in an organisation (Bachrach & Jox, 2000). According to Morrison (1994) this sort of subjective assessment must not be exclusively performed by supervisors. In fact, it must be made by professionals in order to obtain their own point of view regarding which behaviours are expected for them to comply. This perspective of role definition is easily interconnected with the Expectancy Theory of Work Motivation developed by Vroom (1964) in which is determined that employees tend to associate a given organisational outcome, in particular rewards or sanctions that will motivate them to action. In other words, when a professional perceives that performing a behaviour is associated with specific rewards the motivation to comply will increase.

However, the professional will have to perceive that the behaviour in question is part of the required behaviours that is integrated in the definition of his or her role (Morrison, 1994). By taking this literature into account, it appears conceivable that intentions will be able to predict behaviour better, particularly when HCPs perceive hand hygiene compliance as a job requirement, in which adherence is seen as a formal work necessity that leads to specific rewards (e.g. patient safety). Research must try to identify whether role definition plays a significant role as a moderator between the relationship between intention and behaviour. Furthermore, because doctors, nurses and cleaners attribute different importance to intention behavioural predictors and present specific views on the characteristics of work and hygiene (CDC, 2003) it seems rather important to analyse if such moderator mechanisms also play a distinct role according to these occupational categories, affecting differently their personal degree of compliance.

In addition to research addressing medical students, another relevant area that still requires concerns is the one directed to doctors. The results of this thesis demonstrate that more attention needs to be paid to doctors' level of experience as it can be related to

different psychological mechanisms predicting their personal intention to comply. Due to the relevance that social influence processes appear to have, not only for medical students but also for doctors, in particular for junior doctors, senior staff must be perceived as a good example. However, few studies have focused on the importance of the number of professional years to determine compliance and to shape these professionals' intentions to comply. Literature findings emphasize that senior doctors have lowest compliance rates when compared to junior doctors, which somehow contradicts the idea that knowledge and experience are translated into practice (Kampf, 2004). Future research must explore if non-compliance is, in fact, correlated with the amount of work experience.

Another possibility for future studies concerns the associations between individual and group level effects, as little is known about the effectiveness of the interconnections of socio-cognitive and organisational theoretical approaches in the study of hand hygiene compliance. The mechanisms that relate individual perceptions and organisational features, must be analysed using multi-level techniques and are particularly important because: (1) it allows one to test the assumption that team safety climate provides a full range of benefits in conjunction with the TPB to increase hand hygiene compliance; (2) also, and consequently, it may likely go beyond its impact on the individual and constitute itself as an interplay of top-down and bottom-up phenomena that can contribute, in a broader sense, to an organisational change towards the constitution of a patient safety climate. Such perspectives that relate individuals and organisations in a closer point of view may be beneficial to understand how healthcare organisations and professionals perceive their role as determinants of safety and the potential effects for both parties when negative safety climates reinforce non-compliance.

8.5 Concluding remarks

This thesis has contributed to increase our knowledge about HCPs' hand hygiene compliance and their effects on patient safety. As has been outlined in the general introduction, a growing problem of HAIs has been emerging over the past decades, which has raised the question, in the research community and the public, of what are the factors that can explain HCPs' compliance with infection control procedures and what

type of intervention programmes must be developed in order to increase these professionals' compliance.

In general, the results of the five studies presented in this thesis supported the aims of this project and also expanded some of them. More can be learned about hand hygiene compliance when we start to develop a bottom-up perspective focused on professionals' perceptions. The possibility of HCPs having multi-faceted moral norms with different emphasis that may constrain or enable compliance only appeared due to the fact that the first exploratory study was developed with the implementation of the principle of participation. This norm may not contribute with a large amount of explained variance, but it gives an idea that these professionals may have characteristics that go beyond the traditional way of studying the norm, as a moral concern that reinforces compliance. Also, social influence was identified as an important factor in determining professionals' and medical students' intention to comply. Role models and mentors are must be included in students and professionals daily practices in order to reinforce compliance.

The overall conclusion of this thesis is that the specific conditions of a team safety climate, together with the individual attitudes, subjective norm and perceived behavioural control, as they relate to each other, are critical aspects to consider for better understanding the consequences of hand hygiene compliance. This, however, does not imply that the specificities that we found in our studies do not matter. In fact, the results can be orchestrated, and work together, but without neglecting the idea that it is critical that future research on hand hygiene compliance continues to look at the interactive effects of healthcare organisations, care-delivery teams and individuals, and especially the nature of what comprises the individual and organisational circumstances that may lead to HCPs' compliance. This sort of research is fundamental to develop adequate preventive measures in order to transform healthcare institutions in better and safer places for both patients and professionals.

REFERENCES

Adegoboye, A., Roy, P. K. & Emeka, C. (1997). Glove utilization and reasons for poor compliance by health care workers in a Nigerian teaching hospital. *Tropical Doctor*, *27,* 93–97.

Aiken, L. & West, S. (1991). *Multiple Regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Ajzen I. (1988). *Attitudes, personality, and behavior*. Chicago, IL: The Dorsey.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11- 39). Heidelberg, Germany: Springer.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50,* 179-211.

Ajzen, I. (2002a). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32,* 1-20.

Ajzen, I., Brown, T. C., & Carvahal, F. (2004). Explaining the discrepancy between intentions and actions: The case of hypothetical bias in contingent valuation. *Personality and Social Psychology Bulletin, 30,* 1108-1121.

Ajzen, I., & Fishbein, M. (1973). Attitudes and normative beliefs as factors influencing behavioral intentions. *Journal of Personality and Social Psychology*, 27, 41-57.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracín, B.T. Johnson & M. P. Zanna (Eds), *The Handbook of Attitudes*, Erlbaum, Mahwah, NJ, 173-221.

Amireault,S., Godin, G., Vohl, M. & Pérusse, L. (2008). Moderators of the intention-behaviour and perceived behavioural control-behaviour relationships for leisure-time physical activity. *Journal of Behaviour Nutrition and Physical Activity; 5*, 7.

Amorim-Finzi, M., Cury, M., Costa, C., Santos, A. & Melo, G. (2010). Rate of Compliance with hand hygiene by dental healthcare personnel (DHCP) within a dentistry healthcare first aid facility. *European Journal of Dentistry, 4* (3), 233-237.

Apisarnthanarak, A., Babcock, H., Fraser, V. (2006). Compliance with Universal Precautions among medical students in a tertiary care center in Thailand. *Infection Control and Hospital Epidemiology*, *27* (12), 1409-10.

Armitage, C. & Conner, M. (1999a). Distinguishing perceptions of control from self-efficacy: Predicting consumption of a tow fat diet using the theory of planned behavior. *Journal of Applied Social Psychology, 29,* 72-90.

Armitage, C. & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40,* 471-499.

Askarian, M., Khalooee, A., Emroodi, N. (2006). Personal hygiene and safety of governmental hospital staff in Shiraz, Islamic Republic of Iran. *East Mediterranean Health Journal, 12 (6),* 768-774.

Astrom, A. & Nasir, E. (2009). Predicting intention to treat HIV-infected patients among Tanzanian and Sudanese medical and dental students using the theory of planned behaviour - a cross sectional study. *BMC Health Services Research, 9*, 23. doi:10.1186/1472-6963-9-213.

Ayliffe, G., Babb, J., Davies, J. & Lilly, H. (1988). Hand disinfection: a comparison of various agents in laboratory and ward studies. *Journal of Hospital Infection*, *11*, 226–243.

Ayliffe G., Lowbury E., Geddes A. & Williams J. (1992). Control of hospital infection – a practical handbook (3rd Edition). London: Chapman and Hall Medical.

Bachrach, D. G., & Jex, S. M. (2000). Organizational citizenship and mood: An experimental test of perceived job breadth. *Journal of Applied Social Psychology, 30,* 641-663.

Bamberg, S., & Schmidt, P. (2003). Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis. *Environment and Behavior*, *35* (2), 264-285.

Bandura, A., & Walters, R. H. (1963). *Social learning and personality development.* New York: Holt, Rinehart & Winston.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Baraff, L. & Talan, D. (1989). Compliance with universal precautions in a university hospital emergency department. *Annals of Emergency Medicine*, *18*, 654–657.

Bardin, L. (2007). *Content analysis*. Lisbon: Edições 70.

Barker, J. (1993). Tightening the iron cage: concertive control in self-managing teams. *Administrative Science Quarterly*, 38, 408-37.

Baron, R. & Kenny, D. (1986). The Moderator-Mediator variable distinction in Social Psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Bartels, D. (2008). Principled moral sentiment and the flexibility of moral judgment and decision making. *Cognition, 108,* 381-417.

Bartholomew, L., Parcel, G., Kok, G., & Gottlieb, N.H. (2001) Changing behavior and environment: How to plan theory- and evidence-based disease management programs. In R. Patterson (Eds.*), Changing patient behavior: Improving Outcome in Health and Disease Management*. Chicago, Illinois: American Hospital Association Press/Jossey Bass.

Bartko, J. (1976). On variation intraclass correlation reliability coefficients. *Psychological Bulletin*, 83, 762-765.

Bartzokas, C., Williams, E. & Slade, P. (1995). Studies in health and human sciences. *A psychological approach to hospital-acquired infections.* London: Edward Mellen.

Bas, M, Ersun, A. & Ivanç, G. (2006). The evaluation of food Hygiene Knowledge, attitudes, and practices of food handlers' in food businesses in Turkey. *Food Control*, *17* (4), 317-322.

Battista, R. N., Williams, J. L., & MacFarlane, L. A. (1986). Determinants of primary medical practice in adult cancer prevention. *Medical Care, 24,* 216-24.

Bauer, T., Morrison, E. & Callister, R. (1998). Organizational Socialization: A Review and Directions for Future Research. In G. R. Ferris (Ed.) *Research in personnel and human resources management 16,* pp. 149-214. Stamford, CT: JAI Press.

Bauer, D., Preacher, J & Gil, K. (2006). Conceptualizing and testing random indirect effects and moderated mediation in multilevel models: New procedures and recommendations. *Psychological Methods*, *11*, 142-163.

Beatty, P. & Beatty, S. (2004). Anaesthetists' intentions to violate safety guidelines. *Anaesthesia, 59,* 528-540.

Beck, L. and Ajzen, I. (1991) Predicting dishonest actions using the Theory of Planned Behaviour, *Journal of Research in Personality*, *25,* 285–301.

Beggs, C., Noakes, C., Shepherd, S., Kerr, K., Sleigh, P., Banfield, K. (2006). The influence of nurse cohorting on hand hygiene effectiveness. *American Journal of Infection Control, 34* (10), 621-626.

Bell, D., Trevino, R., Atkinson, J. & Carlson, J. (2003). Motivations for condom use and nonunse. *Clinical Laboratory Science*, *16* (1), 20-33.

Berg, C., Jonsson, I., & Conner, M. (2000). Understanding choice of milk and bread for breakfast among Swedish children aged 11-15 years: An application of the theory of planned behaviour. *Appetite, 34,* 5-19.

Bernaix, L. (2000). Nurses' attitudes, subjective norms, and behavioral intentions toward support of breastfeeding mothers. *Journal of Human Lactation, 16,* 201-209.

Bertin, C., Rezende, M., Sigulem, D. & Morais, T. (2009). Hurdles at work: perceptions of hospital food handlers. *Human Resources for Health, 7,* 63. doi:10.1186/1478-4491-7-63.

Biel, A. & Thogersen, J. (2007). Activation of social norms in social dilemmas: a review of the evidence and reflections on the implications for environmental behaviour, *Journal of Economic Psychology*, 28 (1), pp. 93-112.

Bischoff, W., Reynolds, T., Sessler, C., Edmond, M., & Wenzler, P. (2000). Handwashing compliance by healthcare workers, the impact of introducing an accessible alcohol based hand antiseptic. *Archives of Internal Medicine, 160*, 1017-1021.

Bliese, P. D. (1998). Group size, ICC values, and group-level correlations: A simulation. *Organizational Research Methods, 1,* 355-373.

Bliese, P. (2000). Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. In K. J. Klein & S. W. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 349-381). San Francisco: Jossey-Bass.

Bliese, P. & Halverson, R. (1996). Individual and nomothetic models of job stress: An examination of work hours, cohesion, and well-being. *Journal of Applied Social Psychology, 26,* 1171-1189.

Bloomfield, S., Aiello, A., Cookson, B., O'Boyle, C & Larson, E. (2007). The effectiveness of hand hygiene procedures, including handwashing and alcohol-based hand sanitizers, in reducing the risks of infections in home and community settings. American Journal of Infection Control, 35 (10), S27-S64.

Bloomfield, S., Exner, M, Fara, G., Nath, K., Scott, E., Van der Voorden, C. (2009). *The global burden of hygiene-related diseases in. relation to the home and*

community. International Scientific Forum on Home Hygiene. Retrieved January 13 2010 from http://www.ifh-homehygiene.org/IntegratedCRD.nsf/111e68ea0824afe1802575070003f039/29858aa006faaa22802572970064b6e8?OpenDocument.

Bollen, K. A. (1989). *Structural Equations with Latent Variables. Wiley Series in Probability and Mathematical Statistics*. New York: Wiley.

Boyce, J.M. (1999). It is time for action: improving hand hygiene in hospitals. *Annals of Internal Medicine*, *130*, 153-155.

Boyce, J. M., & Pittet D. (2002). Guidelines for Hand Higiene in Healthcare Settings Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA /APIC/IDSA Hand Hygiene Task Force. *Morbidity and Mortality Weeky Report, 51* (16), 1-44.

Boyd, B. & Wandersman, A. (1991) Predicting undergraduate condom use with the Fishbein and Ajzen and the Triandis Attitude-Behaviour models: implications for public health interventions, *Journal of Applied Social Psychology*, *21* (22), 1810–30.

Bradley, E., Holboe, E., Mattera, J., Roumanis, S. Radford, M. & Krumholz, H. (2004). Data feedback efforts in quality improvement: lessons learned from US hospitals. *Quality Safety Health Care, 13,* 26-31.

Braunwald, E., Fauci, A., Kasper, D., Houser, S., Longo, D., Jameson, J. (2001). *Harrison's Principles of Internal Medicine (15th Edition)*. New York: MacGraw-Hill Professional.

Bridger J. (1997) A study of nurses' views about the prevention of nosocomial urinary tract infections. *Journal of Clinical Nursing 6*, 379–387.

British Department of Health. (2007). *Departmental Report 2006: The Health and Personal Social Services Programmes*. Retrieved January 12 2008 from http://www.dh.gov.uk/dr_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4134715.pdf.

Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerard, M., McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology, 26,* 136-145.

Brewer N, Weinstein ND, Cuite C, Herrington J. (2004). Risk perceptions and their relation to risk behavior. *Annals of Behavioral Medicine, 27,* 125–130.

Broughall, J., Marshman, C., Jackson, B. & Bird, P. (1984). An automatic monitoring system for measuring handwashing frequency. *Journal of Hospital Infection*, *5*, 447-453.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models for social and behavioural research: Applications and data analysis methods*. Newbury Park, CA: Sage Publications.

Bryk, A. S., Raudenbush, S. W., & Congdon, R. T. (1996). *HLM. Hierarchical linear and nonlinear modelling with the HLM/2L and HLM/3L programs*. Chicago, IL: Scientific Software International.

Buckley, M. R., Cote, J. A. & Comstock, S. M. (1990). Measurement errors in behavioral sciences: The case of personality/attitude research. *Educational Psychology Measurement, 50,* 447-474.

Buffet-Bataillon, S., Leray, E., Poisson, M., Michelet C., Bonnaure-Mallet, M. & Cormier, M (2010). Influence of job seniority, hand hygiene education and patient-to-nurse ratio on hand desinfection compliance. *Journal of Hospital Infection, 76* (1), 32-35.

Burns, L. J. & Knussen, C. (2005). False consensus and accuracy of perceptions of nurses regarding universal precaution practices. *Psychology, Health and Medicine*, *10* (4), pp. 344-354.

Butz, A., Larson, E., Fosarelli, P. &,Yolken, R. (1990). Occurence of infections symptoms in children in day care homes. *American Journal of Infection Control, 18,* 347-53.

Calabro, K. Bright, K. & Kouzakanani, K. (2000). Long-term effectiveness of infection control training among fourth year medical students. *Medical Educacional Online*, *5,* 1-7.

Centers for Disease Control and Prevention. (1987). Recommendations for prevention of HIV transmission in health-care settings. MMWR Morbidity, Mortality Weekly Report, *36* (2), 1S–18S. Retrieved September 26 2006 from http://www.cdc.gov/mmwr/preview/mmwrhtml/00023587.htm.

Centers for Disease Control. (1989). Guideline for prevention of transmission of human immunodeficiency virus and hepatitis B virus to health care and public safety workers. *Morbidity and Mortality Weekly Report*, *38* (6), 1-37. Retrieved

September 26 2006 from http://wonder.cdc.gov/wonder/prevguid/p0000114/p0000114.asp

Centers for Disease Control and Prevention. (1993). Update: multistate outbreak of Escherichia coli O157:H7 infections from hamburgers western United States (1992-1993). *Morbidity and Mortality Weekly Report, 42*, 258-63. Retrieved September 26 2006 from http://www.cdc.gov/mmwr/preview/mmwrhtml/00020219.htm.

Centers for Disease Control and Prevention. (2002). Guideline for hand hygiene in health care settings. *Morbidity and Mortality Weekly Report,, 51,* 1-44.

Centers for Disease Control and Prevention. (2003). *Exposure to Blood: What healthcare personnel need to know*. Washington, D. C: the Public Health Department of Health and Human Sciences. Retrieved September 26 2006 from http://www.cdc.gov/ncidod/dhqp/pdf/bbp/Exp_to_Blood.pdf.

Centers for Disease Control and Prevention. (2006). Management of multi-drug resistant organisms in healthcare settings. Retrieved September 13 2007 from http://www.cdc.gov/ncidod/dhqp/pdf/ar/mdroGuideline2006.pdf.

Centers for Disease Control and Prevention. (2007). Summary health statistics for U.S children: national health interview survey. Washington, D. C: the Public Health Department of Health and Human Sciences. Retrieved September 20 2009 from http://www.cdc.gov/nchs/data/series/sr_10/sr10_239.pdf.

Cialdini, R. B, (2003). Crafting normative messages to protect the environment. *Current Directions in Psychological Science, 12,* 105 - 109.

Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical renement and reevaluation of the role of norms in human behavior. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 24, pp. 201–234). New York: Academic Press.

Chabot, L., Moisan, J., Gregoire, J. & Milot, A. (2003). Pharmacist intervention program for control of hypertension. *Annals of Pharmacotherapy, 37,* 1186-93.

Chaffee, T., Bridges, M. & Boyer, C. (2000). Adolescent Violence Prevention Practices Among California Pediatricians. *Archives of Pediatric Adolescence Medicine,154,* 1034-1041.

Chan, D. (1998). Functional relations among constructs in the same content domain at different levels of analysis: A typology of composition models. *Journal of Applied Psychology, 83,* 234–246.

Chaney, J., Hunt, B. & Schulz, J. (2000). An examination using the Precede-Proceed model framework to establish a comprehensive program to prevent school violence. *American Journal of Health Studies*, *16* (4), 199-204.

Cheng, T., DeWitt, T., Savageau, J. & O'Connor, K. (1999). Determinants of counseling in primary care pediatric practice. *Archives of Pediatrics & Adolescent Medicine, 153*, 629-635.

Cheyne, A., Cox, A., Oliver, A., Tomas, J. M. (1998). Modeling safety climate in the prediction of levels of safety activity. *Work and Stress, 12* (3), 255–271.

Chiang, L., Huang, J., Yeh, K. & Lu, C. (2004). Effects of a self-management asthma educational program in Taiwan based on Precede-Proceed model for parents with asthmatic children. *Journal of Asthma*, *41* (2), 205-215.

Chief Medical Officer. (2007). *On the state of public health: Annual report Chief Medical Officer 2006.* London: British Department of Health. Retrieved January 12 fromhttp://www.dh.gov.uk/en/Publicationsandstatistics/Publications/AnnualReports/DH076817.

Christian, M. Bradley, J., Wallace, J. & M. (2009). Workplace safety: a meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology, 94 (5),* 1103-1127.

Clarke, S. (2006). The relationship between safety climate and safety performance: a meta-analytical review. *Journal of Occupational Health Psychology, 11* (4), 315-327.

Clayton, D. & Griffith, C. (2004). Observation of food safety practices in catering using notational analysis. British Food Journal, 106 (3), 211-227.

Clayton, D., Griffith, C., Prize, P., & Peters, A. (2002). Food handlers' beliefs and self-reported practices. *International Journal of Environmental Health Research, 12*, 25-39.

Clements D, Dault M, Priest A. (2007). Effective Teamwork in Healthcare: Research and Reality. *Healthcare Papers, 7,* 26-34.

Coello, R., Glenister, H., Fereres, J., Bartlett, C., Leigh, D., Sedgwick, J. & Cooke. E. (1993). The cost of infection in surgical patients: A case control study. *Journal of Hospital Infection*, *25*, 239-250.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd edition). Hillsdale, NJ: Erlbaum.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale: Erlbaum.

Cole, M. (2009). Exploring the hand hygiene competence of student nurses: a case of flawed self assessment. *Nurse Education Today, 29,* 380-388.

Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further *research, foumal of Applied Social Psychology, 28,* 1430-1464.

Conner, M. & McMillan, B. (1999) Interaction effects in the theory of planned behaviour: studying cannabis use, *British Journal of Social Psychology*, *38* (2), 195–222.

Conner, M. and Norman, P. (1995). *Predicting Health Behaviour: Research and Practice with Social Cognition Models*. Open University Press, Buckingham.

Conner, M., Martin, E., Silverdale, N. & Grogan, S. (1996). Dieting in adolescence: An application of the Theory of Planned Behaviour. *British Journal of Health Psychology,* 1, pp. 215 – 315.

Constanza, M. (1992). Breast cancer screening in older women: an overview. *Journal of Gerontology, 47*, 7–8.

Cox T. (1993). *Stress Research and Stress Management: Putting Theory to Work.* London: Health and Safety Research Contract Research Report No. 61.

Cox, T. (1997).Workplace health promotion. *Work and Stress* , *11*, 1-5.

Cox, S., & Cox, T. (1991). The structure of employee attitudes to safety: a European example. *Work & Stress*, *5*, 93-106.

Cox, S., & Flin, R. (1998). Safety culture: Philosopher's stone or man of straw? *Work & Stress, 12*(3), 189-201.

Cox, T., & Leiter. M. (1992). The health of health care organizations. *Work & Stress, 6,* 219-227.

Creedon, S.A. (2005). Healthcare workers' hand decontamination practices: Compliance with recommended guidelines. *Journal of Advanced Nursing, 51(3),* 208-216.

DeJoy, D.M. (1996). Theoretical models of health behavior and workplace self-protective behavior. *Journal of Safety Research, 27*, 61-72.

DeJoy, D. M., Gershon, R. M. & Murphy, L. R. (1998). Minimizing the risk of occupationally-acquired HIV/AIDS: universal precautions and health care workers.

In Feyer, A. M., Williamson, A. (Eds.). *Occupational Injury: Risk, Prevention, and Intervention.* London: Taylor-Francis.

DeJoy, D., Gershon, R., & Schaffer, B. (2004). Safety Climate: Assessing management and organizational influences on safety. *Professional Safety, 49,* 50-57.

Deilkas, E. & Hofoss, D. (2010). Patient safety culture lives in departments and wards: Multilevel partitioning of variance in patient safety culture. *BMC Health Services Research, 10,* 85.

DeJoy, D., Searcy, C. Murphy, L. & Gershon, R. (2000). Behavioral-diagnostic analysis of compliance with Universal Precautions among nurses. *Journal of Occupational Health Psychology*, *5* (1), 127-141.

DiClemenet, C.C., & Prochaska, J.O. (1982). Self change and therapy change of smoking behavior: A comparison of processes of change in cessation and maintenance. *Addictive Behavior*, 133-142.

Dinelli, M., Moreira, T., Paulino, E., Rocha, M., Graciani, F. & Moraes-Pinto, M. (2009). Immune status and risk perception of acquisition of vaccine preventable diseases among health care workers. *American Journal of Infection Control, 37*, (10), 858-860.

Direcção Geral de Saúde. (2005). *Relatório Inquérito de Prevalência de Infecção.* Lisboa: Instituto Nacional de Saúde Dr. Ricardo Jorge. Retrieved March 04 2006 from http://www.dgs.pt/upload/membro.id/ficheiros/i008558.pdf.

Dixon-Woods, M., Suokas, A., Pitchforth**,** E. & Tarrant, C. (2009). An ethnographic study of classifying and accounting for risk at the sharp end of medical wards. *Social Science & Medicine*, *63,* 362-369

Doebbeling, B., Vaughn, T., McCoy, K, Beekman, S., Woolson, R., Ferguson, K. & Torner, J. (2003). Percutaneous injury, blood exposure, and adherence to standard precautions: are hospital-based health care providers still at risk? *Clinical Infection Diseases*, *37*, 1006-1013.

Dubbert, P.M., Dolce, J., Richter, W., Miller, M., & Chapman, S.W. (1990). Increasing ICU staff handwashing: Effects of education and group feedback. *Infection Control Hospital Epidemiology, 11,* 191-193.

Dunlap, W., Burke, M. & Smith-Crowe, K. (2003). Accurate tests of statistical significance for r_{wg} and Average Deviation Interrater Agreement Indexes. *Journal of Applied Psychology, 88* (2), 356-362.

Duroy, E. & Coutour, X. (2010). L'hygiène hospitalière et les étudiants en médicine. Médecine et maladies infectieuses (in press). Doi : 10.1016/jmedmal.2010.02.010.

Eagly, A. & Chaiken, S. (1993) *The Psychology of Attitudes*. New York: Harcourt Brace and Jovanovich.

Eccles, M., Grimshaw, J., Johnston, M., Steen, N., Pitts, N., Thomas, R., Glidewell, E., Maclennan, G., Bonetti, D. & Walker, A. (2007). Applying psychological theories to evidence-based clinical practice: Identifying factors predictive of managing upper respiratory tract infections without antibiotics. *Implementation Science*, ***2*** (1), 2.

Eccles, M., Hrisos, S., Francis., J., Kaner, E., Dickinson, H., Beyer, F. & Johnston, M. (2006). Do self-reported intentions predict clinicians´ behaviour: a systematic review. *Implementation Science,1*:28.

Eggimann, P., Harbarth, S., Constantin, M., Touveneau, S., Chevrolet, J. & Pittet, D. (2000). Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. *The Lancet, 355,* 1864-1868.

Erasmus, V., Brouwer, W., van Beeck, E., Oenema, A., Daha, T., Richardus, J., Vos, M. & Brug, J. (2009). A qualitative exploration of reasons for poor hand hygiene among hospital workers: lack of positive role models and of convincing evidence that hand hygiene prevents cross-infection. *Infection Control and Hospital Epidemiology, 30,* 415-419.

Feather, A., Stone, S., Wessier, A., Boursicot, A. & Pratt, C. (2000). "Now please wash your hands"; the handwashing behaviour of final MBBS candidates. *Journal of Hospital Infection, 45,* 62-64.

Ferguson, K., Waitzkin, H, Beekman, S. & Doebelling, B. (2004). Critical incidents of non-adherence with standard precautions guidelines among community hospital-based health care workers. *Journal of General Internal Medicine*, *19*, 726-731.

Field, M. & Lohr, K. (1992). *Guidelines for clinical practice: from development to use.* Institute of Medicine. Washington, D.C: National Academy Press. Retrieved March 07 2006 from http://www.nap.edu/openbook.php?record_id=1863&page=83.

Fischhoff, B. (1997). Risk perception and health behaviour. In A. Brown, S. Newman, J. West & C. McManus (Eds). *Cambridge Handbook of Psychology, Health and Medicine.* Cambridge: Cambridge University Press.

Fishbein, M. & Ajzen, I. (1980). *Understanding Attitudes and Predicting Social Behavior*. New Jersey: Prentice Hall.

Fishbein, M., Chan, D. K-S., O'Reilly, K., Schnell, D., Wood, R., Beeker, C., & Cohn, D. (1992). Attitudinal and normative factors as determinants of gay men's intentions to perform AIDs-related sexual behavior: A multisite analysis. *Journal of Applied Social Psychology, 22,* 999-1011.

Flin, R., Burns, C., Mearns, K., Yule, S. & Robertson, M. (2006). Measuring safety climate in health care. *Quality Safety Health Care* , *15,* 109–115.

Fogarty, G., & Neal, T. (2002). Explaining safety violations and errors in the construction industry. XXV International Congress of Applied Psychology, Singapore, July 7-12.

Fogarty, G. & Shaw, A. (2010). Safety climate and the theory of planned behavior: towards the prediction of unsafe behavior. *Accident, Analysis and Prevention*, *42*(5), 1455-1459.

Food and Drug Administration. (2010). *Prevention of salmonella enteriditis in shell eggs during production, storage and transportation.* U.S. Department of Health and Human Services Food and Drug Administration, Center for Food Safety and Applied Nutrition. Retrieved August 07 2010 http://www.fda.gov/downloads/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodSafety/UCM222614.pdf.

Fordham, A. (2005). Using a competency based approach in nurse education. *Nursing Standard,* 19, 41-48.

Fox, M. Langner, S. & Wells, R. (1974). How good are hand washing practices? *American Journal of Nursing*, *74*, 1676-1678.

Frankish, C. (1994). Crisis centers and their role in treatment: suicide prevention vs heath promotion. *Death Studies*, *18,* 327-339.

Freeman, S.W. & Chambers, C.V. (1992). Compliance with universal precautions in a medical practice with a high rate of HIV infection. *Journal of the American Board of Family Practitioners*, *5*, 313–318.

Freudenberg, N., Eng, E., Flay, B., Parcel, G., Rogers, T., & Wallerstein, N. (1995). Strengthening individual and community capacity to prevent disease and promote health: search of relevant theories and principles. *Health Education Quarterly, 22,* 290-306.

Gaither, C., Bagozzi, R., Ascione, F. & Kirking, D. (1996). A reasoned action approach to physicians' utilization of drug information sources. *Pharmaceutical Research, 13***,** 1291-1298.

Garner J.S. (1996). Guideline for isolation precautions in hospitals. *Infection Control Hospital Epidemiology, 17*, 53–80.

Gershon, R., Karkashian, C. & Felknor, S. (1994). Universal Precautions: an update. Heart and Lung: the Journal of Critical Care, 23 (4), 352-358.

Gershon R., Vlahov D., Felknor S., Vesley D., Johnson P., Declos G. & Murphy L. (1995). Compliance with universal precautions among health care workers at three regional hospitals. *American Journal of Infection Control, 23,* 225–236.

Gibbs, J. (1991). Toward an integration of Kohlberg's and Hoffman's moral development theories. *Human Development*, *34,* 88-104.

Gielen, A. & McDonald, E. (2002). Using the Precede-Proceed planning model to apply health behavior theories. In K. Glanz, B. Rimer & F. Lewis (Eds). *Health behaviour and health education: theory, research and practice*. San Francisco: Jossey Bass.

Gilbert, K., Stafford, C., Crosby, K., Fleming, E. & Gaynes, R. (2010). Does hand hygiene compliance among health care workers change when patients are in contact precaution rooms in ICUs? *American Journal of Infection Control, 38* (51), 5-7.

Glaser B, Strauss A. (1967). *The discovery of grounded theory: strategies for qualitative research.* New York: Aldine de Gruyter.

Godin, G., Bélanger-Gravel, A., Eccles, M. & Grimshaw, J. (2008). Healthcare professionals' intentions and behaviours: A systematic review of studies based on social cognitive theories. *Implementation Science*, *3*, 36.

Godin ,G., Boyer, R., Duval, B., Fortin, C. & Nadeau, D. (1992). Understanding physicians' decision to perform a clinical examination on an HIV seropositive patient. *Medical Care, 30,* 199-207.

Godin, G., Connor, M., Sheeran, P. (2005). Bridging the Intention-Behaviour "gap": The Role of Moral Norm. *British Journal of Social Psychology. 44,* 497-512.

Godin, G. & Kok, G. (1996) The Theory of Planned Behavior: a review of its applications to health-related behaviors, *American Journal of Health Promotion*, *11* (2), 87–98.

Godin, G., Naccache, H. & Fortin, C. (1998). Understanding physicians' intention to use a simple infection control measure: Wearing gloves. *American Journal of Infection Control, 26,* 413-417.

Godin, G., Naccache, H., Morel, S. & Ébacher, M. (2000). Determinants of nurses' adherence to universal precautions for venipunctures. *American Journal of Infection Control,* 28, pp. 359–364.

Godin, G., Vézina-Im, L. & Naccache, H. (2010). Determinants of influenza vaccination among healthcare workers. *Infection Control and Hospital Epidemiology, 31* (7), 689-693.

Gollwitzer, P.M. & Brandstätter, V. (1997). Implementation intentions and effective goal pursuit, *Journal of Personality and Social Psychology*, 73 *(1),* 186–199.

Gould, D. & Chamberlain A. (1997). The use of a ward based educational teaching package to enhance nurses' compliance with infection control procedures. *Journal of Clinical Nursing*, *6,* 55–67.

Gould, D., Chudleigh, J.H., Moralejo, D. & Drey, N. (2007). Interventions to improve hand hygiene compliance in patient care. *Cochrane Database of Systematic Reviews*, Issue 2. Art. No.: CD005186. DOI: 10.1002/14651858.CD005186.pub2.

Gould, D. & Ream, E. (1993). Nurses' views on infection control: an interview study. *Journal of Advanced Nursing, 19*, 1121–1131.

Graves**,** N., Tong, E., Faddy, M. & Whitby, M. (2008). *Healthcare Infections.* A comparison of two methods for attributing length of stay to healthcare-acquired-infection. *Healthcare Infection*, *13*, 111–119.

Graham, M. (1990). Frequency and duration of hand-washing in an intensive care unit. *American Journal of Infection Control*, *18*, 88–91.

Green, L. W. (1974). "Toward Cost-Benefit Evaluations of Health Education: Some Concepts, Methods and Examples." *Health Education Monographs 2* (1), 34–64.

Green, L. W. (1999). What can we generalize from research on patient education and clinical health promotion to physician counseling on diet? *European Journal of Clinical Nutrition, 53* (2), S9-S18.

Green, L.W., Kreuter, M. W. (1992). CDC's Planned Approach to Community Health as an application of PRECEDE and an inspiration for PROCEED. *Journal of Health Education, 23*, 140-147.

Green, L. & Kreuter, M. (1999). *Health promotion planning: an educational and ecological approach.* New York: MacGraw-Hill.

Green-McKenzie J, Gershon R. R. & Karkashian, C. (2001). Infection control practices among correctional healthcare workers: effect of management attitudes and availabiity of protective equipment and engineering controls. *Infection Control And Hospital Epidemiology,* 22 (9), 555-559.

Greve, W. (2001). Traps and gaps in action explanation: Theoretical problems of a psychology of human action. *Psychological Review, 108*, 2, 435–451.

Griffin, M. & Neal, A. (2000). Perceptions of safety work: a framework for linking safety climate to safety performance, knowledge and motivation. *Journal of Occupational Health Psychology*, *5* (3), 347-358.

Griffiths, A. (1994). Editorial: Musculoskeletal upper-limb disorders and white-collar work in the UK. *Work and Stress*, *9*, 1-3.

Grol, R. (2002). Changing physicians' competence and performance: finding the balance between the individual and the organization. *Journal of Continuing Education in the Health Professions, 22,* 244-51.

Grol, R., Bosch, M., Hulscher, M., Eccles, M. & Wensing, M. (2007). Planning and studying improvement in patient care: the use of theoretical perspectives. *Milbank Quaterly, 85*, 93-138.

Grol, R. & Wensing, M. (2004). What drives change? Barriers to and incentives for achieving evidence-based practice. *Medical Journal of Australia*, *180,* 57-60.

Grosch, J., Gershon, R., Murphy, L. & Dejoy, D. (1999). Safety dimensions associated with occupational exposure to blood-borne pathogens in nurses. *American Journal of Industrial Medicine Supplement*, *1,* 122-124.

Grube, J., Morgan, M., & McGree, S. (1986). Attitudes and normative beliefs as predictors of smoking intentions and behaviours: A test of three models. *British Journal of Social Psychology, 25,* 81–93.

Guldenmund, F.W., 2000. The nature of safety culture: A review of theory and research. *Safety Science, 34,* 215–257.

Hagger, M. S., Cbatzisarantis, N., & Biddle, S. (2002a). The influence of autonomous and controlling motives on physical activity intentions within the theory of planned behaviour. *British Journal of Health Psychology, 7,* 283-297.

Hahn, S. & Murphy, L. (2008). A short scale for measuring safety climate. *Safety Science*, *46,* 1047-1066.

Hammond, J., Eckes, J. & Gomez, G. (1990). HIV, trauma and infection control: universal precautions are universally ignored. *Journal of Trauma, 30*, 555-561.

Hammond B, Yusuf, A., Fendler E, Dolan M, Donovan S. (2000). Effect of hand hygiene sanitizer use on elementary school absenteeism. *American Journal of Infection Control, 28* (5), 340-346.

Hand Hygiene Resource Center. (2005). *Improving hand hygiene practices in healthcare settings*. Retrieved June 13 2007 from www.handhygiene.org.

Hardeman, W., Johnston, M., Johnston, D., Bonetti, D., Wareham, N. & Kinmonth, A. (2002). Application of the theory of planned behaviour in behaviour change interventions: a systematic review. *Psychology and Health*, *17* (2), 123-158.

Harland, P., Staats, H., & Wilke, H. (1999). Explaining proenvironmental intention and behavior by personal norms and the theory of planned behavior. *Journal of Applied Social Psychology*, *29* (12), 2505-2528.

Harris, A., Samore, M., Nafziger, R., DiRosario, K., Roghmann, M. & Carmeli Y. (2000) A survey on hand-washing practices and opinions of health care workers. *Journal of Hospital Infection, 45*, 318–321.

Hayes, B. E, Perander, J., Smecko, T. & Trask, J. (1998). Measuring Perceptions of Workplace Safety: Development and Validation of the Work Safety Scale. *Journal of Safety Research*, *29* (3), 145-161.

Health Media Lab. (2006). *Emerging Infectious Diseases: Ancient Scourge and Modern Menace.* Retrieved August 25 2007 from http://www.healthmedialab.com/exhibits-emerging.php.

Heck, R. H., & Thomas, S. L. (2009). *An introduction to multilevel modeling techniques* (2nd Ed.). New York: Routledge.

Hecker, E. (2000). Feria de Salud: implementation and evaluation of a community wide health fair. *Public Health Nursing, 17* (4), 247-256.

Herman, J. B., & Hulin, C. L. (1972). Studying organizational attitudes from individual and organizational frames of reference. *Organizational Behavior and Human Performance, 8,* 81-108.

Hersht M, Massicotte E, Bernstein M. (2007). Patient satisfaction with the outpatient lumbar microsurgical discectomy: a qualitative study. *Canadian Journal of Surgery, 50* (6), 445-449.

Hoffman M. (1983). Affective and cognitive processes in moral internalization. In T. Higgins, D. Ruble & W. Hantup (Eds.), *Social Cognition and Social Development: a social cultural perspective.* New York: Cambridge University.

Hoffmann, D. A & Gavin, M. B. (1998). Centering decisions in hierarchical linear models: Implications for research in organizations. *Journal of Management, 23*, 723-744.

Hoffman, D. A. & Stetzer, A. (1996). A cross-level investigation of factors influencing unsafe behaviors and accidents. *Personnel Psychology*, *49,* 307-339.

Holmes, N., Gifford, S. & Triggs, T. (1998). Meanings of risk control in occupational health and safety among employers and employees. *Safety Science, 28* (3), 141-154.

Hospital in Europe Link for infection Control through Surveillance. (2004). Surveillance of Nosocomial Infections in Intensive Care Units. European Committee. Retrieved November 10 2006 from http://helics.univ-lyon1.fr/protocols/icu_protocol.pdf.

House, R., Rousseau, D. M., & Thomas-Hunt, M. (1995). The meso paradigm: A framework for integration of micro and macro organizational. In L. L. Cummings & B. Staw (Eds.), Research in organizational behavior (Vol. 17, pp. 71-114). Greenwich, CT: JAI Press.

Hox, J. (1995). *Applied Multilevel Analysis.* Amsterdam: TT-Publikaties.

Howes, M., McEwen, S., Griffith, M., & Harris, L. (1996). Food handler certification by home study: Measuring changes in knowledge and behavior. *Dairy, Food, and Environmental Sanitation,* 16, 737-744.

Hugonnet, S. & Pittet, D. (2000). Hand Hygiene – Beliefs or Science? European Society of Clinical Microbiology and Infectious Diseases. *Clinical Microbiology Infection, 6,* 348-354.

Imamura, E. (2002). Amy's Chat Room: Health promotion programmes for community dwelling elderly adults. *International Journal of Nursing Practice, 8,* 61–64.

Institute of Medicine. (1998). *Emerging infections: Microbial threats to health in the United States* (J. Lederberg, R. Shope & S. Oaks, eds.). Washington, D.C: National

Academy Press. Retrieved September 15 2006 from http://www.nap.edu/catalog.php?record_id=6121.

James, L. R. 1982. Aggregation bias estimates of perceptual agreement. *Journal of Applied Psychology 67*, 219-29.

James, R., Demaree, R. & Wolf, G. (1984) Estimating within-group interrater reliability with and without response bias, *Journal of Applied Psychology*, 69 *(1),* 85-98.

Jarvis, W. R. (1994). Semmelweis - The lesson forgotten? *Lancet, 344 (12),* 1311-1312.

Jeanes A (2003). Improving hand hygiene compliance. *Nursing Times 99,* 47–49.

Jenner, E., Watson, P., Miller, L., Jones, F. & Scott, G. (2002) Explaining hand hygiene practice: an extended application of the Theory of Planned Behaviour. *Psychology, Health and Medicine*, *7* (3), 311-326.

John, O. & Benet- Martínez, C. (2000). Measurement: reliability, construct validity and scale constructor. In H. Reis & C. Judd (Eds.) *Handbook of Research Methods in Social and Personality Psychology* (pp. 339-369). Cambridge: University Press.

Kalberg, S. (1980). Max Weber's types of rationality: cornerstones for the analysis of rationalization processes in history. *American Journal of Sociology, 85,* 1145-1179.

Kampf, G. (2004). The six golden rules to improve compliance in hand hygiene. *Journal of Hospital Infection, 56* (2), 3-5.

Kaplan, L. & McGuckin, M. (1986). Increasing handwashing compliance with more accessible sinks. *Infection Control, 7* (8), 408–410.

Kenny, D. A., Korchmaros, J. D., & Bolger, N. (2003). Lower level mediation in multilevel models. *Psychological Methods, 8*, 115-128.

Kelen G., DiGiovanna T., Celentano D., Kalainov D., Bisson L., Junkins E., Stein A., Lofy L., Scott C., Sivertson K. & Quinn T. (1990). Adherence to universal (barrier) precautions during interventions on critically ill and injured emergency department patients. *Journal of Acquired Immune Deficiency Syndrome, 3*, 987–994.

Kermode, M., Jolley, D. Langkham, B., Thomas, M. S., Holmes, W. & Gifford, S. (2005). Compliance with Universal/Standard Precautions among health care workers in rural north India. *American Journal of Infection Control*, *33,* 27-33.

Kinket, B. & Verkuyten, M. (1999) Intergroup evaluations and social context: A multilevel approach. *European Journal of Social Psychology, 29*, 219-238.

Klein, W. (2003). Self-descriptive, perceived and actual attention to comparative risk information. *Psychology and Health*, *18* (5), 625-643.

Klein, K. J., Dansereau, F., & Hall, R. J. (1994). Levels issues in theory development, data collection, and analysis. *Academy of Management Review, 19,* 195-229.

Klein, K. & Kozlowski, S. (2000). From Micro to Meso: critical steps in conceptualizing and conducting multilevel research. *Organisational Research Methods*, *3* (3), 211-236.

Kohlberg, L. (1976). Moral stages and moralization: The cognitive developmental approach. In T. Lickona (Ed.), Moral development and behavior. New York: Holt, Rinehart & Winston.

Kompier, M. (2003). Job Design and Well-being. In M. Schabracq, J. Winnubst & C.L. Cooper (Eds.), *Handbook of Work and Health Psychology* (pp. 429-54). Chichester. UK: Wiley.

Korniewicz, D. (2007). Hand Hygiene Compliance and Healthcare-associated Infections—Who Is Responsible? *Infectious Disease*, 1-3.

Korniewicz D. & El-Masri. (2010). Exploring the factors associated with hand hygiene Compliance during routine clinical practice. *Applied Nursing Research*, *23* (2), 86-90.

Kozlowski, S. & Hattrup, K. (1992). A disagreement about within-group agreement: Disentangling issues of consistency versus consensus. Journal of Applied Psychology, 77, 161-167.

Kozlowski, S. & Klein, K. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. J. Klein & S.W.J. Kozlowski (Eds.), *Multilevel theory, research and methods in organizations: Foundations,extensions, and new directions* (pp. 3-90). San Francisco, CA: Jossey-Bass.

Kreft, I., & De Leeuw, J. (1998). *Introducing Multilevel Modeling* . London: Sage.

Kretzer, E.K. & Larson, E.L. (1998). Behavioural interventions to improve infection control practices. *American Journal of Infection Control*, *26*, 245–253.

Krull, J. L., & MacKinnon, D. P. (2001). Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research, 36,* 249-277.

Laschinger, H.K., & Finegan, J. (2005). Using empowerment to build trust and respect in the workplace: A strategy for addressing the nursing shortage. *Nurse Economy, 23 (1),* 6-13.

Lakatos, E. & Marconi, M. (1991). *Fundamentos de metodologia científica.* São Paulo: Atlas.

Lankford, M., Zembower, T., Trick, W., Hacek, D., Noskin, G., Peterson, L. (2003). Influence of role models and hospital design on hand-hygiene of healthcare workers. *Emerging Infectious Diseases, 9*, 217-223.

Larson, E. (1988). A causal link between handwashing and risk of infection? Examination of the evidence. *Infection Control Hospital Epidemiology*, *9*, 28-36.

Larson, E. (1997). Hygiene of the Skin: When Is Clean Too Clean? *Emerging Infectious Diseases, 7* (2), 225-230.

Larson, E. (1999). Skin hygiene and infection prevention: more of the same or different approaches? *Clinical Infectious Diseases*, *29*, 1287–94.

Larson, E. Bryan, J., Adler, L. & Blane, C. (1997). A multifaceted approach to changing handwashing behavior. *American Journal of Infection Control, 25*, 3-10.

Larson, E. L., Bryan, J., L., Adler, L. M. & Blane, C. (1997). A multifaceted approach to changing and washing behavior. *American Journal of Infection Control, 25*, 3-10.

Larson, L., Early, E., Cloonan, P., Sugrue, S. & Parides, M. (2000). An organizational climate intervention associated with increased handwashing and decreased nosocomial infections. *Behavioral Medicine*, *26*, 14–22.

Larson, E., Friedman, C., Cohran, J., Treston-Aurand, J. & Green, S. (1997). Prevalence and correlates of skin damage on the hands of nurses. *Heart Lung*, *26*, 404–412.

Larson, E. & Killien, M. (1982) Factors influencing handwashing behavior of patient care personnel. *American Journal of Infection Control*, *10*, 93–99.

Larson, E, Kretzer, E. K. (1995). Compliance with handwashing and barrier precautions. *Journal of Hospital Infection, 30*, 88-106.

Larson, E., McGee, Z., Quraishi, et al. (1991). Effect of an automated sink on handwashing practices and attitudes in high-risk units. *Infection Control and Hospital Epidemiology, 12,* 422-427.

Larson, E., Norton, C., Pyrak, J., Sparks, S., Cagatay, E. & Bartkus, J. (1998). Changes in bacterial flora associated with skin damage on hands of health care personnel. *American Journal of Infection Control*, *26*, 513–21.

Larson, E., Albrecht, S., & O' Keefe, M. (2005). Hand hygiene behavior in a pediatric emergency department and a pediatric intensive care unit: comparison of use of 2 dispenser systems. *American Journal of Critical Care, 14* (4), 304-311.

Lawrie, R. A. (1998). *Lawrie's Meat Science* (6th Edition). Lancaster: Woodhead Publishing Ltd.

Lenfant C. (2003). Shattuck lecture – clinical research to clinical practice – lost in translation? *New England Journal of Medicine*, *349*, 868-874.

Legard, R., Keegan, J., & Ward, K. (2003). In-depth interviews. In J. Ritchie & J. Lewis (Eds.), *Qualitative research practice* (pp. 138-169). Thousand Oaks, CA: Sage.

Leventhal, H., Kelly, K. & Leventhal, E. (1999). Population risk, actual risk, and cancer control: A discussion. *Journal of the National Cancer Institute Monographs*. *25,* 81-85.

Levin, P. (1999). Test of the Fishbein and Ajzen models as predictors of health care workers' glove use. *Research Nursing Health***,** *22,* 295-307.

Lewin, K. (1951). Field theory in the social sciences. New York: HarperCollins.

Liabsuetrakul, T., Chongsuvivatwong, V., Lumbiganon, P. & Lindmark, G (2003). Obstetricians' attitudes, subjective norms, perceived controls, and intentions on antibiotic prophylaxis in caesarean section**.** *Social Science and Medicine, 57,* 1665-1674.

Lima, M. (1998). Factores Sociais na percepção de risco. *Psicologia, XII* (1), 11-28.

Lima, M. (1999). Percepção risco e culturas nas organizações. *Psicologia, XII* (2), 379-386.

Lima, M., Barnett, J. & Vala, J. (2005). Risk Perception and Technological Development at a Societal Level. *Risk Analysis* 25 (5), 1229-1239.

Limbert, C. & Lamb, R. (2002). Doctors use of clinical guidelines: two applications of the Theory of Planned Behaviour. *Psychology, Health & Medicine*, *7* (3), 301-310.

Lund, S., Jackson, J., Leggett, J., Hales, L., Dworkin, R. & Gilbert, D. (1994). Reality of glove use and handwashing in a community hospital. *American Journal of Infection Control, 22*, 352–357.

Lymer U, Richt B, Isaksson B. (2004). Blood exposure: factors promoting health care workers compliance with guidelines in connection with risk. *Journal of Clinical Nursing, 13,* 547-554.

Mahloch, J., Taylor, V., Taplin, S. & Urban, N. (1993). A breast cancer screening educational intervention targeting medical office staff. *Health Education Research, 8* (4), 567–579.

Maki, D. G. (1989). Risk factors for nosocomial infection in intensive care: "devices vs nature" and goals for the next decade. *Archives of Internal Medicine, 149*, 30-35.

Mann, K. & Putnam, R. (1989). Physicians' perceptions of their role in cardiovascular risk reduction. *Preventive Medicine, 18*, 45-58.

Mann, K. V., Lindsay, E. A., Putnam, R. W., & Davis, D. A. (1996). Increasing physician involvement in cholesterol-lowering practices. *Journal of Continuing Education in the Health Professions, 16,* 225-240.

Manstead, A. (2000). The role of moral norm in the attitude-behavior relation. In D. J. Terry & M. A. Hogg (Eds.), *Attitudes, behavior, and social context: The role of norms and group membership.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Manstead, A. & Parker, D. (1995). Evaluating and extending the theory of planned behaviour, In W. Stroebe and M. Hewstone (Eds), *European Review of Social Psychology*, (6), Chichester: Wiley.

Manstead, A. S. R.. & Van Eekelen, S. A. M. (1998). Distinguishing between perceived behavioral control and self-efficacy in the domain of academic achievement intentions and behaviors. *Journai of Applied Social Psychology, 28,* 1375 - 1392.

Maue, S., Segal, R., Kimberlin, C. & Lipowski, E. (2004). Predicting physician guideline compliance: an assessment of motivators and perceived barriers. *American Journal of Managerial Care, 10,* 383-391.

McCuckin, M., Waterman, R., Porten, L., Bello, S., Caroso, M., Juzaitis, B., Kurg, E., Mazer, E. & Ostrawski, S. (1999). Patient education model for increasing hand-washing compliance. *American Journal of Infection Control*, *27* (4), 309–314.

McGovern, P., Vesley, D., Kochevar, L., Gershon, R., Rhame, F. & Anderson, E. (2000). Factors affecting universal precautions compliance. *Journal of Business and Psychology, 15* (1), 149-161.

McLeroy, K., Bibeau, D., Steckler, A. & Glanz, K. (1988). An Ecological perspective on health promotion programs. *Health Education Quarterly 15,* 351-377.

Mearns, K. & Flin, R. (1995) Risk perception and attitudes to safety by personnel in the offshore oil and gas industry: A review. *Journal of Loss Prevention in the Process Industries, 8, (5),* 299-305.

Mearns, K., Flin, R., Gordon, R., & Fleming, M. (2001). Human and organizational factors in offshore safety. *Work & Stress*, *15* (2), 144 – 160.

Mearns, K., Whitaker, S. M. & Flin, R., 2003. Safety climate, safety management practice and safety performance in offshore environments. *Safety Science, 41,* 641–680.

Melià, J. L. (1998). A psychosocial causal model of work accidents. *Anuario de Psicologia, 29,* 25–43.

Melià, J. L., Mearns, K., Silva, S. & Lima, L. (2008). Safety climate responses and the perceived risk of accidents in the construction industry. *Safety Science, 46,* 949-958.

Meyer, J. & Herscovitch, L. Commitment in the workplace: toward a general model. *Human Resource Management Review, 11 (3),* 299-326.

Mensah, E., Murdoch, I., Binstead, K, Rotheram, C. & Franks, W. (2005). *Hand hygiene in routine glaucoma clinics. British Journal of Ophthalmology, 89 (11),* 1541-1542.

Middleton ,D. (1993). Upper respiratory tract infections of childhood, part I. The common cold. *Family Practice Recertification*, *15* (8).

Mierlo, H., Rutte, C., Vermunt, J., Konpier, M. & Doorwaard, J. (2007). A multi-level mediation model between team autonomy, individual task design and psychological well-being. *Journal of Occupational and Organizational Psychology, 80,* 647-664.

Millstein, S. (1996). Utility of the theories of reasoned action and planned behavior for predicting physician behaviour: a prospective analysis. *Health Psychology*, 15, 398-402.

Mohr, J., Batalden, P. & Barach, P. (2004). Integrating patient safety into the clinical microsystem. *Quality Safety of Health Care, 13 (2),* ii34-ii38.

Moret. L., Tequi, B. & Lombrail, P. 2004. Should self‐assessment methods be used to measure compliance with handwashing recommendations? A study carried out in a French university hospital. *American Journal of Infection Control, 32(7),* 384‐90.

Morris, C. (1995). Hierarchical models for educational data: an overview. *Journal of Educational Statistics, 20*, 190-200.

Morse, S. S. (1991). Emerging viruses: defining the rules for viral traffic. *Perspectives in Biology and Medicine, 34*, 387-409.

Morse, S. S. (1993). Examining the origins of emerging viruses. In S. Morse (ed.) *Emerging viruses.* New York: Oxford University Press, pp. 10-28.

Morse, S. S. (1995). Factors in the Emergence of Infectious Diseases. *Emerging Infectious Diseases, 1* (1), 7-15.

Morse., S. S. & Schluederberg, A. (1990). Emerging viruses: the evolution of viruses and viral diseases. *Journal of Infectious Diseases*, *162*, 1-7.

Mortel, T., Apostolopoulou, E. & Petrikkos, G. (2010). A comparison of the hand hygiene knowledge, beliefs, and practices of Greek nursing and medical students. *American Journal of Infection Control, 38* (1), 75-77.

Morrison, E. W. (1994). Role definitions and organizational citizenship behaviors: The importance of the employee's perspective. *Academy of Management Journal, 37,* 1543-1567.

Mufson M. A. (1997). Professionalism in medicine: the department chair's perspective on medical students and residents. *American Journal of Medicine,103,* 253-255.

Mullan, B., & Wong, C. (2010). Using the Theory of Planned Behaviour to design a Food Hygiene Intervention. Food Control. 21 (11), 1524-1529.

Murphy, L. R., Gershon, R.M. & DeJoy, D. (1996). Stress and occupational exposure to HIV/AIDS. In Cooper, C.L. (Ed.). *Handbook of Stress, Medicine, and Health.* Boca Raton, Florida: CRC Press.

Murphy, L. R., Grosch, J., Gershon, R. & DeJoy, D. (1997). Safety climate and injuries: the case of occupational exposure to HIV. In: Seppa¨la¨ , P., Luopaja¨rvi, T., Nyga˚rd, C.-H., Mattila, M. (Eds.). *From Experience to Innovation* (vol. 5). Helsinki: Finnish Institute of Occupational Health.

Muto, C., Sistrom, M. & Farr, B. (2000). Hand hygiene rates unaffected by installation of dispensers of a rapidly acting hand antiseptic. *American Journal of Infection Control*, *28*, 273–276.

Naikoba, S. & Hayward, A. (2001). The effectiveness of interventions aimed at increasing handwashing in healthcare workers - a systematic review. *Journal of Hospital Infection*, *47*, 173-80.

Nandrup-Bus I. (2009). Mandatory handwashing in elementary schools reduces absenteeism due to infectious illness among pupils: A pilot intervention study. *American Journal of Infection Control. 37,* 820.

National Health and Medical Research Council. (2003). *Dietary guidelines for Australian adults.* Retrieved September 15 2006 from http://www.nhmrc.gov.au/_files_nhmrc/file/publications/synopses/n33.pdf.

National Nosocomial Infections Surveillance. (1999a). National Nosocomial Infections Surveillance System report, data summary from October 1986 – April 1998. *American Journal of Infection Control*, *26* (5), 522-33.

National Nosocomial Infections Surveillance. (1999b). System Report, Data Summary from January 1990 – May 1999. *American Journal of Infection Control*, *27*, 520-532.

Navon, T., Naveh, E. & Stern, Z. (2005). Safety climate in health care organizations: a multidimensional approach. *Academy of Management Journal*, *48* (6), 1075-1089.

Neal, A., & Griffin, M. A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *Journal of Applied Psychology, 91,* 946–953.

Neal, A., Griffin, M.A., & Hart, P.M. (2000). The impact of organizational climate on safety climate and individual behavior. *Safety Science,* 34, 99–109.

Nettina, S. M. (2008). *Lippincott Manual of Nursing Practice* (9th Edition). PA: Lippincontt, Williams & Wilkins.

Neves, Z., Tipple, A., Silva & Souza, A., Pereira, M., Melo, D. & Ferreira, L. (2006). Hand hygiene: the impacto of incentive strategies on adherence among healthcare workers from a newborn intensive care unit. *Revista Latino-Americana de Enfermagem, 14* (4), 546-552.

Nichols, S. & Mallon, R. (2006). Moral dilemmas and moral rules. *Cognition 100,* 530-542.

Niffingger, J. (1997) Proper handwashing promotes wellness in child care. *Journal of Pediatric Health Care, 11,* 26-31.

Nilsson, S. & Pilhammar, E. (2009). Professional approaches in clinical judgements among senior and junior doctors: implications for medical education. *BMC Medical Education,* 9:25.

Nucifora, J., Gallois, C, & Kashima. Y. (1993). Predicting AlDS preventive behaviour among adolescents. In D. J. Terr, C. Gallois, & M. M. McCamish (Eds), *The theory of reasoned action: Its application to AIDS prerentive behaviour* (pp. 65-80). Oxford: Pergamon.

O'Boyle, C., Henly, S. & Larson, E. (2001). Understanding adherence to hand hygiene recommendations: The theory of planned behavior. *Journal of Infection Control, 29*, 352-360.

Ohlund, L. & Ericsson, K. (1994). Elementary School Achievement and Absence Due to Illness. *Journal of Genetic Psychology, 155* (4), 409-421.

Ojajärvi, J., Mäkelä, P. & Rantasalo, I. (1977). Failure of hand disinfection with frequent hand washing: a need for prolonged field studies. *Journal of Hygiene*, *79*, 107-119.

Olsen, S., MacKinnon, L., Goulding, J., Bean, N. & Slutsker, L. (2000). Surveillance for foodborne disease outbreaks—United States,1993–1997. *MMWR Morb idity and Mortality Weekly Report. 49* (SS01), 1–51.

Oandasan, I., G.R., Baker, K. Barker, C. Bosco, D. D'Amour, L. Jones, S. Kimpton, L. Lemieux-Charles, L. Nasmith, L. San Martin Rodriguez, J. Tepper & D. Way. (2006). *Teamwork in Healthcare: Promoting Effective Teamwork in Healthcare in Canada*. Ottawa: Canadian Health Services Research Foundation. Retrieved October 10 2009 from http://www.chsrf.ca/research_themes/pdf/teamwork-synthesis-report_e.pdf.

Orbell, S. and Sheeran, P. (1998) 'Inclined abstainers': a problem for predicting health-related behaviour, *British Journal of Social Psychology*, *37,* 151–65.

Palmer M. B. (1986). *Manual de Control de Infecciones*. Espanha: Interamericana.

Parker, D., Manstead, A. S. R., & Stradling, S. G. (1995). Extending the theory of planned behaviour: The role of personal norm. *British Journal of Social Psychology, 34* (2), 127–138.

Paukert, J. & Richards, B. (2000). How medical students and residents describe the roles and characteristics of their influential clinical teachers. *Academic Medicine, 75,* 843–845.

Pedhazur, E. J. & Schmelkin, L. P. (1991). *Measurement, design, and analysis: An integrated approach.* Hillsdale, N.J.: Lawrence Erlbaum Associates.

Pellowe CM, Pratt RJ, Harper P et al. (2003). Section 3: Guidelines for preventing healthcare-associated infections during long-term urinary catheterisation in primary and community care. *British Journal of Hospital Infection, 55,* Suppl 2, p. S65-S87.

Perkins, M., Jensen, P., Jaccard, J., Gollwitzer, P., Oettingen, G., Pappadopulos, E. & Hoagwood , K. (2007). Applying theory-driven approaches to understanding and modifying clinicians' behavior: what do we know? *Psychiatric Service*, *58*, 342-348.

Pilling, V. K., Brannon, L, Roberts, K. R., Shanklin, C. W., & Howells, A. (2009). Using the Theory of Planned Behavior to Elicit Restaurant Employee Beliefs about Food Safety: Using Surveys versus Focus Groups. *Journal of Foodservice business Research, 12* (2), 180-197.

Pittet, D. (2004). The lowbury lecture: behavior in infection control. *Journal of Hospital Infection, 58*, 1-13.

Pittet, D., Dharan, S., Touveneau, S., Sauvan, V., Perneger, T. (1999). Bacterial contamination of the hands of hospital staff during routine patient care. *Archives of Internal Medicine, 159,* 821-826.

Pittet, D., Hugonnet, S., Harbarth, S., Mourouga, P., Sauvan, V. & Touveneau, S. (2000). Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet, 356*, 1307–1312.

Pittet, D., Mourouga, P. & Perneger, T. (1999). Members of the Infection Control Program. Compliance with handwashing in a teaching hospital. *Annals of Internal Medicine*, *130*, 126–130.

Pittet, D., Simon, A., Hugonnet, S., Pessoa-Silva, C.L., Sauvan, V. & Perneger, T.V. (2004). Hand hygiene among physicians: performance, beliefs, and perceptions. *Annals of Internal Medicine*, *141*, 1-8.

Podsakoff, P.M., MacKenzie, S.M., Lee, J., & Podsakoff, N.P. (2003). Common method variance in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88,* 879-903.

Povey. R., Conner. M., Sparks, P, James, R., & Shepherd, R. (2000), Application of the theory of planned behaviour to two dietary behaviours: Roles of perceived control and self-efficacy. *British Journal of Health Psychology,* 121-139.

Preacher, K. J., & Selig, J. P. (2010, July). Monte Carlo method for assessing multilevel mediation: An interactive tool for creating confidence intervals for indirect effects in 1-1-1 multilevel models [Computer software]. Available from http://www.quantpsy.org.

Plsek, P. (2001). *Redesigning health care with insights from the science complex adaptive systems.* In *Crossing the Quality Chasm, A new health system for the 21st Century*. Washington D.C. Institute of Medicine, National Academy Press, USA.

Puffer, S. & Rashidian, A. (2004). *Practice nurses' intentions to use clinical guidelines. Journal of Advancing Nursing*, *47,* 500-509.

Quine, L., Rutter, D. & Arnold, L. (1998). Predicting and understanding safety helmet use among schoolboy cyclists; A comparison of the theory of planned behaviour and the health belief model. *Psychology and Health, 13,* 251-269.

Raats, M. M., Shepherd, R., & Sparks, P. (1995). Including moral dimensions of choice within the structure of the theory of planned behavior. *Journal of Applied Social Psychology, 25,* 484–494.

Racine, E. (2008). Enriching our views on clinical ethics: results of a qualitative study of the moral psychology of healthcare ethics committee members. *Bioethical Inquiry, 5,* 57–67

Randall, D. & Wolff, J. (1994). The time interval in the intention-behaviour relationship: meta-analysis. *British Journal of Social Psychology*, *33* (4), 405-18.

Raudenbush, S. W. (2001a). Comparing personal trajectories and drawing causal inferences from longitudinal data. *Annual Review of Psychology, 52,* 501–525.

Raudenbush, S. W. (2001b). Toward a coherent framework for comparing trajectories of individual change. In L. M. Collins & A. G. Sayer (Eds.), *New methods for the analysis of change.* Washington, DC: American Psychological Association.

Raudenbush, S. & Bryk, A. (2002). *Hierarchical linear models* (2nd ed.). Newbury Park, CA: Sage.

Renfroe, D., O'Sullivan, P. & McGee, G. (1990). The relationship of attitude, subjective norm, and behavioral intent to the documentation behavior of nurses. *Scholarly Inquiry for Nursing Practice*, *4,* 47-60.

Renn, O. (1998). The role of risk communication and public dialogue for improving risk management. *Risk, Decision and Policy, 3*, 5-30.

Rennie, D. M. (1994). Evaluation of food hygiene education. *British Food Journal, 96,* (11), 20–25.

Reyna, V. (2004). How people make decisions that involve risk: a dual process approach. *Current Directions in Psychological Science*, *13* (2), 60-66.

Ritchie, D., Amos, A., Phillips, R., Cunningham-Burley. & Martin, C. (2009). Action to achieve smoke-free homes- an exploration of experts' views. *BMC Public Health, 9,* 112-120.

Rivis, A. & Sheeran, P. (2003). Descriptive norms as an additional predictor in the theory of planned behavior: a meta-analysis. *Current Psychology: Developmental, Learning, Personality, Social, 22* (3), 218–233.

Roberto, M. & Silva, S. (2007). Estudo dos factores que promovem a adesão dos profissionais de saúde às Precauções Universais. In Guedes Soares, A. P. Teixeira & A. Antão (Eds.) *Riscos Públicos e Industriais* (Vol. 2), Lisboa: Edições Salamandra, 1217-1232.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91,* 93-114.

Ronis, D. (1992). Conditional health threats: health beliefs, decisions, and behaviours among adults. *Health Psychology, 11*, 127-134.

Ross, L., Greene, D., & House, P. (1977). The false consensus phenomenon: An attributional bias in self-perception and social perception processes. *Journal of Experimental Social Psychology, 13* (3), 279-301.

Rosenstock, I.M. (1966). Why people use health services. *Milbank Memorial Fund Quarterly*, 44, 94-124.

Roup, B. (1997). Factors associated with compliance of critical care nurses with universal precautions: A pilot study. *American Journal of Critical Care, 6 (3),* 218-224.

Rundmo, R. (1997). Associations between risk perception and safety. *Safety science*, *24* (3), 197-209.

Rundmo, T. (2000). Safety climate, attitudes and risk perception in Norsk Hydro. Safety Science, 34 *(1-3),* 47-59.

Rutter, D. & Quine, L. (eds). (2002). *Changing Health Behaviour*. Open University Press, Buckingham.

Sable, M., Schwartz, L., Kelly, P., Lisbon, E. & Hall, M. (2006).Using the theory of reasoned action to explain physician intention to prescribe emergency contraception. *Perspectives on Sexual and Reproductive Health,* 38, 20-27.

Sacar, S., Turgut, H., Kaleli, I., Cevahir, N., Asan, A., Sacar, M. & Tekin, K. (2006). Poor hospital infection control practice in hand hygiene, glove utilization and usage of tourniquets. *American Journal of Infection Control, 34* (9), 606-609.

Sanderson, P. J. & Weissler, S. (1992). Recovery of coliforms from the hands of nurses and patients: activities leading to contamination. *Journal of Hospital Infection*, *21*, 85-93.

Salemi, C., Canola, M. T, Eck, E. K. (2002). Hand washing and physicians: how to get them together. *Infection Control and Hospital Epidemiology*; *23,* 32–35.

Sauls, D. (2007). Nurses' attitudes toward provision of care and related health outcomes. *Nursing Research, 56,* 117-123.

Schmidt, P., Wloch, C., Biran, A., Curtis, V. & Mangtani, P. (2009). Formative research on the feasibility of hygiene interventions for influenza control in UK primary schools. *BMC Public Health, 9,* 390.

Schneider, B., Bowen, D. E., Ehrhart, M. G., & Holcombe, K. M. (2000). The climate for service: Evolution of a construct. In N. M. Ashkanasy, C. P. Wilderom, & M. F. Peterson (Eds.), *Handbook of organizational culture and climate* (pp. 21–36). Thousand Oaks, CA: Sage.

Schneider, J., Moromisato, D., Zemetra, B., Rizzi-Wagner, L., Rivero, N., Mason, W., Imperial-Perez, F. & Ross, L. (2009). Hand hygiene adherence is influenced by the behavior of role models. *Pediatric Critical Care Medicine, 10* (3), 360-3.

Schumpeter, J. (1939). *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process* (2 vol.). New York: McGraw Hill.

Schwartz, S. H. (1977). Normative Influences on Altruism. In L. Berkowitz (ed.) *Advances in Experimental Social Psychology* (Vol. 10). New York: Academic Press.

Schwartz, R.J., Jacobs, L.M. & Juda, R.J. (1992). Evaluating the compliance of universal precautions by aeromedical personnel before and after an educational seminar on infectious diseases. *Connecticut Medicine*, *56*, 3–5.

Seaman, P. & Eves, A. (2010a). Perceptions of hygiene training amongst food handlers, managers and training providers – a qualitative study. *Food Control, 21,* 1037-1041.

Seaman, P. & Eves, A. (2010b). Efficacy of the theory of planned behaviour model in predicting safe food handling practices. *Food Control, 21,* 983-987.

Shanley, J. P. (1930). Some features of the progress of medicine during the nineteenth century. *Irish Journal of Medical Science*, *5* (6), 240-246.

Sharir R., Teitler N., Lavi I., Raz R. (2001). High-level handwashing compliance in a community teaching hospital: a challenge that can be met! *Journal of Hospital Infection, 49,* 55-58.

Sheeran, P. (2002). Intention-behaviour relations: A conceptual and empirical review. In M. Hewstone & W. Stroebe (Eds.), *European Review of Social Psychology.* (Vol. 12, pp. 1-36.): Chichester, UK: John Wiley & Sons.

Sheeran, P. & Orbell, S. (1998). Do intentions predict condom use? A meta-analysis and examination of six moderator variables. *British Journal of Social Psychology*, 37, 231-250.

Sheeran, P., & Orbell, S. (1999). Augmenting the theory of planned behavior: Roles for anticipated regret and descriptive norms. *Journal of Applied Social Psychology*, *23*, 2107–2142.

Sheeran, P. and Orbell, S. (2000a) Self-schemas and the theory of planned behaviour, *European Journal of Social Psychology*, *30,* 533–50.

Sheeran, P. & Taylor, S. (1999) Predicting intentions to use condoms: a meta-analysis and comparison of the theories of reasoned action and planned behavior. *Journal of Applied Social Psychology*, *29* (8), 1624–75.

Sheeran. P. Norman, P, & Orbell. S. (1999). Evidence that intentions based on attitudes better predict behaviour than intentions based on subjective norms. *European Journal of Social Psychology. 29,* 403-406.

Sheppard, B. H., Hartwick, J., & Warshaw, P.R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research.*Journal of Consumer Research*, *15*, 325-343.

Silva, S., Lima, L. & Baptista, C. (2004). OSCI: an organizational and safety climate inventory. *Safety Science*, *42,* 205-220.

Silvestri, L. Petros, A. J. Sarginson, R. E. de la Cal, M. A. Murray, A. E. & van Saene, H. K. F. (2005) Handwashing in the intensive care unit: a big measure with modest effects. *Journal of Hospital Infection, 59,* 172-9.

Simmons, B., Bryant, J., Neiman, K., Spence, L. & Arheart, K. (1990) The role of handwashing in prevention of endemic intensive care unit infections. *Infection Control Hospital Epidemiology, 11*, 589–594.

Simons-Morton, B. G., Brink, S. G., Simons-Morton, D. G., McIntyre, R., Chapman, M., Longoria, J., et al. (1989). Ecological approach to the prevention of injuries due to drinking and driving. *Health Education Quarterly*, *16* (3), 397-411.

Sjoberg, L. (2003). Neglecting the risks: the irrationality of health behavior and the quest for La Dolce Vita. *European Psychologist*, 8 (4), 266-278.

Sjoberg, L., & Drottz-Sjöberg, B.-M. (1991). Knowledge and risk perception among nuclear power plant employees. *Risk Analysis, 11,* 607-618.

Sjöberg, A. & Sverke, M. (2000). The interactive effect of job involvement and organizational commitment on job turnover revisited: A note on the mediating role of turnover intention. *Scandinavian Journal of Psychology, 41,* 247-252.

Sjostrom, M., Karlsson, A., Kaati, G. Yngve, A. Green, L. & Bygren, L. (1999). A 4 week residential program for primary healthcare patients to control obesity and related heart risk factors: effective application of principles of learning and lifestyle change. *European Journal of Clinical Nutrition*, *53* (2), 572-577.

Smith, J.L. (1999). An agentic psychology model based on the paradigmatic repositioning of the theory of planned behaviour. *Theory and Psychology 9* (5) 679–700.

Smith, J.L. (2000). *The psychology of action*. Basingstoke: Macmillan.

Snijders, C., Boudewijn, B., Kollen, R., Lingen, R., Fetter, W. & Molendijk, H. (2009). Which aspects of safety culture predict incident reporting behavior in neonatal intensive care units? A multilevel analysis. *Critical Care Medicine, 37 (1),* 61-67.

Sparks, P. (1994) Food choice and health: applying, assessing, and extending the Theory of Planned Behaviour. In D.R. Rutter and L. Quine (Eds), *Social Psychology and Health: European Perspectives*. Aldershot: Avebury.

Sparks P, Sheperd R. (2002). The role of moral judgements within expectancy value based attitude behavior models. *Ethics Behavior, 12* (4), 299-321.

Steckler, A., Dawson, L., Israel, B. & Eng, E. (1993). Community health development: An overview of the works of Guy W. Stewart. *Health Education Quarterly, 1,* S3-S20.

Stern P, Dietz T, Abel T, Guagnano G, Kalof L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecological Review, 6* (2), 81-97.

Stevens, J. (1986). *Applied multivariate statistics for the social sciences.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Stone, S. P. (2001). Hand hygiene – the case for evidence based-education. *Journal of the Royal Society of Medicine*, *94,* 278-281.

Stroebe, W. & Stroebe, M. (1995). *Psicologia Social e Saúde.* Lisboa: Instituto Piaget.

Suchitra, J. Lakshmi Devi, N. (2007). Impact of education on knowledge, attitudes and practices among various categories of health care workers on nosocomial infections. *Indian Journal of Medical Microbiology, 25* (3), 181-187.

Taylor, L. (1978). An evaluation of handwashing techniques. *Nursing Times*, 54–55.

Teare, E., Cookson, B., French, G., Gould, D., Jenner, E., McCulloch, J., et al. (1999). Hand washing – a modest measure with big effects. *British Medical Journal, 318,* 686.

Terry, D. J., & Hogg, M. A. (1996). Group norms and the attitude-behavior relationship: A role for group identification. *Personality and Social Psychology Bulletin*, *22*, 776-793.

Tomás, J. M., Melia, J. L., & Oliver, A. (1999). A cross-validation of a structural equation model of accidents: Organizational and psychological variables as predictors of work safety. *Work & Stress, 13* (1), 49-58.

Trafimow, D., & Finlay, K. A. (1996). The importance of subjective norms for a minority of people: Between-subjects and within-subjects analyses. *Personality and Social Psychology Bulletin*, *22*, 820-828.

Trifiletti, L., Gielen, A. Sleet, D. & Hopkins, K. (2005). Behavioral and social sciences theories and models: are they used in unintentional injury prevention research? *Health Education Research*, *10,* 1-10.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*, 1124–1131.

United Nations. (2008). *World urbanization prospects: the 2007 revision.* New York: United Nations. Retrieved October 10 2009 from http://www.un.org/esa/population/publications/wup2007/2007WUP_Highlights_web.pdf.

Van der Pligt, J. and de Vries, N.K. (1998) Expectancy-value models of health behavior: the role of salience and anticipated affect, *Psychology and Health*, *13,* 289–305.

Voss, A. & Widmer, A. (1997). No time for handwashing!? Handwashing versus alcoholic rub: can we afford 100% compliance? *Infection Control of Hospital Epidemiology, 18*, 205–208.

Vroom, V. H. (1964). *Work and Motivation*. New York: Wiley.

Waldron, I. (1997). Changing roles and gender differences in health behavior. In G. S. Gochman (Ed.), *Handbook of Health Behavior Research I: Personal and Social Determinants* (pp. 303-328). New York: Plenum Press.

Walker, A., Grimshaw, J. & Armstrong, E. (2001). Salient beliefs and intentions to prescribe antibiotics for patients with a sore throat. *British Journal of Health Psychology, 6,* 347-360.

Watson, P. & Myers, L. (2001). Which cognitive factors predict clinical glove use amongst nurses? *Psychology, Health and Medicine*, *6* (4), 399-409.

Weinstein, N. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39* (5), 806-820.

Weinstein, N. (1988). The precaution adoption process. *Health Psychology*, 355-386.

Wenzel, R. P. (1995). The economics of nosocomial infections. *Journal of Hospital Infection, 31*, 79–87.

Wendel, D., Maes, L., Labeau, S., Vereecken, C. & Blot, S. (2010). Behavioural determinants of hand hygiene compliance in intensive care units. *American Journal of Critical Care,* 19 (3), 230-240.

Wechsler, H., Levin, S., Idelson, R., Rothman, M. & Taylor, J. (1983) The physician's role in health promotion--a survey of primary care practitioners. *New England Journal of Medicine, 308*, 97-100.

Weyman, A. & Clarke, D. (2003). Investigating the influence of organizational role on perceptions of risk in deep coal mines. *Journal of Applied Psychology*, 88 (3), pp. 404-412.

Weyman, A. K., and Kelly, C. J. (1999). Risk perception and risk communication: A review of the literature. Health and Safety Laboratory. CRR 248/1999.

White, C. M., & Berger, M. C. (1992). Using force field analysis to promote use of personal protective equipment. *Infection Control and Hospital Epidemiology, 13,* 752-755.

White, C., Shinder, F., Shinder, A. & Dyer, D. (2001). Reduction of illness absenteeism in elementary schools using an alcohol free instant hand sanitizer. *The Journal of School Nursing 17*, 258–265.

White, K. M., Terry, D. J., & Hogg, M. A. (1994). Safer sex behavior: The role of attitudes, norms and control factors. *Journal of Applied Social Psychology*, *24*, 2164–2192.

Wilkens, P. (2003). Preventing work-related musculosketal disorders in VDT users: a comprehensive health promotion program. *Work*, *20,* 171-178.

Wissen, K., Siebers, R & Fnzimls, M. (1993). Nurses' attitudes and concerns pertaining to HIV and AIDS. *Journal of Advanced Nursing*, *18*, 912-917.

Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs, 59,* 329-349.

Wong, E. S. (1999). Surgical Site Infections. *Hospital Epidemiology and Infection Control*, *26*, 189-21.

World Health Organization. (1996). *The world health report - Fighting disease, fostering development.* Retrieved August 25 2007 from http://www.who.int/whr/1996/en/index.html.

World Health Organization. (2002). *Prevention of hospital-acquired infections - A practical guide* (2nd Edition). Retrieved August 25 2007 from http://www.who.int/csr/resources/publications/drugresist/en/whocdscsreph200212.pdf.

World Health Organization. (2003). 2002 World Health Report: Reducing risks, promoting healthy life. Retrieved November 23 2006 from http://www.who.int/whr/2002/en/whr02_en.pdf.

World Health Organization (2005). *The Global Patient Safety Challenge 2005–2006 "Clean Care is Safer Care" Geneva.* Retrieved December 20 2008 from http://www.who.int/patientsafety/events/05/GPSC_Launch_ENGLISH_FINAL.pdf

Worsfold, D., Griffith, C. & Worsflod, P. (2004). A survey of environmental health officers' views of food hygiene training. *British Food Journal.* 106 (1), 51-64.

Wright S. (1996). Examining what residents look for in their role models. *Academic Medicine*, 71, 290-292.

Wright, S., Kern, D., Kolodner, K., Howard, D. & Brancati, F. (1998). Attributes of excellent attending-physician role models. *The New England Journal of Medicine, 339* (27), 1986-1993.

Wright, S., Wong, A. & Newill, C. (1997). The impact of role models on medical students. *Journal of General Internal Medicine, 12*, 53-56.

Wurtz, R., Moye, G. & Jovanovic, B. (1994). Handwashing machines, handwashing compliance, and potential for cross-contamination. *American Journal of Infection Control, 22*, 228–230.

Yamazhan, T., Tasbakan, M., Calik, S., Pullukcu, H., Sipahi, O. & Ulusoy, S. (2009). Evaluation of the Knowledge of Hospital Cleaning Staff about Prevention of Nosocomial Infections. *Turkish Journal of Medical Science, 39 (1),* 77-80.

Yuan, C., Dembry, L., Higa, B., Fu, M., Wang, H. & Bradley, E. (2009). Perceptions of hand hygiene practices in China. *Journal of Hospital Infection, 71,* 157-162.

Zimakov. J., Kjelsberg, A. B., Larsen, S.O. & Holstein, B. (1992). A multicenter questionnaire investigation of attitudes toward hand hygiene assessed by the different hospitals in Denmark and Norway. American Journal of Infection Control, *20*, 58-64.

Zohar, D. (1980). Safety Climate in Industrial Organizations: Theoretical and Applied Implications. *Journal of Applied Psychology, 65* (1), 96-102.

Zohar, D. (2000). A group-level model of safety climate: testing the effect of group climate on micro accidents in manufacturing jobs. *Journal of Applied Psychology, 85,* 587–596.

Zohar, D. (2001). Safety climate: Conceptual and measurement issues. In J. C. Quick & L. E. Tetrick (Eds.), *Handbook of Occupational Health Psychology* (pp. 123–142). Washington, DC: American Psychological Association.

Zohar, D. (2003). Safety climate: conceptual and measurement issues. In J. C. Quick & L. E. Tetrick (Eds) *Handbook of Occupational Health Psychology*. Washington: APA.

Zohar, D. (2008). Safety climate and beyond: a multi-level multi-climate framework. *Safety Science*, 46, pp. 376-387.

Zohar, D. (2010). Thirty years of safety climate research: reflections and future directions. *Accident Analysis and Prevention, 42,* 1517-1522.

Zohar, D. & Luria, G. (2004). Climate as social-cognitive construction of supervisory safety practices: scripts as proxy of behaviour patterns. *Journal of Applied Psychology*, *89* (2), 322-333.

Zuckerman, M. & Reis, H. (1978). Comparison of Three Models for predicting Altruistic Behavior. *Journal of Personality and Social Psychology*, *36* (5), 498-510.

APPENDICES

Appendix A
Rotated Component Matrix to extract professionals' attitudes, subjective norm, PBC and intention (Study I – Quantitative Part)

Table 1. Principal Component Analysis

Rotated Component Matrix (with varimax rotation)				
	Component			
	1	2	3	4
Attitudes 1	-,005	,161	**,800**	,006
Attitudes 2	,077	-,016	**,848**	,035
Attitudes 3	,050	,063	**,728**	-,018
Subjective Norm 1	**,902**	-,007	,002	-,058
Subjective Norm 2	**,871**	,119	,029	,011
Subjective Norm 3	**,901**	,024	,110	-,101
PBC 1	,092	**,831**	,080	,120
PBC 2	,085	**,861**	,042	,012
PBC 3	-,030	**,843**	,122	,087
Intention 1	-,001	-,009	-,017	**,829**
Intention 2	-,081	,030	,166	**,856**
Intention 3	-,086	,387	-,184	**,671**

Table 2. Items used in the questionnaire to measure TPB constructs

Attitudes
Hand hygiene is a useful technique for professionals like me
Hand hygiene is a beneficial technique for professionals like me
Hand hygiene is a safety guaranty for professionals like me
Subjective Norm
My colleagues consider that I should comply with hand hygiene procedures
My colleagues approval of my hand hygiene behaviour is important to me
My colleagues comply with hand hygiene procedures
PBC
I consider hand hygiene as an easy procedure to perform
I consider that I control hand hygiene technique
I consider that hand hygiene is an effortless procedure
Intention
I intend to comply with hand hygiene in every situation where this procedure is required
I intend to wash my hands despite the hand hygiene equipment's condition
I intend to wash my hands to be able to decrease the spread of infections

Appendix B
Rotated Component Matrix to extract medical students' attitudes, subjective norm, PBC, moral norm and intention (Study II)

Table 1. Principal Component Analysis

Rotated Component Matrix (with varimax rotation)

	Component				
	1	2	3	4	5
Attitudes 1	,062	**,718**	,099	,010	-,035
Attitudes 2	-,016	**,851**	,030	-,007	-,101
Attitudes 3	-,008	**,828**	-,042	-,046	-,030
Subjective Norm 1	,105	,022	**,877**	-,001	-,001
Subjective Norm 2	,092	-,001	**,897**	-,014	,027
Subjective Norm 3	,330	,164	**,492**	-,279	,015
Moral Norm 1	,303	-,045	-,317	**,544**	-,251
Moral Norm 2	,116	-,062	,015	**,887**	-,039
Moral Norm 3	-,032	,048	-,021	**,861**	-,079
PBC 1	-,028	,053	,029	,096	**,808**
PBC 2	,075	-,227	-,113	-,164	**,825**
PBC 3	,155	-,059	,124	-,233	**,725**
Intention 1	**,679**	,003	,115	,066	-,006
Intention 2	**,801**	-,122	,274	,040	,115
Intention 3	**,830**	,133	-,035	,085	,091

Table 2. Items used in the questionnaire applied in Study II

Attitudes
Hand hygiene is an useful technique for me and for the patient
Hand hygiene is a beneficial technique for me and for the patient
Hand hygiene is an adequate technique to decrease infections for professionals and patients
Subjective Norm Colleagues
What my colleagues consider that I should do about hand hygiene is important to me
My colleagues approval of my hand hygiene behaviour is important to me
My colleagues comply with hand hygiene procedures
PBC
I consider hand hygiene as an easy procedure to perform
I consider that I control hand hygiene technique
I consider that hand hygiene is an effortless procedure
Moral Norm Patient
I consider my personal commitment towards the patient more important than hand hygiene
Doing what I think is morally correct is more important to the patient than to comply with hand hygiene
In a routine procedure (e.g. contact with the patient) is more important to me to focus on my commitment to the patient than to wash my hands

Intention
I intend to comply with hand hygiene in every situation where this procedure is required
I intend to wash my hands despite the hand hygiene equipment's condition
I intend to wash my hands to be able to decrease the spread of infections

Appendix C
Rotated Component Matrix to extract medical students' attitudes, subjective norms, PBC, moral norms and intention (Study III)

Table 1. Principal Component Analysis

Rotated Component Matrix (with varimax rotation)

	Component						
	1	2	3	4	5	6	7
Attitudes 1	-,134	**,888**	,071	,028	,165	,076	,040
Attitudes 2	-,080	**,903**	,180	,023	,130	,070	,041
Attitudes 3	-,156	**,852**	,257	-,013	,169	,102	,126
Subjective Norm Colleagues 1	,025	,003	-,015	**,876**	,132	,008	,120
Subjective Norm Colleagues 2	,041	-,002	-,060	**,935**	,055	,025	,028
Subjective Norm Colleagues 3	,035	,034	,049	**,858**	,066	,027	,050
Subjective Norm Professor 1	-,114	,102	,086	,044	,021	**,737**	-,054
Subjective Norm Professor 2	,137	,049	,055	,001	,133	**,886**	,099
Subjective Norm Professor 3	,057	,051	,060	,012	,063	**,866**	-,061
Moral Norm Patient 1	**,916**	-,153	-,097	-,015	-,040	,078	,073
Moral Norm Patient 2	**,958**	-,129	-,023	,052	-,013	,001	,083
Moral Norm Patient 3	**,909**	-,054	,141	,071	-,009	-,014	,075
Moral Norm Hygiene 1	-,090	,089	**,859**	,051	,160	,007	,047
Moral Norm Hygiene 2	,103	,186	**,865**	-,056	,252	,100	,100
Moral Norm Hygiene 3	,039	,237	**,823**	-,040	,224	,158	,076
PBC1	,041	-,054	,026	,054	,074	,070	**,841**
PBC2	,102	,096	,038	,055	,112	-,056	**,872**
PBC3	,068	,130	,118	,080	,095	-,048	**,721**
Intention 1	-,073	,085	,177	,106	**,841**	,049	,095
Intention 2	,022	,226	,229	,096	**,842**	,109	,156
Intention 3	-,009	,177	,224	,099	**,855**	,096	,095

Table 2. Items used in the questionnaire applied in Study III

Attitudes

Hand hygiene is an useful technique for me and for the patient

Hand hygiene is a beneficial technique for me and for the patient

Hand hygiene is an adequate technique to decrease infections for professionals and patients

Subjective Norm Colleagues

What my colleagues consider that I should do about hand hygiene is important to me

My colleagues approval of my hand hygiene behaviour is important to me

My colleagues comply with hand hygiene procedures

Subjective Norm Professor

What my Professor consider that I should do about hand hygiene is important to me

My Professor approval of my hand hygiene behaviour is important to me

My Professor values hand hygiene compliance

PBC

	I consider hand hygiene as an easy procedure to perform
	I consider that I control hand hygiene technique
	I consider that hand hygiene is an effortless procedure
Moral Norm Patient	
	I consider my personal commitment towards the patient more important than hand hygiene
	Doing what I think is morally correct is more important to the patient than to comply with hand hygiene
	In a routine procedure (e.g. contact with the patient) is more important to me to focus on my commitment to the patient than to wash my hands
Moral Norm Hygiene	
	I consider hand hygiene a personal moral obligation towards the patient
	Hand hygiene is a moral commitment towards the patients that allows to save his life
	In a routine procedure (e.g. contact with the patient) is more important to me to focus on my obligation to comply with hand hygiene
Intention	
	I intend to comply with hand hygiene in every situation where this procedure is required
	I intend to wash my hands despite the hand hygiene equipment's condition
	I intend to wash my hands to be able to decrease the spread of infections

Appendix D
Rotated Component Matrix to extract HCPs' attitudes, subjective norm, PBC, moral norm, intention, behaviour, safety climate and vulnerability perception (Study IV – Research Goal 1)

Table 1. Principal Component Analysis

Rotated Component Matrix (with varimax rotation)

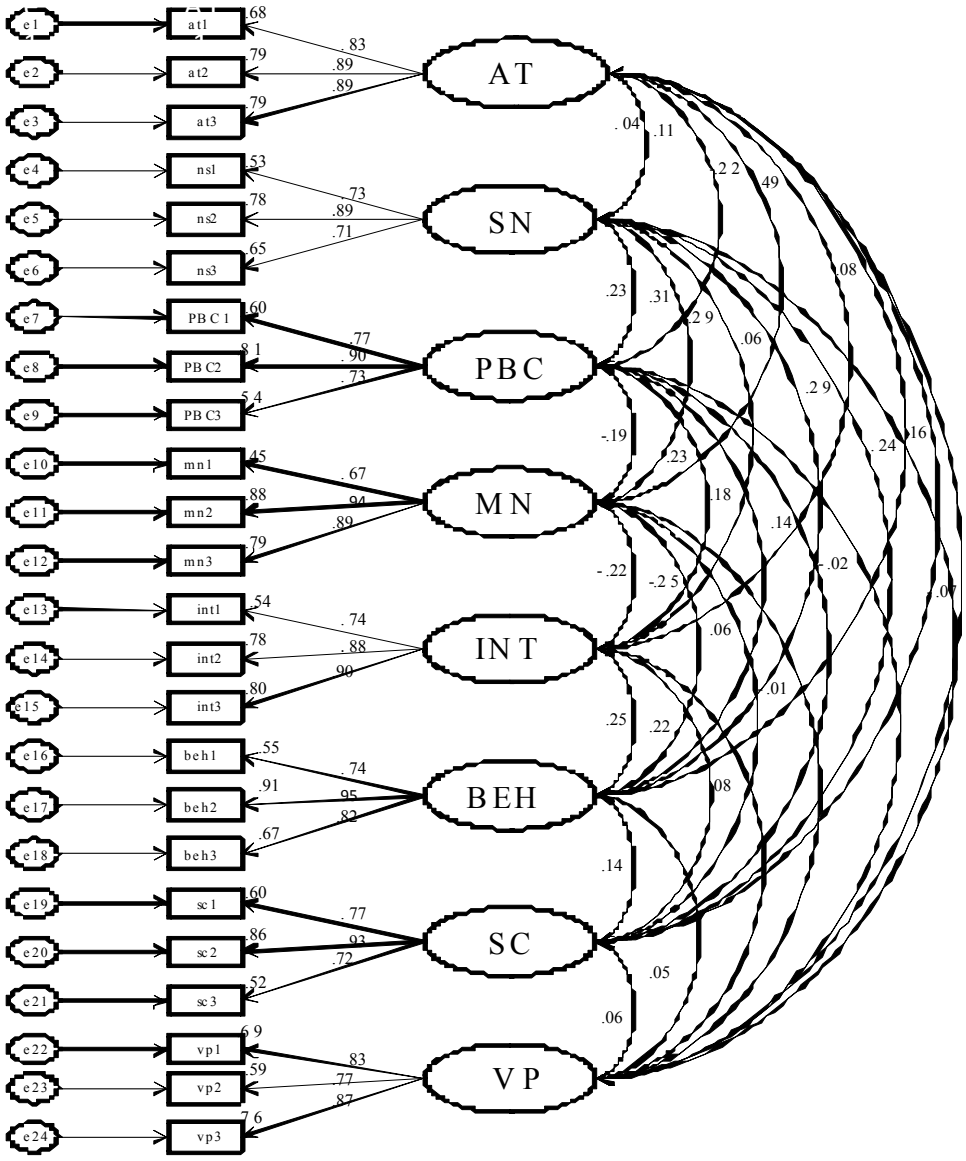
	Component							
	1	2	3	4	5	6	7	8
Attitudes 1	,055	**,872**	-,014	-,011	,035	,179	-,087	,106
Attitudes 2	,054	**,893**	,022	-,018	,086	,202	,010	-,022
Attitudes 3	,093	**,892**	,033	-,053	,115	,165	,017	,030
Subjective Norm 1	,090	-,139	-,011	-,001	,096	,055	**,836**	,061
Subjective Norm 2	,111	,027	,032	,161	,109	,082	**,867**	,088
Subjective Norm 3	,132	,063	,011	,105	,141	,124	**,835**	,060
Moral Norm 1	,063	-,013	,077	,006	**,801**	,157	,059	,138
Moral Norm 2	,068	,106	-,025	-,006	**,907**	,036	,140	,062
Moral Norm 3	,050	,143	-,057	-,010	**,888**	-,008	,148	,073
PBC 1	,069	,030	-,042	-,021	,079	,072	,054	**,852**
PBC 2	,036	,045	-,029	-,020	,078	,019	,127	**,897**
PBC 3	,040	,033	-,032	,022	,102	,185	,019	**,816**
Intention 1	,076	,136	,141	-,054	,061	**,829**	,024	,156
Intention 2	,075	,240	,191	-,020	,072	**,837**	,141	,066
Intention 3	,120	,267	,197	-,017	,082	**,815**	,149	,101
Behaviour 1	,017	-,034	**,849**	-,034	-,002	,115	-,030	-,035
Behaviour 2	,064	,027	**,912**	-,052	-,045	,162	,040	-,062
Behaviour 3	,088	,053	**,874**	,003	,043	,157	,023	-,011
Safety Climate 1	**,792**	,074	,102	-,076	,005	,110	,107	,051
Safety Climate 2	**,863**	,057	,045	,029	,012	,022	,148	,066
Safety Climate 3	**,866**	-,019	,042	,045	-,002	,015	,068	,039
Safety Climate 4	**,615**	,085	-,012	,137	,171	,089	,012	,003
Vulnerability Perception 1	-,015	-,054	-,077	**,872**	-,055	-,002	,138	-,026
Vulnerability Perception 2	,121	-,006	,002	**,865**	,013	-,037	,034	,004
Vulnerability Perception 3	,025	-,017	-,007	**,899**	,033	-,039	,067	,001

Table 2. Items used in the questionnaire applied in Study IV

Attitudes
Hand hygiene is an useful technique for me and for the patient
Hand hygiene is a beneficial technique for me and for the patient
Hand hygiene is an adequate technique to decrease infections for professionals and patients
Subjective Norm Colleagues
What my team colleagues consider that I should do about hand hygiene is important to me
Team colleagues approval of my hand hygiene behaviour is important to me
My team colleagues comply with hand hygiene procedures
PBC
I consider hand hygiene as an easy procedure to perform
I consider that I control hand hygiene technique
I consider that hand hygiene is an effortless procedure
Moral Norm Patient
I consider my personal commitment towards the patient more important than hand hygiene
Doing what I think is morally correct is more important to the patient than to comply with hand hygiene
In a routine procedure (e.g. contact with the patient) is more important to me to focus on my commitment to the patient than to wash my hands
Intention
I intend to comply with hand hygiene in every situation where this procedure is required
I intend to wash my hands despite the hand hygiene equipment's condition
I intend to wash my hands to be able to decrease the spread of infections
Hand Hygiene Behaviour
Every time I see a patient I wash my hands for 22 seconds according to the hand hygiene safety procedures
I always wash my hands with soap and water after performing an invasive procedure
I always wash my hands with alcohol-rubs after performing a routine procedure
Safety climate perceptions
Whenever pressure builds up, we have to work faster rather than by the safety compliance rules such as hand hygiene
In my ward there's a concern with hand hygiene compliance routine problems
In my team we can make suggestions for improving hand hygiene compliance
In my team we pay attention when a colleague violates hand hygiene compliance
Vulnerability Perception
Hand hygiene compliance protects me from acquiring a cross-infection
Hand hygiene compliance protects patients from acquiring a nosocomial infection
When I comply with hand hygiene I feel that I'm protecting myself and the patient

Appendix E
Confirmatory Factor Analysis Solution Eight-Factor Model with three safety climate items (Study IV – Research Goal 1)

Figure 1. Confirmatory Factor Analysis



Appendix F
Rotated Component Matrix to extract HCPs' attitudes, subjective norm, PBC, moral norm, self-reported behaviour, safety climate (Study V)

Table 1. Principal Component Analysis

Rotated Component Matrix (with varimax rotation)

	Component					
	1	2	3	4	5	6
Attitudes 1	**,898**	,180	,071	,011	,008	,035
Attitudes 2	**,897**	,013	,123	,019	,141	,018
Attitudes 3	**,891**	,080	,224	,063	,081	,056
Subjective Norm 1	-,035	,137	,107	,047	**,847**	,000
Subjective Norm 2	,092	,173	,150	,039	**,862**	,132
Subjective Norm 3	,198	,139	,187	,008	**,823**	,053
Moral Norm 1	,056	,177	**,852**	,054	,078	,060
Moral Norm 2	,124	,076	**,900**	,042	,184	,039
Moral Norm 3	,275	,046	**,856**	-,049	,203	,030
PBC 1	,085	**,889**	,139	-,053	,067	,012
PBC 2	,062	**,904**	,106	,003	,188	,021
PBC 3	,115	**,833**	,047	-,090	,188	,017
Safety Climate 1	,097	,046	,006	,028	,027	**,855**
Safety Climate 2	,085	,022	,022	,070	,073	**,903**
Safety Climate 3	-,079	-,022	,088	,078	,058	**,821**
Behaviour 1	-,034	-,076	,012	**,870**	-,058	-,005
Behaviour 2	,036	-,046	-,038	**,919**	,062	,153
Behaviour3	,085	-,009	,076	**,878**	,090	,044

Table 2. Items used in the questionnaire applied in Study V

Attitudes
Hand hygiene is an useful technique for me and for the patient
Hand hygiene is a beneficial technique for me and for the patient
Hand hygiene is an adequate technique to decrease infections for professionals and patients
Subjective Norm Colleagues
What my colleagues consider that I should do about hand hygiene is important to me
My colleagues approval of my hand hygiene behaviour is important to me
My colleagues comply with hand hygiene procedures
PBC
I consider hand hygiene as an easy procedure to perform
I consider that I control hand hygiene technique
I consider that hand hygiene is an effortless procedure
Moral Norm Patient
I consider my personal commitment towards the patient more important than hand hygiene
Doing what I think is morally correct is more important to the patient than to comply with hand hygiene
In a routine procedure (e.g. contact with the patient) is more important to me to focus on my commitment to the patient than to wash my hands
Intention
I intend to comply with hand hygiene in every situation where this procedure is required
I intend to wash my hands despite the hand hygiene equipment's condition
I intend to wash my hands to be able to decrease the spread of infections
Hand Hygiene Behaviour
Every time I see a patient I wash my hands for 22 seconds according to the hand hygiene safety procedures
I always wash my hands with soap and water after performing an invasive procedure
I always wash my hands with alcohol-rubs after performing a routine procedure
Safety climate perceptions
Whenever pressure builds up, we have to work faster rather than by the safety compliance rules such as hand hygiene
In my ward there's a concern with hand hygiene compliance routine problems
In my team we can make suggestions for improving hand hygiene compliance

Appendix G
Pearson Coefficient and Spearman Rho Correlations between self-reported compliance, direct observation and team level variables (Study V)

Table 1. Pearson and Spearman correlation coefficients

	1		2		3		4		5		6	
	r	ρ	r	ρ	r	ρ	r	ρ	r	ρ	r	ρ
1 Reported Compliance												
2 Observed Compliance	0.42**	0.40**										
3 Attitudes	0.21**	0.18*	-0.02	-0.09								
4 Subjective Norm	0.25**	0.23**	0.20**	0.22**	0.16*	0.13						
5 Moral Norm	-0.18*	-0.19*	-0.21**	-0.24**	-0.19*	-0.18*	0.09	0.12				
6 PBC	0.16*	0.17*	-0.13	0.15	0.05	0.07	-0.03	-0.05	-0.41**	-0.39**		
7 Safety Climate	0.18*	0.19*	0.20**	0.22**	0.11	0.13	0.05	0.07	0.12	0.11	0.04	0.06

Appendix H
Homogenous subsets for observed and reported compliance according to ward team membership (Study V)

Table 1. Post-Hoc Tests

Group	N	Subset for alpha = 0.05		
		Observed Compliance		
		1	2	3
Medicine	2	3.14		
Pediatric/ Obstetric	2		4.07	
Ambulatory	2			4.41
Surgery	7			4.42
		Reported Compliance		
		1	2	
Medicine	2	5.91		
Pediatric/ Obstetric	2	6.03		
Ambulatory	2		6.32	
Surgery	7		6.37	

Post-hoc tests Tukey HSD and Scheffe

CURRICULUM VITAE

Personal Details

Name: Magda Sofia Valadas Dominguez Roberto

Date of Birth: 5th March 1981

Birthplace: Rotterdam

Nationality: Portuguese

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Education

2006/ …

Ph.D in Psychology, specialty in Social Psychology

PhD Grant financed by Fundação para a Ciência e Tecnologia (refª SFRH / BD / 30860 / 2006)

ISCTE – Lisbon University Institute

2006/ 2007

Advanced Studies Certificate in Psychology

ISCTE – Lisbon University Institute

Final Classification: 18

2001/ 2006

Degree in Social and Organisational Psychology

ISCTE –Lisbon University Institute

Final Classification: 17

Research

2010/ now

Post-Doctoral Researcher in the Department of Research and Development of the Institute of Child Health, Birmingham Children's Hospital, United Kingdom.

Research Group: Birmingham and Black Country Collaboration for Academic Leadership in Health Research and Care (BBC CLAHRC)

Research Projects:

"Emergency care pathway redesign: an implementation of lean methodology." Lead Researcher, Magda Sofia Roberto (University of Birmingham, Birmingham Children's Hospital). Project Manager, Dr. Alexandra Enocson (University of Birmingham, Birmingham Children's Hospital). Coordinators, Professor Deirdre Kelly and Dr. Carole Cummins (University of Birmingham, Birmingham Children's Hospital).

"Birmingham Children's Hospital Portal Paediatric Outpatient Referral Triage and Liaison." Lead Researcher, Magda Sofia Roberto (University of Birmingham, Birmingham Children's Hospital). Project Manager, Dr. Alexandra Enocson (University of Birmingham, Birmingham Children's Hospital). Coordinators, Professor Deirdre Kelly and Dr. Carole Cummins (University of Birmingham, Birmingham Children's Hospital).

"A randomised control trial of the impact on quality of life and self-efficacy of a psychological and educational intervention compared with standard care in children with moderate to severe asthma." Lead Researcher, Magda Sofia Roberto (University of Birmingham, Birmingham Children's Hospital). Project Manager, Dr. Alexandra Enocson (University of Birmingham, Birmingham Children's Hospital). Coordinators, Professor Deirdre Kelly and Dr. Carole Cummins (University of Birmingham, Birmingham Children's Hospital).

"An analysis of frequent attendance at a Paediatric emergency department and Outpatients clinics" Lead Researcher, Dr. Carole Cummins (University of Birmingham, Birmingham Children's Hospital), Quantitative Analyst, Magda Sofia Roberto (University of Birmingham, Birmingham Children's Hospital), Project Manager, Dr. Alexandra Enocson (University of Birmingham, Birmingham Children's Hospital). Coordinators, Professor Deirdre Kelly and Dr. Carole Cummins (University of Birmingham, Birmingham Children's Hospital).

Project Supervision:

"An exploration of perceptions and views of the key stakeholders about what constitutes successful transition for young people with liver transplants." Researcher: Jessica Arkley (Birmingham Children's Hospital), Project Supervisor, Magda Sofia Roberto (University of Birmingham, Birmingham Children's Hospital). Coordinator, Professor Deirdre Kelly (University of Birmingham, Birmingham Children's Hospital).

2010/ now

Research Member of the School of Public Health, Epidemiology & Biostatistics University of Birmingham, United Kingdom

Teaching Experience

2006/ 2009

Teaching and tutor experience

Masters degree subject units "Qualitative Research Methods", "Work Psychology", "Content Analysis using Software Programmes" coordinated by Dra. Silvia Silva

Department of Social and Organisational Psychology, ISCTE – Lisbon University Institute

Post-graduate course unit "Human Factors and Safety Culture" coordinated by Dra. Silvia Silva, Instituto Superior Técnico, University of Lisbon

Projects

2007/ 2008

Data analysis in "CAPTAR – Coding, Analysis and Prevention of Accidents at Work" (PTDC/ SDE/ 71193/ 2006) coordinated by Dra. Silvia Silva

Colaboration in the development of the application of the Project "Impacto da certificação em qualidade e segurança na sinistralidade laboral: o papel das práticas de gestão e percepção dos trabalhadores" (Refª Nº 0033PJS/ 07) coordinated by Dra. Silvia Silva

Conferences Organisation

2009

V PhD Meeting in Social and Organisational Psychology (with Edition of the Book of Proceedings)

Department of Social and Organisational Psychology, ISCTE – Lisbon University Institute

XIth European Conference ENOP on Organisational Psychology and Human Services Work

Department of Social and Organisational Psychology, ISCTE – Lisbon University Institute

Academic Awards

2011

Candidate for the Agostinho Roseta Award (results to be known in April 2011)

2006

Kurt Lewin Award

Department of Social and Organisational Psychology, ISCTE – Lisbon University Institute

2006

Academic Distinction Scholarship

ISCTE – Lisbon University Institute

Workshops and training

2010

Life and Resuscitation Training

Birmingham Children's Hospital

2008

Death, lost and the quest for meaning

Department of Social and Organisational Psychology

ISCTE – Lisbon University Institute

2008

Training in Journalism

CENJOR – Journalists Training Centre, Lisbon

Statistical analysis work

2007/ 2010

Infection control data analysis

Infection Control Commission, Hospital Garcia de Orta

Academic Interchange

2007

Industrial Psychology Research Center, School of Psychology, University of Aberdeen, United Kingdom

Scientific Papers

Roberto, M. & Silva, S. (2007). Estudo dos factores que promovem a adesão dos profissionais de saúde às Precauções Universais. In Guedes Soares, A. P. Teixeira & A. Antão (Eds.) *Riscos Públicos e Industriais* (Vol. 2), Lisboa: Edições Salamandra, pp.1217-1232.

Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Does work experience constrain physicians' intention to comply with hand hygiene? An extended application of the Theory of Planned Behavior.* (*In prep*).

Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Using a multi-level approach of safety climate to study healthcare professionals' compliance with infection control practices: a literature review.* (Submitted).

Roberto, M., S., Mearns, K. & Silva, S. A. (2010). *Hand hygiene compliance among health, educational and food professionals: a study on social influence and PRECEDE factors.* (Submitted).

Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Perceptions of social and moral norms towards hand hygiene compliance from first and sixth year Portuguese medical students.* (Submitted).

Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *A multi-level mediation model of safety climate and the Theory of Planned Behavior: exploring hand hygiene intention to comply among healthcare professionals.* (Submitted).

Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *How to comply with hand hygiene? Different behavioural intention predictors among doctors, nurses and cleaners.* (Submitted).

Roberto, M. S., Mearns, K. & Silva, S. A. (2010). *Measuring hand hygiene compliance using self-assessment and direct observation methods: analysing consensus in care-delivery teams.* (Submitted).

Conference Presentations

2º Ciclo de Conferências de Controlo de Infecção e Saúde. Escola Superior de Sadúde de Setúbal. Setúbal, Oct, 2010. Roberto, M., Mearns, K. & Silva, S. Especificidades das práticas de controlo de infecção em diferentes fases de formação e socialização. Oral Presentation.

ENOP (European Network of Work and Organizational Psychologists), Lisbon, Oct 2009
Roberto, M., Mearns, K. & Silva, S. Does work experience constrain physician's intention to comply with hand hygiene? An extended application of the Theory of Planned Behavior. Oral Presentation.

European Academy of Organizational and Work Psychology, Santiago de Compostela, May 2009. Roberto, M., Mearns, K. & Silva, S. Safety climate and norms influence on healthcare workers compliance with hand hygiene procedures. Oral Presentation.

Vth Ph.D Meeting in Social and Organisational Psychology, Lisbon, May 2009 and EAWOP Small Group Meeting: Organisational and Individual Influences on the Management of Healthy and Safe Behaviours, Santiago de Compostela, May 2009
Roberto, M., Mearns, K., Silva, S. The role of subjective and moral norms in promoting hand hygiene compliance during medical student's socialization. Oral Presentation.

7th Work, Stress and Health Conference (American Psychology Association, Centers for Disease Control, NIOSH), Washington, Mar 2008. Roberto, M. & Silva. S. Handwashing

Compliance amongst Food Providers, Healthcare Workers and Educational Professionals. Poster Presentation.

III Encontro de Fiabilidade, Riscos e Segurança (Instituto Superior Técnico), Lisbon, Nov 2007. Roberto, M. & Silva, S. Estudo dos factores que promovem a adesão dos profissionais de saúde às Precauções Universais. Oral Presentation.

Xth European Conference on Organizational Psychology and Human Service Work Kiev, Oct 2007. Roberto, M. & Silva, S. Blood-Borne Pathogens: which factors promote healthcare workers compliance to Standard Precautions. Oral Presentation.

Portuguese Psychology Association, Évora, Nov 2006. Roberto, M., Silva, S. et al. O papel do Fear Arousal nos comportamentos de segurança e no incremento da percepção de risco dos profissionais de saúde. Oral Presentation.

European Academy of Occupational Health Psychology, Dublin, Oct 2006. Roberto, M. & Silva, S. The role of Fear Arousal on healthcare workers compliance to safety procedures. Oral Presentation.

Other presentations

Infection Control Commission. Hospital Garcia de Orta. May, 2010. Roberto, M., Mearns, K., Silva, S. Hand hygiene compliance specificities across professionals and medical students': implications for the design of intervention programmes.

School of Psychology, University of Aberdeen. Nov, 2007. Roberto, M., Mearns, K., Silva, S. Handwashing compliance among healthcare workers: a socio-cognitive contribution.

Volunteer Collaboration in Projects

2010

Vendas Novas Community Intervention Association

Social Psychologist

Project: Preventing social isolation amongst older people

2007/ now

Amnesty International Translator (English/ French)

2006/ 2007

Portuguese Sport Federation for People with Disability

Social Psychologist

Project: Paralympic Athletes Mission

2004/ 2005

Santa Maria Hospital, Neurology Unit

Social Psychologist

Project: Ambulatory Social Support