

**HAND HYGIENE KNOWLEDGE, ATTITUDE AND PRACTICES AMONG HEALTH
CARE WORKERS OF PIETERSBURG TERTIARY HOSPITAL, POLOKWANE,
LIMPOPO PROVINCE**

by

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DEDICATION

In loving memory of my late husband Makoena Nathaniel Setati. You left fingerprints of love in our lives. You shall never be forgotten. Psalm 107:20 New International Version (NIV) 'He sent out his word and healed them; he rescued them from the grave'.

DECLARATION

I Musa Eileen Setati, hereby declare that this mini dissertation is my own work. The mini dissertation is submitted to the University of Limpopo for the degree of Master of Medicine in Public Health Medicine. I hereby declare that this work has not previously been submitted by me for a degree at this or any other university, and that all materials contained in this mini dissertation has been duly acknowledged.

M E Setati

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ABSTRACT

Background: Health care workers (HCWs) hands are the most common vehicle for the transmission of health care associated infections (HCAIs) between patients and the health care environment. Hand hygiene is regarded as the most important, simplest, and least expensive means of reducing the burden of HCAIs. However, hand hygiene compliance remains low among HCWs.

Aim: To assess the level of knowledge, attitude and self-reported practices (KAP) of HCWs on hand hygiene and associated factors.

Method: A quantitative, descriptive study using a pre-tested self-administered questionnaire was conducted among HCWs of Pietersburg Hospital. Data collection was carried out between January and February 2018. KAP scores were summarised into means, standard deviations and percentages. Chi-square and Fisher's exact tests were used to determine association between KAP scores and selected independent variables (gender, age, profession, experience, discipline and training).

Results: There were 324 respondents, mostly females (74.3%), <40 years (70.6%) and predominantly nurses (52.4%). Majority had moderate knowledge (79.3%), positive attitude (88.8%) and good practices (87.9%). Respondents had knowledge gaps on HCAIs, WHO "Five (5) moments for hand hygiene" and alcohol based hand rub. Association was found between respondent's KAP scores and age ($p < 0.05$). Nursing profession was associated with good practices ($p = 0.000$). Knowledge and attitude were associated with years of clinical experience ($p < 0.05$). Positive attitude ($p = 0.019$) and good practices ($p = 0.000$) were associated with training in the last 3 years. No significant relationship was found between KAP and undergraduate training.

Conclusion: Most respondents had moderate knowledge, positive attitude and good practices. Respondent's variety in KAP scores and associated factors indicate that a multimodal, multifaceted improvement approach should be undertaken to address KAP gaps.

Keywords: Hand hygiene, knowledge, attitude, practices, HCAIs

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DEFINITION OF CONCEPTS

Alcohol based hand rub formulation is an alcohol containing preparation (liquid, gel or foam) designed for application to the hands to kill germs (World Health Organization guideline on hand hygiene in healthcare; WHO 2009). For this study, this was the liquid alcohol hand rub found on ward basins, ward round trolleys and consultation desks.

Allied Health Professionals are physiotherapists, occupational therapists, dieticians, speech and hearing therapists, radiation therapists, radiographers, clinical psychologists and optometrist (Health Professions Council of South Africa 2017). In this study, allied health professionals referred to all of the above excluding pharmacists, pharmacy assistants, dental therapist, dental assistants and oral hygienists.

Attitude refers to the way one thinks and feels about something (Oxford Dictionary 2015). For this study, attitude was awareness and approach to activities in the health care environment that relate to needs and practice of hand hygiene.

Clinical means relating to the bedside of a patient (Stedman's Medical Dictionary 2015). In this study, clinical related to the bedside of the patient in terms of how long the health care worker had attended to the patient. This were disciplines reporting directly to the Clinical Executive Director (CED) of the hospital.

Critical site represents a particular risk for the transmission of microorganisms by hands inside the patient zone. It refers to mucous membranes, breaches in skin integrity, access to invasive devices and body fluid (WHO 2009).

Health Care Associated Infection (HCAI) is an infection acquired in a health care facility by a patient who was in the facility for a reason other than that infection. Such an infection should have neither been present nor incubating at the time of admission or at the time when the initial contact with the health care facility was made (NDoH 2007; Nejad, Allegranzi, Syed, et al 2011).

HCAI prevalence is the number of infection episodes or infected patients per 100 patients present in the health care setting or ward at a given point in time (WHO 2009).

HCAI incidence is the number of new infection episodes or new patients acquiring an infection per 100 patients followed up for a defined time period. Periods vary according to the patient population. For surgical site infections, it is usually 30 days after surgery (1 year in the case of prosthesis or implant), whereas it refers to the duration of hospital or ward stay for other infections (WHO 2009).

HCAI incidence density

Number of infection episodes per 1000 patient-days or device-days (WHO 2009).

Health Care Worker is a general term for a member of the health care team who provides preventative, curative and rehabilitative health care services (Stedman's Medical Dictionary 2015). In this study it referred to allied, dental, medical, nursing and pharmacy health professionals who provided care and had direct contact with patients.

Hand hygiene is a general term that applies to hand washing or hand rubbing (WHO 2009). For this study, it was the practice of keeping the hands free from pathogens by washing with antiseptic soap and water or rubbing with alcohol based hand rub whenever indicated as per WHO five (5) moments for hand hygiene (Annexure 2).

Hand hygiene compliance is defined as using alcohol based hand rub or hand washing with antiseptic soap and water during patient care according to the WHO guidelines on hand hygiene (Kowitt, Jefferson and Mermel 2013). For this study, compliance was self-reported act of cleaning hands whenever indicated by WHO five (5) moments for hand hygiene.

Hand rubbing practice is treatment of hands with an alcohol based formulation (WHO 2009; NDoH 2007). This was self-reported hand rubbing with alcohol based hand rub in

a step by step manner for 20 to 30 seconds according to the WHO and National Department of health posters (Annexure 1).

Hand washing practice is washing hands with plain or antimicrobial soap and water (WHO 2009 and NDoH 2007). This was self-reported washing hands with water and antiseptic soap in a step by step manner for 40 to 60 seconds according to the WHO and National Department of health posters (Annexure 1).

Knowledge on hand hygiene refers to the information, understanding and skills that you gain through education and experience (Oxford Dictionary 2015). For this study it was facts or condition of knowing something about hand hygiene and health care associated infections, with familiarity gained through education, experience or association.

Patient contact means touching patients while examining and giving care (Abdella, Tefera, Eredie et al 2014). For this study, it included health professionals who are exposed to patient surroundings or patient zone (e.g. pharmacists).

Patient zone is a WHO concept related to the geographical visualisation of key moments for hand hygiene. It contains the patient X and his/her immediate surroundings (WHO 2009; Annexure 3).

Training is the process of learning the skills that you need to do the job (Oxford Dictionary 2015). For this study it meant previous training on hand hygiene during undergraduate training, during in-service training, workshop or course attended on hand hygiene.

LIST OF ACRONYMS AND ABBREVIATIONS

ABHR	Alcohol Based Hand Rub
CDC	Center for Disease Control and prevention
DoH:	Department of Health
GNB:	Gram Negative Bacteria
CED	Clinical Executive Director
HCAI:	Health Care Associated Infection
HCW:	Health Care Worker
ICAT	Infection Control Assessment Tool
IPC:	Infection Prevention and Control
ICU:	Intensive Care Unit
KAP	Knowledge, Attitude and Practices
MRSA:	Methicillin Resistant Staphylococcus Aureus
MDR:	Multi-Drug Resistance
NCS:	National Core Standards
NICD	National Institute for Communicable Diseases
NHLS	National Health Laboratory Service
NDoH:	National Department of Health
NTSG	National Tertiary Services Grant framework
SA :	South Africa
SSIs:	Surgical Site Infections
TPB	Theory of Planned Behaviour
USAID	United States Agency for International Development
US	United States
UTI:	Urinary Tract Infection
VRE:	Vancomycin Resistant Enterococci
WHO:	World Health Organization

CHAPTER 1

INTRODUCTION, BACKGROUND AND ORIENTATION TO THE STUDY

1.1 Introduction

Infection Prevention Control (IPC) refers to measures, practices, protocols and procedures aimed at preventing and controlling infections in health care settings (NDoH 2007). Hand hygiene is regarded as the most important, simplest, and least expensive measure of reducing the prevalence of health care associated infections (HCAIs) and the spread of antimicrobial resistance (Sax, Allegranzi, Chraïti, Boyce and Larson 2009; Mortell, Balkhy, Tannous et al 2013). The hands of the health care worker (HCW) are the most common vehicle for the transmission of HCAIs from patient to patient and within the health care environment (Pittet and Boyce 2001; Pittet, Allegranzi, Sax et al 2006).

Substantial evidence has proven that cleansing heavily contaminated hands with alcohol-based hand rub (ABHR) removes organisms more effectively than hand washing with soap or other antiseptic agents and water (Allegranzi and Pittet 2009; WHO 2009). Despite knowledge and evidence on hand hygiene, HCW's compliance is consistently less than 50 percent (Gould, Moralejo; Drey, et al 2017; Luangasanatip, Hongsuwan, Limmathurotsakul, et al 2015). HCW's compliance to hand hygiene is influenced by various factors including HCW's knowledge, attitude and practices (KAP) on hand hygiene (White, Jimmieson, Obst, et al 2015; Glanz, Rimer and Viswanath 2015; Scheithauer, Haefner, Schwanz, et al 2012). Few studies in South Africa (especially Limpopo) have assessed the knowledge, attitudes and practices of HCWs on hand hygiene (Visser, Moore, Whitelaw, et al 2011). Therefore, this study reviewed hand hygiene KAP of HCWs at Pietersburg tertiary hospital in Limpopo in order to develop strategies to strengthen hand hygiene practices.

1.2 Background of the study

HCAI, also known as nosocomial infection or hospital acquired infection, is an infection occurring in a patient during the process of care in a hospital or other health care facility which was not present or incubating at the time of admission (Cardoso, Almeida,

Friedman, et al 2014). The concept of hand hygiene and antisepsis dates back to the 19th century when Ignaz Semmelweis demonstrated that cleansing heavily contaminated hands with an antiseptic agent between patient contacts, may reduce transmission of contagious diseases more effectively than hand washing with plain soap and water (Mathur 2011). However, many HCWs fail to comply to correct hand hygiene practices as a result, morbidity and mortality from HCAs remain unacceptably high (Rosenthal, Pawar, Leblebicioglu, et al 2013; Mathur 2011).

As in many other health-related areas, beliefs, attitudes, and perceptions influence HCWs' hand hygiene behaviour (Sax, Uçkay, Richet et al 2007). The theory of planned behaviour (TPB) proposes that the best determinant of behaviour is intention which is influenced by three factors: attitude, subjective norm, and perceived behavioural control (White, Jimmieson, Obst, et al 2015; Glanz, Rimer and Viswanath 2015; Annexure 4). Intention thus translates into action (practice) that can be assessed by direct observation of hand hygiene, consumption of hand hygiene products or self-reported practices (Sax, Uçkay, Richet et al 2007). HCW's knowledge of the appropriate manner to perform hand hygiene has been associated with education and consequent practice (Smiddy, O'Connell and Creedon 2015).

Infection prevention and control programme

In 2007, SA committed to reduce HCAs by way of aligning the national IPC policy with the WHO's 'Clean Care is Safer Care' global patient safety drive (NDoH 2007). National Core Standards (NCS) for health establishments then followed to improve on patient safety by ensuring compliance to IPC standards (NDOH 2011). According the policy and NCS, health care facilities must conduct orientation and annual in-service training on IPC for relevant categories of HCWs and disciplines. HCWs have the responsibility to comply with IPC practices such as hand hygiene. IPC teams have to evaluate and report on compliance to IPC standards and HCAs periodically (NDoH 2007). Currently, the National Institute for Communicable Diseases (NICD) under National Health Laboratory Service (NHLS), serves as a national hub of expertise in laboratory based surveillance of

infectious diseases. Plans are underway to pilot the surveillance of HCAs at sentinel hospitals and detect HCAs outbreaks at facility level (NICD 2018).

Globally, the WHO released the first international guidelines on hand hygiene in health care in 2009 along with 'SAVE LIVES: Clean Your Hands' initiative. The WHO together with United States Agency for International Development (USAID), created an Infection Control Assessment Tool (ICAT) to assist countries in assessing and monitoring their IPC programme in a systematic manner at national and facility level (WHO 2012; NDoH 2013). One study utilised the ICAT tool to assess to IPC practices between low and middle income countries. SA obtained a score of 64% on hand hygiene practices and 90% on hand hygiene equipment and supplies (Weinshel, Dramowski, Hajdu, et al 2015).

Locally, Limpopo Province scored 38% on IPC programme during the 2011 NCS baseline assessments of the six (6) ministerial priority areas (NCS 2012). A study conducted at Red Cross War Memorial Children's Hospital found hand hygiene compliance rates to be approximately 60%, and that hand hygiene compliance was better after patient contact than before (Whitelaw, Blake and Rinqest 2007). To improve hand hygiene compliance, it is recommended that facilities conduct education and training including evaluation of hand hygiene practice, perception, knowledge, and infrastructure available using NDoH and WHO tools (WHO 2009; NDoH 2013).

1.3 Problem statement

Hand hygiene compliance is a serious problem at Pietersburg tertiary hospital. According to unpublished reports by the IPC team, HCWs fail to comply to hand hygiene practices, thus contributing towards the number of HCAs reported by the team monthly. The team has on several occasions complained informally about HCW's level of knowledge on IPC practices, especially hand hygiene. Additionally, there are complaints about HCW's negative attitude towards hand hygiene evaluations. The IPC team uses a locally designed audit tool to measure hand hygiene compliance and resources in wards. However, the tool does not assess HCW's knowledge, attitude or self-reported practices.

Part of the tool evaluates availability of hand hygiene resources as adopted from the NCS self-assessment tool (questionnaire) for health establishments (NCS 2011).

1.4 Significance of the study

Data generated from epidemiological studies may be useful to determine the need for clinical or public action and to assess the effectiveness of a programme (Khan, Ahmad and Mehboob 2015). Knowledge, attitudes and practices surveys can therefore provide useful baseline data to inform IPC programmes and guide interventions to reduce HCAs. To the best of our knowledge, no hand hygiene KAP study has been conducted in this hospital. Therefore, a cross-sectional study was undertaken to determine the knowledge, attitude and practices of HCWs on hand hygiene at Pietersburg tertiary hospital. The findings will inform education and training of HCWs on hand hygiene and improve compliance.

1.5 Research questions

- What is the level of hand hygiene Knowledge, Attitude and Practices (KAP) of health care workers of Pietersburg tertiary hospital?
- What is the association between health care workers hand hygiene KAP and professional category, years of clinical experience, clinical discipline/ward and previous hand hygiene training?

1.6 Aim of the study

The aim of this study was to assess the level of knowledge, attitude and self-reported practices of health care workers on hand hygiene and associated factors.

1.7 Objectives

The objectives of this study were:

- To determine the level of knowledge, attitude and self-reported practices of health care workers of Pietersburg hospital on hand hygiene
- To determine the association between the knowledge, attitude and self-reported practices of health care workers and professional category, years of clinical experience, clinical discipline/ward and previous hand hygiene training.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter discusses relevant literature that was reviewed. The literature review was conducted using a variety of sources such as scholarly journals, internet search engines, books and unpublished studies. The search terms used were, “hand hygiene knowledge attitude and practices”, “KAP”, “HCAIs”, “nosocomial infections”, “hospital acquired infections” and “WHO five moments for hand hygiene”.

2.2 Role of hand hygiene

Hand hygiene serves many purposes in the health care setting (WHO 2009). It is regarded as the most important, simplest, and least expensive means of reducing the prevalence of HCAIs and the spread of antimicrobial resistance (Sax, Allegranzi, Chraïti, et al 2009). Hand hygiene remains the cornerstone in the prevention of cross transmission of HCAIs among patients (Salmon, Pittet, Sax et al 2015). It prevents both endogenous and exogenous infections in patients, contamination of the hospital environment with potential pathogens, and the cross-transmission of microorganisms between patients (Longtin, Sax, Allegranzi, et al 2011).

Hand hygiene addresses the three (3) aspects involved in the transmission of HCAIs, that is, the host, the agent and the environment. HCW’s hands are commonly colonised with pathogens like Methicillin Resistant *Staphylococcus Aureus* (MRSA), Vancomycin Resistant Enterococcus (VRE), Multi-Drug resistance (MDR) Gram Negative Bacteria (GNBs), *Candida species* and *Clostridium difficile*, which can survive for as long as 150 hours (Abdella et al 2014; Mathur 2011). Hands of the HCW when not clean, are the main route of cross-transmission of potentially harmful germs between patients in a health care facility (Allegranzi and Pittet 2009).

2.3 Consequences of health care associated infections

HCAIs are a major public health problem globally (Nejad et al 2011). They pose a serious threat to both the patient and the health care professional. HCAIs are one of the most common complications of hospitalisation that contribute to the morbidity and mortality of patients in health care (Geffer and Gastmeier 2011). They prolong duration of hospitalisation, cause disability or death, increase the costs of health care, and place a serious economic burden on patients and their families (Glance, Stone, Mukamel, et al 2011). The direct and indirect costs of HCAIs deplete the already limited financial resources allocated to health care for developing countries such as SA (Brink, Feldman, Duse, et al 2006).

Approximately one (1) in seven (7) patients entering SA hospitals are at high risk of acquiring HCAI (Brink et al 2006). The burden of HCAIs in developing countries is higher than proportions reported from Europe and the USA (Allegranzi et al 2011). The prevalence of HCAIs in developed countries varies between 3.5% and 12% while in low and middle income countries it fluctuates between 5.7% and 19.1% (WHO 2011). In Africa alone, the overall prevalence of HCAI ranged from 2.5% to 14.8% (Nejad et al 2011).

HCAIs can develop either as a direct consequence of treatment or from a health care environment. The development of HCAIs is dependent on three (3) key pathophysiological factors: patient related factors, health care/environmental factors and agent factors through colonisation by pathogenic or potentially pathogenic microorganisms (Shalini, Vidyasree, Abiselvi, et al 2015). These factors interact in any given health care system and multiple factors such as staffing (e.g. nurse to patient ratio) and the lack of effective intervention programmes may play a role (Al-Tawfiq and Tambyah 2014). The organisms causing most HCAIs usually come from the patient's normal flora of the skin and mucous membranes (endogenous flora), when host factors that alter susceptibility to infection permit these organisms to behave as pathogens (Azimi Motevallian, Ebrahimzadeh Namvar, et al 2011). HCAIs are transmitted in three (3) ways; through contact (direct, indirect, common vehicle and vector), droplet and airborne (Ferguson 2009). The most common sites for HCAIs include the urinary tract, respiratory

tract, surgical sites, intravascular catheters and bloodstream (Khan et al 2015).

2.4 Hand hygiene knowledge, attitude and practices studies

Numerous KAP studies have been conducted worldwide to assess the level of knowledge, attitude and practices of hand hygiene among students (Labrague, McEnroe-Petitte, Mortel et al 2017). A systematic review of hand hygiene knowledge and compliance studies conducted on nursing students was done. Of the nineteen(19) studies reviewed, nine(9) were conducted in Europe, eight (8) in Asia, one (1) in Africa and one (1) in North America (Labrague, McEnroe-Petitte, Mortel et al 2017). The review revealed a low-to-moderate knowledge and compliance with hand hygiene among nursing students. Nursing students had significantly higher rates of hand hygiene compliance compared to medical students.

A variety of data collection tools were used to assess knowledge and practices. Ten studies used validated research-designed instruments based on existing review of hand hygiene literature to capture nursing students hand hygiene competence. Three (3) studies utilised the WHO hand hygiene questionnaire for HCW and the other studies used other instruments e.g. Handwashing Assessment Inventory (HAI) scale; Hand Hygiene Belief Scale (HHBS) Hand Hygiene Practices Inventory (HHPI); Hand Hygiene Knowledge; Hand Hygiene Knowledge Inventory(HHKI); Hand Hygiene Questionnaire(HHQ); Fulkerson Scale. To measure compliance, six (6) studies used researcher-designed scoring form to directly observe hand hygiene compliance. Other studies utilised standardised tools such the Handwashing Inventory (HWI); Hand Hygiene Questionnaire (HHQ); Fulkerson Scale (Labrague, McEnroe-Petitte, Mortel et al 2017). Similarly in Egypt, Elkhawaga and El-Masry (2017) observed good knowledge and self-reported practices of female medical students using the Hand Hygiene Questionnaire (HHQ).

Several studies have been conducted among HCWs globally. A study in Ethiopia found majority (77.3%) of the HCWs were knowledgeable on hand hygiene compliance.

However, HCWs compliance was on average low at 16.5% when direct observation was conducted (Abdella et al 2014). Using different tools to measure hand hygiene knowledge, most KAP studies observed moderate/fair (score 50-74%) or good (>75%) hand hygiene knowledge among participants (Ariyaratne, Gunasekara, Weerasekara, et al 2013; ALSofiani, AlOmari and AlQarny 2015; Ekwere and Okafor 2013; Mu'taz, Alrimawi, Saifan, et al 2016.; Zakeri, Ahmadi, Rafeemanesh, et al 2017; Nawab, Mehnaz, Abedi et al 2015; Ango, Awosan, Adamu et al 2017; Paudel, Ghosh and Adhikari 2016; Khanal and Thapa 2017).

In a systematic review of hand hygiene compliance prior the 2009 WHO hand hygiene guidelines, majority (67.7%) of the studies were conducted in intensive care unit (ICU) and less frequently in general and surgical wards. The overall hand hygiene compliance rate among HCWs was found to be 40%. Compliance was measured using direct observation by a trained observer and/or self-reporting by a HCW. Information on compliance rates had been collected from physicians, registered nurses, and other HCWs (Erasmus, Daha, Brug, et al 2010). Similarly, a study in Saudi Arabia found overall hand hygiene non-compliance of 41.0% during observation of HCWs (Mahfouz, El Gamal and Al-Azraqi 2013). Dramowski, Whitelaw and Cotton (2016) found self-reported adherence of 88% for hand hygiene among HCWs of Tygerberg Children's Hospital in SA. However, self-reported practices were found to be poor in some studies (Kudavidnange, Gunasekara and Hapuarachchi 2015; Nair, Hanumantappa, Hiremath, et al 2014).

Further KAP studies have been conducted on HCWs in other countries such as Botswana, Namibia, Ethiopia, Ghana, Nigeria, Zambia, Sudan, China etc. However, from literature reviewed, most studies assessed the KAP of HCWs on HCAI and IPC. For instance, the following studies focused on HCW's KAP on HCAs: Dramowski, et al 2016 and Zhou, Zhang, Chen, et al 2014. Studies which assessed HCW's KAP on IPC and IPC compliance include those conducted by Arbee, Mahes, Mankahla et al 2012; Ojulong, Mitonga and Ipinge 2013; Peta 2015; Gulilat and Tiruneh 2014; Chitimwango 2017; Tenna, Stenehjem, Margoles et al 2013). Some studies on hygiene practices were conducted by Legese and Hurissa (2016), Mugweni (2017) and Hlabano (2015).

However, few studies were published and therefore only available through university repository.

Some KAP studies that specifically focused on hand hygiene were conducted in Egypt, Ethiopia, Ghana, Nigeria, and Sudan (Elkhawaga et al 2017; Abdella et al 2014; Amissah, Salia and Craymah, JP. 2013; Ango, Awosan, Adamu, et al 2017; Ekwere and Okafor 2013). In Ghana, Amissah et al (2013) observed fair knowledge (scored 50-69.9%) and practices among their participants. Ango et al (2017) found good knowledge, positive attitude and self-reported practices on hand hygiene on most of their participants in Nigeria. Ekwere et al (2013) likewise observed good knowledge, good attitude and good hand washing practices. Contrary, Nair et al (2014) in India found negative attitude among students. Langoya and Fuller (2015) in Sudan, found insufficient and inconsistent knowledge of hand hygiene among HCWs.

2.5 Factors influencing hand hygiene KAP

Despite the relative simplicity of hand hygiene procedure, compliance remains low in many health care settings (Mathai, George and Abraham 2011; Erasmus et al 2010). Multiple and complex factors such as HCW factors, clinical factors environmental/institutional and environmental/institutional and behavioural factors, affect hand hygiene compliance (Mathur 2011). Several KAP studies have explored potential determinants of hand hygiene compliance (Erasmus et al 2010). Factors influencing reduced compliance of hand hygiene include; being a physician rather than a nurse; being a nursing assistant rather than a nurse; being male; working in ICU; working during weekdays rather than the weekend; wearing gown and gloves; using an automated sink; performing activities with high risk for cross-transmission; and having many opportunities for hand hygiene per hour of patient care (Pittet and Boyce 2001; Mahfouz et al 2013).

Gogia and Das (2013) found the following reasons for not performing hand hygiene; lack of appropriate accessible equipment at every bed; high patient to staff ratios; allergies to hand washing products; laziness and emergencies. Knowledge of hand hygiene compliance; taking training on hand hygiene; availability of individual towel/tissue paper,

availability of ABHR in the ward and presence of IPC committees were associated with hand hygiene compliance in Ethiopia (Abdella et al 2014). A study in Namibia found more institutional than individual factors associated with non-compliance to hand hygiene (Mugweni 2017). In the same study, dryness of the skin caused by hand hygiene agents and lack of active participation in hand hygiene promotion at individual level, contributed to non-compliance to hand hygiene among nurses.

A systematic review among nursing student review identified several determinants influencing hand hygiene compliance such as sex (being female), knowledge on HCAI, utilisation and technique of using hand rubs, and exposure to situations that requires hand hygiene. Furthermore, being busy, forgetfulness and the fear of having skin damaged due to alcohol handrub were all found to predict compliance in nursing students (Labrague, McEnroe-Petitte, Mortel et al 2017).

Regarding hand hygiene knowledge, Langoya et al (2015) found that younger age was associated with hand hygiene knowledge score. Training in hand hygiene was found to be significantly associated with participants' knowledge of hand hygiene in Iran (Nabavi, Alavi-Moghaddam, Gachkar et al 2015). A study among nurses showed that work experience and history of previous training were the most important predictors of participants' knowledge about hand hygiene (Asadollahi, Bostanabad, Jebrailli et al 2015). Mu'taz, Alrimawi, Saifan, et al (2016) found no statistically significant differences between nurses and physicians regarding importance of hand hygiene, compliance, knowledge, practice and attitude scores. However, the study found that older participants (with more clinical experience) had better attitudes regarding hand hygiene than younger participants.

2.6 Strategies to improve hand hygiene compliance

Many strategies have been designed, implemented and evaluated to address hand hygiene non-compliance (Huis, van Achterberg, de Bruin, et al 2012; Gould, Moralejo, Drey, et al 2017). To successfully address HCAs, IPC interventions must acknowledge

and address the interaction between the host, the pathogen, the HCW and the health care environment (Castro-Sánchez and Holmes 2015). One globally accepted strategy is the WHO multimodal (combinations of) hand hygiene improvement strategy aimed to assist health care facilities to implement improvements. Five (5) key components of the strategy are: system change, training and education, reminders in the workplace, institutional system climate and evaluation and feedback (WHO 2009). The strategy was field tested in a wide range of different health care settings for feasibility, adaptability and success, subsequently demonstrated both in high and low/middle income countries (Mathai et al 2011; Scheithauer, Reisinger, Ohl, et al 2013; Chen Sheng, Wang et al 2011 and Pfäfflin, Tufa, Getachew 2017; Ansari, Gupta, Jais, et al 2015).

Hand hygiene interventions include both single and multi-level interventions (Gould, Moralejo, Drey et al 2017). While there are some evidence that single component interventions lead to improvements in hand hygiene, a review of literature suggests that single intervention programmes produce less success in leaving a lasting impact on hand hygiene compliance (Ansari et al 2015; Gould et al 2017). Strong evidence suggest that the WHO multimodal intervention can lead to substantial, rapid and sustained improvements in compliance with hand hygiene among HCWs in hospital settings (Luangasanatip et al 2015; Rosenthal et al 2013).

2.7 Impact of the hand hygiene interventions

Successful interventions to improve hand hygiene have been reported in many countries. A meta-analysis and systematically review of 8148 studies, identified two (2) bundled interventions associated with an increase in hand hygiene compliance. The first bundle included feedback, education, and reminders, and the second bundle included those interventions as well as improved access to ABHR and administrative support (Schweizer, Reisinger, Ohl, et al 2013). In England and Wales, the Cleanyourhands campaign was associated with sustained increases in hospital procurement of ABHR and soap; and declining rates of MRSA bacteraemia/*Clostridium difficile* infection (Stone, Fuller, Savage, et al 2012). However in the Netherlands, Huis et al (2013) reported that hand hygiene compliance was the same immediately post-intervention and six months

later (53%) for the intervention group receiving leadership support, while there was a slight increase in the control group which had a state-of-the art multimodal campaign (42% post-intervention and 46% at six months).

A multi-centre study was conducted to implement and evaluate the impact of the International Nosocomial Infection Control Consortium (INICC) multi-dimensional hand hygiene approach (IMHHA) in hospitals of 19 limited-resource countries. Among the countries included in the study was, Latin America, Asia, the Middle East, and Europe. The study demonstrated that overall hand hygiene compliance increased from 48.3% to 71.4% and ABHR use increased following the interventions (Rosenthal et al 2013). However, in 40 hospitals in the US, wide dissemination of CDC hand hygiene guidelines was not sufficient to change hand hygiene practices when hygiene rates remained low with mean of 56.6 % (Larson, Quiros and Lin 2007).

Groote Schuur Hospital in Cape Town in SA, implemented the WHO hand hygiene multimodal intervention approach and observed significant improvement for before patient contact from 34% in 2014 to 76% in 2015 and for after patient contact from 47% in 2014 to 82% in 2015 (Patel , Engelbrecht , McDonald , et al 2016). A significant increase in hand hygiene adherence among HCWs was also observed in Ethiopia following the implementation of a WHO recommended multimodal hand hygiene programme (Schmitz, Kempker, Tenna, et al 2014). Adherence increased from 2.1% at baseline to 12.7% after the implementation of the hand hygiene campaign. In Mali compliance likewise increased from 8.0% at baseline to 21.8% at follow-up after implementation of the WHO multimodal hand hygiene improvement strategy (Allegranzi, Sax, Bengaly, et al 2010).

2.8 Monitoring and measuring hand hygiene compliance

Monitoring hand hygiene compliance and providing HCWs with feedback regarding their performance are considered integral parts of hand hygiene improvement programmes (Boyce 2011). Monitoring hand hygiene compliance serves multiple functions such as

system monitoring, patient safety monitoring, incentive for performance improvement, outbreak investigation, staffing management, and infrastructure design (Sax et al 2009). Moreover, it allows for evaluation of the success of hand hygiene interventions. Hand hygiene performance in health care can be monitored directly or indirectly (WHO 2009). Direct methods include direct observation, patient assessment or self-reporting by HCWs. Indirect methods include monitoring consumption of products. However, three main methods for measuring hand hygiene performance are; directly observing, measuring product use and conducting surveys (Squires, Suh, Linklater, et al 2013). Each method has its advantages and disadvantages (Marra, Moura, Paes, et al 2010).

Direct observation

Direct observation of HCWs during patient care by a trained and validated observers is considered as the gold standard for hand hygiene monitoring (Boyce 2011). Observation makes it possible to quantify the specific need for hand hygiene and assess the quality of practice (Hagel, Reischke, Kesselmeier, et al 2015). However, it is time-consuming, labour intensive, costly and requires careful selection and training observers (Conway, Riley, Saiman, et al 2014). Direct observation is also prone to observer or Hawthorne effects, selection bias and confounding factors (Erasmus et al 2010; Larson, Aiello and Cimiotti 2004). However, these can be minimised by applying a rigorous method. The success of this method depends on the accurate calculation of adherence rates, the careful training of data collectors, and the data collectors' uses of clear, easy-to-understand observation forms (Sax et al 2009).

The WHO's "My five (5) moments for hand hygiene" concept was developed to bridge the gap between scientific evidence and daily hand hygiene practice and provide a solid basis to understand, teach, monitor and report hand hygiene practices (Sax et al 2007). It considers the patient contact, patients' surrounding, equipment and hand hygiene compliance during patient care. The concept lays a reference grid over activities during hand hygiene monitoring and minimises inter-observer variation. Five (5) types of transitions have been identified as risk prone (annexure 2);

- before touching a patient,

- before clean/aseptic procedures,
- after body fluid exposure/risk,
- after touching a patient and
- after touching patient surroundings.

The central principle of “My five (5) moments for hand hygiene” is the separation of micro-organism from one patient zone to the next zone and from critical sites where contamination could lead to infection (Salmon et al 2015; Annexure 3). During direct observations, HCWs are assessed based on these five (5) moments.

Direct observations by patients

Another monitoring method is through direct observations of HCWs by patients (Boyce 2011). This method is also inexpensive but may have potential negative impact on the patient-HCW relationship (WHO 2009). However, Bittle and LaMarche (2009) concluded that engaging patients as hand hygiene observers did not appear to adversely affect patient-HCW relationships. Patient monitoring of hand hygiene compliance is however not well documented (WHO 2009).

Monitoring products

Monitoring the consumption of hand hygiene products such as towels, soap, and ABHR is inexpensive and reflects overall hand hygiene activity (Boyce 2011; Van de Mortel and Murgu 2006). This method has no selection bias (McGuckin, Waterman and Govednik 2009). However, it does not reliably measure the need for hand hygiene and provides no information about the appropriate timing of hand hygiene actions. Prolonged stocking of products at ward level complicates and jeopardise the validity of the method. Validity is also threatened by increased patient and visitor usage (WHO 2009). Some studies have shown that the consumption of products used for hand hygiene correlated with observed hand hygiene compliance, whereas others have not (Boyce 2011; Hagel et al 2015). However, the use of this method as a surrogate for monitoring hand hygiene practices deserves further validation (Boyce 2011).

Automated hand hygiene monitoring systems

Automated hand hygiene monitoring systems use electronic counters embedded in soap and/or ABHR dispensers (Conway et al 2014; Boyce 2011). These electronic systems monitor hand hygiene on a constant, real-time basis without requiring direct observation (Hagel et al 2015) by an observer thus, may reduce observation bias. They may potentially produce valuable detailed information about hand hygiene behaviour and infectious risks (Conway et al 2014; Ward, Schweizer, Polgreen, et al 2014). Systems generate reports in a timely manner in formats that are meaningful for staff as a feedback mechanism (Conway et al 2015). However, systems may be costly and are prone to failure and have an unknown impact on staff and patient behaviour (Srigley, Gardam, Fernie, et al 2015).

Self-reporting during surveys

One more method of measuring hand hygiene practices is self-report in a form of interview or questionnaire (Larson et al 2004). Surveys of HCWs can yield information about perceptions, attitudes, and behaviour related to hand hygiene (Joint Commission 2009). Through surveys, HCWs reveal what they know and think about hand hygiene as well as why they adhere (or do not adhere) to guidelines. Quantitative studies generally use a reductionist approach focusing on single dimensions such as education, and their effect on HCWs compliance with hand hygiene guideline (Smiddy et al 2015). However self-reporting by HCW is inexpensive. The disadvantage with this method is that; data collected may suffer from memory recall bias (Larson et al 2004). Additionally, self-reporting is prone to overestimation of true compliance and may be unreliable (Boyce 2011).

Nonetheless using a well-designed and carefully administered survey whose validity and reliability have been established can achieve the most accurate results possible. Data collected using qualitative methods may make a valuable contribution because interviews can provide rich data that can better explore the issues for HCWs in terms of their compliance with hand hygiene guidelines (Huis et al 2012; Smiddy et al 2015). Qualitative

studies are increasingly recognised as an important contribution to evidence based practice and health services research.

Ideal method

An ideal method of monitoring hand hygiene performance should be unbiased, with exact numerical measure of HCWs practices, not interfere with the behaviour of those observed, should not require excessive staff time or costs, assesses the microbiological outcome of each hand cleansing action in real time, and reliably captures each moment requiring hand hygiene even during complex care activities (WHO 2009). Currently, such an ideal method does not exist. Different methods of measuring hand hygiene adherence and frequency each have different advantages and disadvantages that must be considered when making decisions about methodology (Van de Mortel and Murgu 2006).

2.9 Surveillance of hand hygiene and health care associated infections

Surveillance is the systematic, ongoing observation of the occurrence and distribution of disease in a population and the events or conditions that increase or decrease the risk of disease (Durlach, McIlvenny, Newcombe, et al 2012). HCAI surveillance data is a useful measurements for comparing the quality of patient care among health care facilities and reducing morbidity and mortality (Talbot, Bratzler, Carrico, et al 2013).

Although national surveillance systems exist in some countries, they often use different diagnostic criteria and methods, which render international comparisons difficult due to benchmarking obstacles (Lowman 2016 and WHO 2009). South Africa currently has no national standardised surveillance system for HCAs and IPC practices thus, creating a challenge in determining the burden of HCAs. Overall, surveillance of HCAs in SA is understood to be fundamentally neglected and poorly resourced (Lowman 2016).

CHAPTER 3 RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents the methodology of the study. The chapter describes the study design, study setting, study population, inclusion and exclusion criteria, sampling procedure and sample size, data collection and analysis, validity, reliability, bias and ethical considerations.

3.2. Study design

This was a quantitative descriptive cross-sectional study conducted among HCWs of Pietersburg tertiary Hospital in Polokwane, Limpopo Province.

3.3. Study setting

The study was conducted at Pietersburg Hospital, a tertiary and academic hospital in Polokwane town, Limpopo Province. Pietersburg hospital is located in the Capricorn district of the Province. The hospital renders some level 1 and 2 tertiary services to the 5, 8 million population of Limpopo Province (Stats SA 2017) as defined by the National Tertiary Services Grant framework (NTSG) for tertiary health services in SA. It is a referral centre for several district and regional hospitals in the Province.

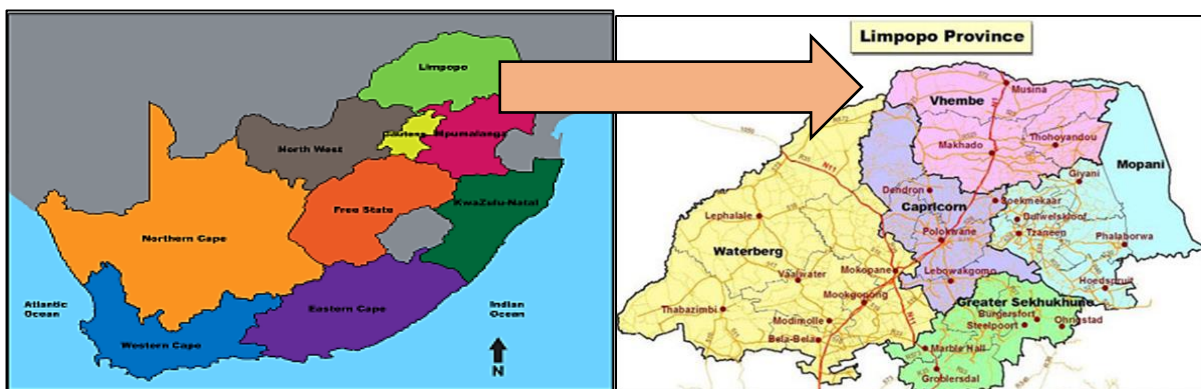


Figure 3.3.1 Geographic location of Limpopo Province, its Districts and neighboring countries.

<https://municipalities.co.za/provinces/view/5/limpopo> (accessed 5 May 2018).

Pietersburg hospital has 701 approved beds but only 504 usable beds. The hospital has 20 wards which include adult Intensive Care Unit (ICU), paediatric ICU and a paediatric high care unit. There is an IPC committee and team present at the hospital. Hand hygiene training is conducted by IPC nurses with assistance from a microbiologist occasionally. Hand hygiene reminder posters are displayed on basins, however, there are no posters on 'How to handrub'.

3.4. Study population

The study population were HCWs employed at Pietersburg hospital stationed at selected clinical disciplines. According to the hospital's human resource planning database, there were 1136 HCWs by January 2018. For the purpose of reporting, human resource planning categorises health care professionals into three (3) categories, that is, medical, nursing and allied professionals. There were 272 medical professionals, 699 nursing professionals and 165 allied professionals. For this study, respondents were categorised into five (5) professional categories, namely, Allied, Dental, Medical, Nursing and Pharmacy.

Allied professionals were physiotherapists, dieticians, optometrists, occupational therapists, speech therapists, podiatrists, radiographers, radiation therapists, and clinical psychologists. Dental professionals were dental therapists, oral hygienists, dental officers and dental specialists. Medical professionals were medical doctors, that is, interns, medical officers, registrars and medical specialists. Nursing professionals were all nursing professional ranks, that is, enrolled nursing assistants, enrolled nurses, and professional and specialist nurses). And pharmacy professionals were pharmacists and pharmacist assistants.

Inclusion criteria

HCWs working in direct contact and care of patients were included in the study. These were HCWs whose hand hygiene practices can contribute towards the transmission of infections between patients and the hospital environment. Only HCWs stationed in the following clinical disciplines were recruited into the study: Anaesthesia, Obstetrics and

Gynaecology, Internal Medicine, Family medicine, Psychiatry, Renal, Outpatient department, Surgical disciplines (general surgery, Ear, nose and throat, Urology, Neurosurgery, Orthopaedics, Cardiothoracic, plastic), Paediatrics, Emergency unit, Intensive Care Unit (ICU), high care, Radiology, Dermatology, Dental, Oncology, Forensic Medicine, Nuclear medicine and Allied professionals (Occupational therapy, Physiotherapy, Speech therapy and radiotherapy, Pharmacy, Dietetics, Optometry, dental therapist). All professional ranks were recruited in the study including interns and students.

Exclusion criteria

Only HCWs working in Public Health Medicine discipline and Clinical Psychology were excluded.

3.5. Sampling procedure and sample size

Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a much larger population for the purpose of determining characteristics or trait distribution of the whole population (Govender, Mabuza, Ogunbanjo and Mash 2014). The two (2) main techniques used in survey research are probability sampling and non-probability sampling. Probability sampling (also known as random sampling) is a sampling technique wherein every member of a population has a known and equal chance of being selected (Ehrlich and Joubert 2014). Non-probability sampling (also known as non-random sampling) is a sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected (Ehrlich and Joubert 2014).

Probability sampling is the preferred technique because the results are more likely to accurately reflect the entire population. The initial plan was to use probability sampling by means of stratified random sampling strategy. However, because of the unavailability of a detailed and accurate sampling frame from human resource, convenience sampling

was done. There are a number of strategies used to calculate the sample size. Krejcie and Morgan (1970) used the following formula to determine sample size:

$$s = \frac{X^2 NP (1-P)}{d^2 (N-1) + X^2 P (1-P)}$$

s = required sample size

X^2 = the table value of chi-square for one degree of freedom at the desired confidence level (3.841)

N = the population size

P = the population proportion (assumed to be .50 since this would provide the maximum sample size)

d = the degree of accuracy expressed as a proportion (.05)

According to human resource, there were 1136 HCWs at Pietersburg hospital. Based on Krejcie and Morgan's (1970) table for determining sample size (annexure 5), for a given population of 1200, a sample size of 291 would be needed to represent the population. When the following assumption were made; total population of 1136, 95% confidence level, 5% margin of error and the population proportion assumed to be 0.5. A sample of 291 or more was needed. Considering a 10% non-response rate to the survey, the total required sample size was 320. A total of 324 participants completed the questionnaire.

3.6. Data collection and analysis

Data collection procedure

Data collection was done over a period of 2 months (January to February 2018) by the principal researcher. Participants were briefed on the nature and objectives of the study. A written consent was obtained from those who agreed to participate. Questionnaires were distributed at the end of departmental academic meetings or hand-over ward meetings. A drop-and-collect strategy was done for some wards to maximise response rate without interfering with service delivery. Questionnaires were then checked visually for completeness and consistency.

Instrument

A self-administered questionnaire was used to collect data for the study (Annexure 6). The questionnaire was in English and comprised of three (3) main components, namely;

Section A (demographics), Section B (hand hygiene training) and Section C (assessment of Knowledge, Attitude and self-reported Practices-KAP). The assessment of knowledge included a total of 25 questions which included a combination of multiple choice questions and binary type questions requiring yes or no. The questions were derived from the World Health Organisation (WHO) hand hygiene knowledge questionnaire (WHO 2009). Assessment of attitude and practices comprised of ten (10) attitude and six (6) practices statements of Likert type. The statements were derived and modified from previous hand hygiene studies (Paudel, et al 2016; Arthi, Abarna, Bagyalakshmi, et al 2016; Ariyaratne et al 2013). A four (4) Likert scale (Strongly agree, agree, disagree, strongly agree) was used.

Data analysis

Data from the questionnaire was entered into Microsoft office excel spreadsheet. Appropriate measure was taken to check for completeness before data entry. Data clean up and cross-checking was done before analysis. Numerical data coding system was applied to all categorical data for the purpose of statistical analysis on statistical software (STATA 14.0; StataCorp; College Station, TX). To determine the level of knowledge, attitude and practices, a scoring system derived from the WHO hand hygiene guideline and literature was applied to the responses (Paudel et al 2016; Arthi, et al 2016). A score of one (1) point was given for each correct KAP response whereas zero (0) was given for each incorrect KAP response. Likert scales were later collapsed into dichotomous values (one or zero) for data analysis. Agree responses (strongly agree and agree) together, and disagree responses (disagree and disagree) together.

The total scores of knowledge, attitude and practices were equated to 100 %. For knowledge assessment which is the primary outcome measure, a score of more than 75% was considered good, 50-74% moderate and less than 50% poor. The cut-off values to determine good, moderate, and poor levels were taken from previously studies with some modification to suit the purpose of this study (NDoH 2013; Abdella et al 2014; Paudel et al 2016; Arthi et al 2016; Ariyaratne et al 2013). An attitude score of 50% and above was positive, and a score less than 50% was considered negative. For practices, a score of

50% and above was good, and a score less than 50% was considered as poor (Ekwere et al 2013).

Table 3.6: Assessment scores

Assessment	Score %	Level
Knowledge	< 50	Poor
	50 -74	Moderate
	>75	Good
Attitude	< 50	Negative
	≥50	Positive
Practices	< 50	Poor
	≥50	Good

Descriptive statistics was used to calculate the numbers and percentages for categorised data. Before analysis, all numerical variables including the KAP scores were checked for normal distribution using Shapiro Wilk test and visual observation of the histogram. Means and standard deviations (SD) were then calculated for normally distributed data. Analytic statistics were used to determine the relationship between predictor variables (such as previous training, professional category, clinical discipline, etc.) and the outcome variable (KAP).

Chi-square and Fisher's exact tests of independent association were used to test for relationship between categorical variables. For association, knowledge score was collapsed into two (2) categories; good (by combining good and moderate) and poor categories. To further test for association, the following categories had to be combined; age group (40-49 and >50), professional category (Allied, dental and pharmacy) and clinical disciplines/ward (theatre, ICU and high care; the other wards as one group). P value less than 0.05 was considered statistically significant.

3.7. Reliability, Validity and bias

Validity

Validity is an expression of the degree to which a test is capable of measuring what it is intended to measure (Bonita, Beaglehole and Kjellström 2006). The questionnaire demonstrated an adequate validity and reliability when applied on a wider sample of HWs

and students from different countries (Arthi et al. 2016; Paudel et al 2016; Ariyaratne et al 2013; WHO 2009). In order to determine content validity for our setting, a panel of three infection prevention and control experts (IPC nurses) were asked to review and advice on the readability of the questionnaire, accuracy and comprehensiveness of the questions.

Reliability

Reliability, also known as repeatability or reproducibility, refers to the degree to which an instrument produces reproducible results (Ehrlich and Joubert 2014). The WHO had piloted the questionnaire in different countries (WHO 2009). The questionnaire was piloted at Mankweng hospital. After the pilot testing, necessary and appropriate modifications were done to the questionnaire.

Bias

Bias is a term commonly used to refer to problems in the design or conduct of epidemiological studies (Ehrlich and Joubert 2014). In this study, non-probability sampling techniques introduced a selection bias thereby, limiting the generalisability of the results. However, repeated visits to the wards during data collection was done, to ensure high coverage of the target population. Non response bias was minimised by making sure the respondents were aware that any information given was completely confidential or anonymous. Over-reporting, courtesy bias and end avoidance were avoided by omitting a neutral point on the Likert scale for attitude and practices.

3.8. Ethical Considerations

Ethical clearance

Ethical clearance was obtained from Turfloop Research Ethics Committee (TREC) before commencing data collection, project number TREC/382/2017/PG (Annexure 8). Permission to conduct the study was obtained from Limpopo provincial Department of Health research committee, approval number LP-201711014 (Annexure 9). Additional

permission was obtained from Pietersburg tertiary hospital ethics committee, reference PMRE24Jan2018AUL (Annexure 10).

Informed consent

A written informed consent was obtained from participants who agreed to take part in the study before completion of the questionnaire (Annexure 7). The consent and questionnaire were separated after completion to ensure confidentiality.

Protecting the rights of participants and institution

Participation was free and voluntary. Participants who were unwilling to participate in the study and those who indicated their intention to stop their participation did so without any restriction. Data collection did not interfere with service delivery of the institution.

Confidentiality and Anonymity

Confidentiality was maintained at all levels of the study by avoiding use of names of participants. Unique identifiers were used instead.

CHAPTER 4

PRESENTATION AND INTERPRETATION OF RESULTS

4.1 Introduction

In the previous chapter, the study design, setting, study population, inclusion and exclusion criteria, data collection and analysis, ethical consideration, validity and reliability and bias were outlined. This chapter presents the results and interprets the findings of the study. The chapter is subdivided into:

- 1) Demographic characteristics of the respondents,
- 2) Respondent's knowledge on hand hygiene,
- 3) Respondent's attitude on hand hygiene,
- 4) Respondent's self-reported practices on hand hygiene and
- 5) Association between knowledge, attitude and self-reported practices (KAP) and selected demographic variables.

4.2 Demographic characteristics of the participants

A total of 324 HCWs participated in this study, giving a response rate of 100%. Of the total, 241(74.3%) were females and 83(25.6%) were males (Figure 4.2.1).

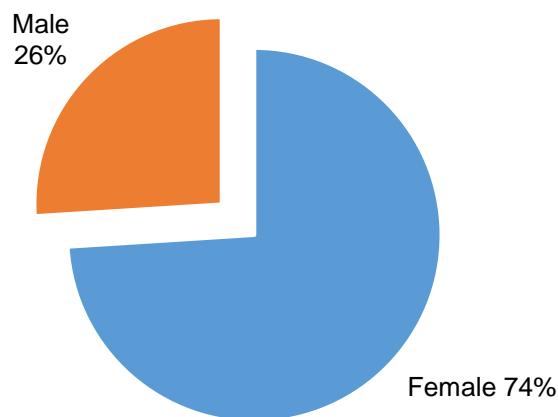


Figure 4.2.1: Gender distribution of the respondents (n=324)

The age group of the respondents is shown in Figure 4.2.2. Most of the respondents were within age group 30-39 years with a total of 123(37.9%). Respondents in the age group 50 years and older were 43(13.2%).

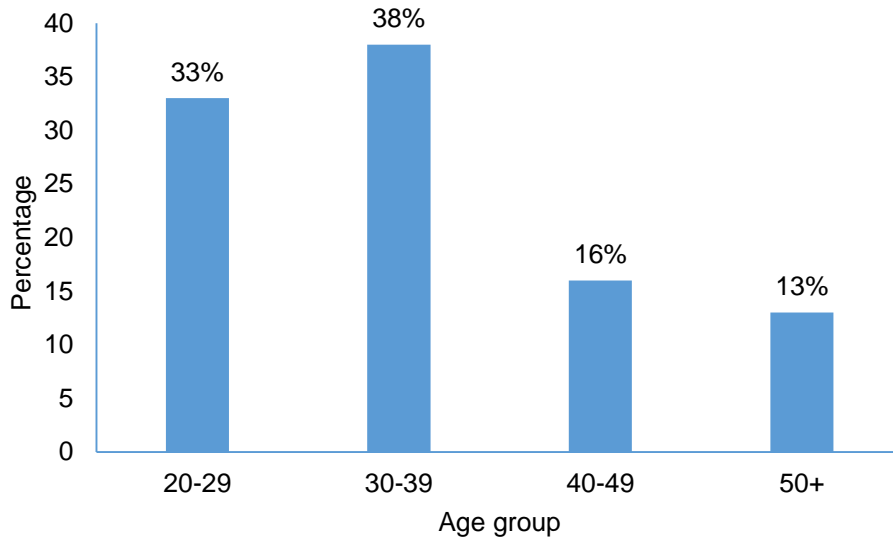


Figure 4.2.2: Age distribution of respondents (n=324)

A greater proportion of the respondents were nursing professionals with a total of 170(52.4%), followed by 85(26.2%) medical professionals and 49(15.1%) allied professionals (Figure 4.2.3).

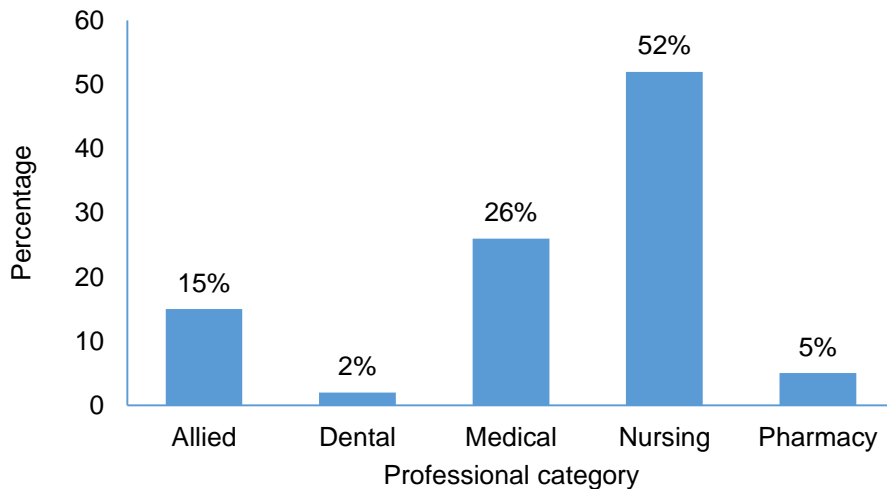


Figure 4.2.3: Distribution of respondents by professional category (n=324)

Figure 4.2.4 shows that respondents with less than five (5) years of clinical experience were 119(36.7%), those with clinical experience between 5 and 10 years were 96(29.6%) and those with more than 10 years were 109(33.6%).

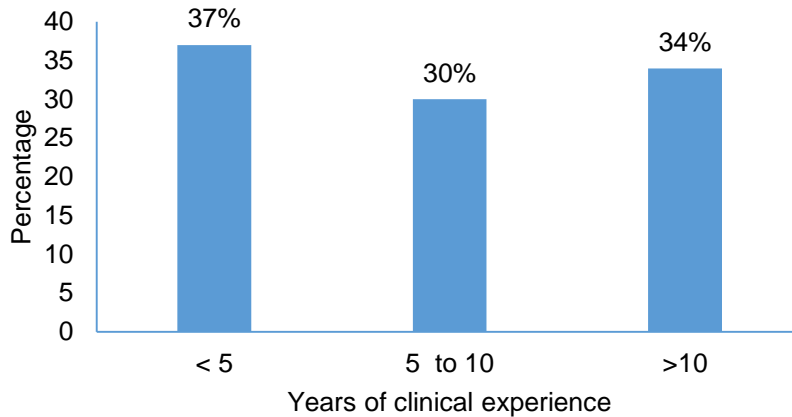


Figure 4.2.4: Respondent's years of clinical experience (n=324)

Figure 4.25 presents distribution of respondents by clinical discipline.

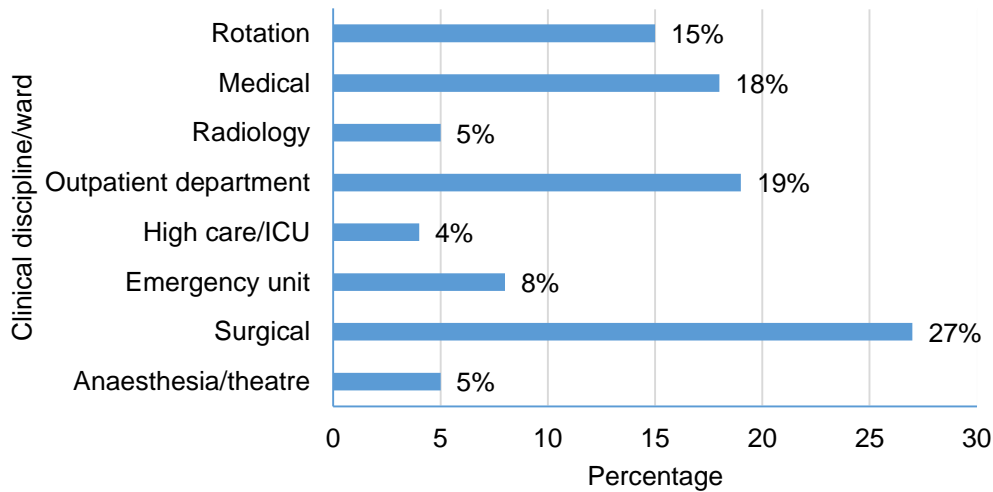


Figure 4.2.5: Distribution of respondents by clinical discipline/ward (n=324)

The clinical discipline/ward which participated in the study included 15(4.6%) respondents from Anaesthesia/theatre, 88(27.1%) from surgical disciplines/wards, 25(7.7%) from

Emergency unit, 13(4.0%) from High care or ICU, 61(18.2%) from Outpatient department, 16(4.9%) from Radiology/X-ray and 59(18.8%) respondents from Medical disciplines/wards (Figure 4.2.5). There were 47(14.5%) respondents on rotation at various clinical disciplines/wards. Previous training on hand hygiene is shown in figure 4.2.6. Respondents who received training in the last 3 years were 185(57.1%) and 196(60.4%) respondents received training during undergraduate programme.

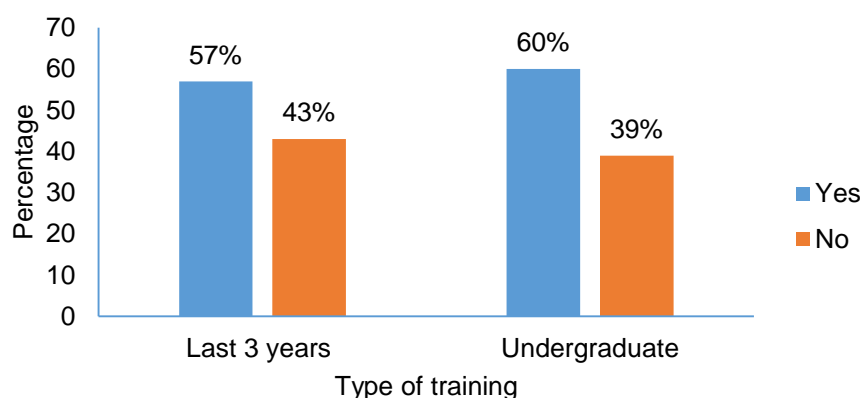


Figure 4.2.6: Type of hand hygiene training received by respondents (n=324)

Majority of the respondents routinely use alcohol based handrub 259(79.9%) whilst a few 65(20.0%) respondents do not handrub. A greater 304(93.8%) proportion of respondents routinely wash their hand with soap and water.

4.3 Respondent's knowledge on hand hygiene

The mean overall score for knowledge on hand hygiene was 15.81 ± 2.4 (63.2%). Table 4.3.1 presents respondent's level of knowledge. Respondents with moderate knowledge were 269(83.0%), 33(10.1%) had good knowledge and 22(6.7%) had poor knowledge on hand hygiene.

Table 4.3.1: Respondent's overall knowledge on hand hygiene (n=324)

Knowledge	No	%
Knowledge level		
Poor	22	7
Moderate	269	83
Good	33	10

The percentages of correct responses of the respondents to the individual questions on hand hygiene knowledge are shown in Table 4.3.2.

Table 4.3.2: Respondent's answers on knowledge questions (n=324)

No	Knowledge based questions	n	%
K1	Main route of cross-transmission of potentially harmful germs between patients in hospital(HCWs hands when not clean)	257	79
K2	Frequent source of germs responsible for health care-associated infections (Germs already present on or within the patient)	104	32
K3	Hand hygiene actions that prevent transmission of germs to the patient		
	Before touching a patient (Yes)	315	97
	Immediately after a risk of body fluid exposure(No)	74	23
	After exposure to the immediate surroundings of a patient(No)	108	33
	Immediately before a clean/aseptic procedure(Yes)	287	89
K4	Hand hygiene actions that prevents transmission of germs to the health-care worker		
	After touching a patient(Yes)	292	90
	Immediately after a risk of body fluid exposure(Yes)	285	88
	Immediately before a clean/aseptic procedure (No)	115	35
	After exposure to the immediate surroundings of a patient(Yes)	268	83
K5	True statements on alcohol-based hand rub and handwashing with soap and water		
	Handrubbing is more rapid for hand cleansing than handwashing(True)	219	68
	Handrubbing causes skin dryness more than handwashing(False)	103	32
	Handrubbing is more effective against germs than handwashing(True)	81	25
	Handwashing and Handrubbing are recommended to be performed in sequence(False)	96	30
K6	Minimal time needed for alcohol-based hand rub to kill most germs(20 seconds)	99	31
K7	Type of hand hygiene method required in the following situations		
	Before palpation of the abdomen(Rubbing)	199	61
	Before giving an injection(Rubbing)	148	46
	After emptying a bedpan(Rubbing/washing)	299	92
	After removing examination gloves(Rubbing/washing)	321	99
	After making a patient's bed(Rubbing)	41	13
	After visible exposure to blood(Washing)	292	90
K8	Actions to be avoided during hand hygiene		
	Wearing jewellery(Yes)	293	90
	Damaged skin(Yes)	297	92
	Artificial fingernails(Yes)	307	95
	Regular use of a hand cream(No)	225	69

WHO “My five (5) moments for hand hygiene” and indications for hand hygiene

Few respondents (22.8% and 35.4%) knew that moments for hand hygiene “Immediately after a risk of body fluid” and “Immediately before a clean/aseptic procedure” protect the HCW (and hospital environment) and patient respectively. Respondents who knew that handrubbing was the required method before giving an injection were 148(45.6%). Few (12.6%) respondents chose the correct method for the question on “after making a patient’s bed”.

Comparing handrubbing and hand washing

Handrubbing was known to be more rapid for hand cleansing than hand washing by 219(67.5%) respondents. Only 103(31.7%) respondents knew that handrubbing does not cause skin dryness. Of the 324 respondents, only 81(25.0%) knew that hand rubbing was more effective against germs than handwashing, while few 96(29.6%) knew that hand rubbing and handwashing are not recommended to be performed in sequence. Minimal time needed for AHBR to kill most germs was known by 99(30.5%) respondents.

4.4 Respondent’s attitude on hand hygiene

The mean overall score of the respondent’s attitude was 6.99 ± 1.90 (69.9%). Table 4.4.1 presents respondent’s level of attitude on hand hygiene. Most respondents (88.8%) had positive attitude towards on hand hygiene, and 36(11.1%) had negative attitude towards hand hygiene.

Table 4.4.1: Respondent’s overall attitude on hand hygiene (n=324)

Overall attitude % score	n	%
Positive ≥ 50%	288	89
Negative < 50%	36	11

Respondent’s responses to individual attitude statement are presented in Table 4.4.2. Eight (8) out of the ten (10) attitude statements were selected correctly by >70% of the respondents.

Gaps in attitude

Few (37.0%) respondents felt that emergencies and other priorities did not make hand hygiene difficult at times. Respondents who were not reluctant to ask others to engage in hand hygiene were 173(53.4%), and 134(41.3%) disagreed with the statement that “newly qualified staff have not been properly instructed in hand hygiene in their training”.

Table 4.4.2: Respondent’s responses to attitude statements (n=324)

No	Statement	n	%
A1	I adhere to correct hand hygiene practices at all times	295	91
A2	I have sufficient knowledge about hand hygiene	272	84
A3	Sometime I have more important things to do than hand hygiene	232	72
A4	Emergencies and other priorities make hand hygiene more difficult at times	120	37
A5	Wearing gloves reduce the need for hand hygiene	254	78
A6	I feel frustrated when others omit hand hygiene	265	82
A7	I am reluctant to ask others to engage in hand hygiene	173	53
A8	Newly qualified staff have not been properly instructed in hand hygiene in their training	134	41
A9	I feel guilty if I omit hand hygiene	286	88
A10	Adhering to hand hygiene practices is easy in the current setup	235	73
	Average	288	89

4.5 Respondent’s self-reported practices on hand hygiene

The mean overall score of self-reported practices on hand hygiene was 4.02 ±1.30 (67.1%). Table 4.5.1 presents the respondent’s level of self-reported practices. Most (87.9%) respondents reported good hand hygiene practices, whereas few (12.0%) reported poor practices. Of the six (6) practice statements, more than 70% of the respondents reported good practices on three (3) of the six (6) statements.

Table 4.5.1: Respondent’s overall practices on hand hygiene (n=324)

Overall practice % score	n	%
Good ≥50%	285	88
Poor <50%	39	12

Gaps in self-reported practices

Missing hand hygiene sometimes due to forgetfulness was reported as poor practice by 174(53.7%) respondents. Respondents who disagreed with a statement that the

frequency of hand hygiene required made it difficult for them to carry out hand hygiene as often as necessary, were 174(53.7%). In terms of attendance of hand hygiene courses, 141(43.5%) respondents reported difficulty in attending courses due to time pressure.

Table 4.5.2: Respondent’s responses to practice statements (n=324)

Statement	n	%
P1 Sometime I miss out hand hygiene simply because I forget it	174	54
P2 Hand hygiene is an essential part of my role	311	96
P3 The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	174	54
P4 Infection prevention team have a positive influence on my hand hygiene	251	77
P5 Infection prevention notice boards remind me to do hand hygiene	254	78
P6 It is difficult for me to attend hand hygiene courses due to time pressure	141	44
Average	285	88

4.6 Association between the KAP and explanatory (independent) variables

The association between selected demographics and hand hygiene knowledge, attitude and practices is shown in Table 4.6.1. There was no statistical significant relationship between knowledge ($p=0.854$), attitude ($p=0.472$) and practices ($p=0.436$) on hand hygiene and gender ($p>0.05$). However, females were more knowledgeable and had positive attitude than males. Respondents’ knowledge decreased significantly with increase in age ($p=0.003$). The attitude ($p=0.033$) and practices ($p=0.015$) of respondents also showed statistically significant relationship with age ($p<0.05$). However age group >40 years had positive attitude and good practices than age groups <40 years.

There was significant statistical relationship between hand hygiene attitude and practices and respondent’s professional category ($p=0.000$). Professionals in the clinical group had more knowledge ($p=0.377$) but, the difference was not statistically significant. Nursing professionals had positive attitude ($p= 0.051$) and good practices ($p=0.000$) compare to professionals in the clinical group ($p<0.05$).

Significant association was also observed between respondent’s knowledge ($p=0.033$) and practices ($p=0.012$) on hand hygiene and years of clinical experience. Respondents with less than 10 years clinical experience had more knowledge than respondents with

more than 10 years' experience. Though, >10years of experience was associated with good hand hygiene practices (p=0.012).

Table 4.6.1: Association between KAP score and independent variables (n=324)

Variable	n	Knowledge		Attitude		Practices	
		Good K*	P value	Positive A	P value	Good P	P value
Gender							
Female	241	225(93)	0.854	216(90)	0.472	210(87)	0.436
Male	83	92(77)		72(87)		75(90)	
Age group							
<40 years	229	221(97)	0.001	198(86)	0.033	195(85)	0.015
≥40years	95	81(85)		90(95)		90(95)	
Profession category							
Clinical #	154	146(95)	0.377	131(85)	0.051	121(79)	0.000
Nursing	170	156(92)		157(92)		164(96)	
Years of clinical experience							
<5	119	114(96)	0.033	104(87)	0.707	99(83)	0.012
5-10	96	92(96)		85(89)		82(85)	
>10	109	96(88)		99(91)		104(95)	
Clinical discipline/ward							
Theatre/ICU/High care	28	26(93)	1.000	26(93)	0.753	26(93)	0.552
Casualty/Wards/OPD	296	276(93)		262(89)		259(88)	
Training last 3 years							
Yes	185	171(92)	0.521	171(92)	0.019	173(94)	0.000
No	139	131(94)		117(84)		112(81)	
Undergraduate training							
Yes	196	184(94)	0.653	172(88)	0.473	170(87)	0.486
No	127	118(93)		115(91)		114(90)	

K=knowledge, **A**=attitude, **P**=practices;

Good K*=knowledge=score 50-74% and above 50%

Clinical # =Allied, dental, pharmacy and medical professionals

There was no statistical significant relationship between the knowledge, attitude and practices on hand hygiene and clinical discipline/ward (p>0.05). Statistical significant relationship was observed between respondents who received hand hygiene training in the last 3 years and attitude (p= 0.019) and practices (p=0.000). Positive attitude and good practices was observed on respondents who received hand hygiene training in the last 3 years (p<0.05). No statistical significant relationship was observed between knowledge, attitude and practices on hand hygiene and undergraduate training (p>0.05).

CHAPTER 5

DISCUSSION, CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

5.1 Introduction

This chapter outlines a summary discussion of the respondent's KAP outcomes on hand hygiene. The chapter also discusses the association observed between the respondent's KAP scores and predictors/associated factors, conclusion, recommendations and limitations.

5.2 Background

HCWs hands are the most common vehicle for the transmission of HCAs from patient to patient and within the health care environment (Allegranzi and Pittet 2009). Hand hygiene is regarded as the most important, simplest, and least expensive means of reducing the burden of HCAs and the spread of antimicrobial resistance (WHO 2009). Optimal hand hygiene behaviour is considered the cornerstone of prevention of HCAs. However, compliance among HCWs is as low as 40 percent despite the relative simplicity of the procedure (Mathai et al 2011). Some of the reasons for low compliance to hand hygiene include; lack of appropriate infrastructure and equipment to enable hand hygiene performance, allergies to hand washing products, perception and knowledge of the transmission risk and of the impact of HCAI; and casual attitudes of HCWs towards IPC (Allegranzi et al 2009; Ekwere et al 2013).

Recommended strategies to improve hand hygiene compliance include education, motivation, and ensuring competency of HCWs about proper hand hygiene. HCW's knowledge are usually tested on indications for hand hygiene and often required to demonstrate hand hygiene techniques. Monitoring hand hygiene adherence and providing performance feedback to HCWs is a critical component of multimodal hand hygiene promotion programmes (Sax et al 2009). It is important to identifying the gaps and strengths in hand hygiene knowledge, attitude, and practices (KAP) with a view to improve on the existing training programme and to promote good practices. We undertook a study to assess HCWs level of KAP on hand hygiene and factors associated with KAP.

5.3 Summary and interpretation of the results

In this study, a vast majority of the respondents were females (74.3%), aged below 40 years (70.6%) and of nursing profession (52.4%). Different from the present study, Langoya et al (2015) in Sudan had predominately (61.8%) male HCWs in their study. However in South Africa, Dramowski et al 2016 had mostly female (81.4%), young (aged 20-39 years) and nursing professional (47.2%). The distribution of professionals was similar to the national representation in which, majority of health professionals in SA, are nurses (Day and Gray 2017; NDOH HRH 2011).

Previous hand hygiene training was received by 196(60.4%) respondents during undergraduate training and 185(57.1%) respondents in the last 3 years. Similar in Iran, only 53.4% of the participants had received the formal training in hand washing within the last three years (Zakeri et al 2017). However in Ghana, majority of the respondents (77.3%) had received training in hand hygiene (Amissah et al 2013). This means 127(39.2%) respondents in our study were not trained in theory and practice during undergraduate training and, 139(42.9%) respondents were not trained in the last 3 years. According to the SA IPC policy and NCS, all HCWs should receive IPC education and training (inclusive of hand hygiene) during undergraduate, orientation and in-service training. This results indicates a gap in undergraduate and in-service training. Although it is possible that respondents may not recall undergraduate training or training was not part of the curriculum.

5.4 Knowledge

The results for this study indicate that respondents had moderate 269(83.0%) and good 33 (10.1%) knowledge on hand hygiene. This was a positive finding correspondingly found in Ethiopia, Nigeria and Nepal (Abdella et al 2014; Ango et al 2017; Paudel et al 2016). It could be due to previous hand hygiene training reportedly received by more than 50% of the respondents. This means respondents were knowledgeable on hand hygiene. However, there were critical knowledge gaps on HCAs, “My 5 moments for hand hygiene” and ABHR.

Knowledge gaps related to HCAs

In terms of HCAs, majority (79.3%) of the respondents knew that HCW's hands when not clean, were the main route of transmission of potentially harmful germs between patients in a health care setting. But, few (32.1%) knew the frequent source of these germs that are responsible for HCAs. Comparable results were observed in India and China (Nawab et al 2015; Zhou et al 2014). Locally, a study in Tygerberg Hospital observed poor knowledge when majority (76%) of the HCWs incorrectly identified the environment as the predominant source of HCAI (Dramowski et al 2016). It seems respondents knew that hands transmit HCAs but, were not sure of the source of pathogens responsible for HCAs. A possible explanation could be that, training focused more on hand hygiene technique than the theory of hand hygiene in relation to its role on HCAs. Knowledge on HCAs need to be reinforced during training at undergraduate and continuous professional training (CPD).

Gaps on WHO 5 moments for hand hygiene

Though respondents answered correctly most of the questions on "My 5 moments for hand hygiene", there were gaps on this knowledge topic. For instance, most (>60%) respondents did not know that performing hand hygiene immediately after a risk of body fluid exposure and after exposure to the immediate surroundings of a patient, protects the HCW and the hospital environment. Langoya et al in Sudan likewise, observed similar knowledge gap to these knowledge questions. Ansari et al (2015) found both doctors and nurses had low knowledge on WHO's five moments for hand hygiene. An important focus of the "My 5 moments" concept is the visualisation of the individual patient zone, which defines hand hygiene indications (Salmon et al 2015). In our study, the results identified crucial knowledge gaps around the concept and indications for hand hygiene. It means respondents are not aware of the purpose of each of the five (5) moments for hand hygiene.

Gaps on alcohol based hand rub

Another critical gap in knowledge was on respondent's misconception of ABHR and hand washing with soap and water. Majority of the respondents indicated that they routinely

use ABHR (79.9%) and wash (93.3%) with soap and water. Different from a study in China where only 30.0% of physicians and 50.9% of nurses reportedly used ABHR. It shows that respondents prefer washing than hand rubbing. ABHR has been shown to be more effective for hand antiseptis than hand washing with soap and water (WHO 2009; Longtin et al 2011; Salmon et al 2014). Although most (67.5%) respondents knew that handrubbing was more rapid for hand cleansing than handwashing, few (25.0%) knew that handrubbing was more effective than hand washing. These findings were similar to that of a KAP study in Saudi Arabia (ALSofiani, et al 2015). This might be that pre-2009 undergraduate and in-service training promoted hand washing than hand rubbing.

Although most respondents (67.5%) said ABHR was rapid, only 31.5% knew the minimum time needed for ABHR to kill most germs. Similarly, in a study by Thakker and Jadhav (2015), only a few undergraduate students (medical 40.4%, dental 37.8%, and nursing 32.5%) knew that 20 seconds was the minimum time required for ABHR to be effective as per the WHO hand hygiene guideline (2009). The reason might be the lack of reminder posters on “how to hand rub” or lack of training on ABHR.

Furthermore, few (31.7%) respondents knew that handrubbing does not cause skin dryness. It means respondents associate ABHR with skin dryness. According to NCS criteria for ABHR in SA, all ABHR must contain emollient to prevent skin dryness. Additionally, few (29.6%) respondents knew that handrubbing and hand washing were not performed in sequence. Comparable, Paudel et al (2016) and Maheshwari (2014) observed similar responses. It means respondents have conflicting knowledge on ABHR. This mismatch and misconception may have serious impact on hand hygiene compliance. Kingston et al (2017) likewise found some confusion among nursing students around when to use soap and water and when to use ABHR. The level of knowledge shown by the proportions of respondents in answering these questions correctly, was clearly inconsistent and inadequate on the aspects of ABHR. To change this misconception, dedication and time is needed to educate HCWs on the use ABHR.

5.5 Attitude

Overall, majority (88.8%) of the respondents in this study had positive attitude on hand hygiene similar to a study in Nigeria (Ango et al 2017). This was a positive finding. It means respondents are aware of the importance of hand hygiene. Contrary to Nabavi et al (2015) and Ariyaratne et al (2013) in Iran and India respectively, the attitude of their participants towards hand hygiene was overall poor. However, respondents had attitude gaps related to emergencies, undergraduate training and mentoring of colleagues.

Attitude gaps

Interestingly, most (83.9%) of the respondents felt hand hygiene was important and should be adhered to. However, most (62.9%) felt emergencies and other priorities made hand hygiene more difficult at times. This was different to findings of Paudel et al (2016) where participants felt the opposite. It means respondents miss hand hygiene during emergencies. This was worrisome as emergencies are common in health care settings.

Although most respondents (81.7%) felt frustrated when others omit hand hygiene, some (46.6%) were however reluctant to ask their colleagues to perform hand hygiene. Nawab et al (2015), Nair et al (2014) and Ariyaratne et al (2013) similarly observed this negative attitude. Furthermore, some (41.3%) respondents thought newly qualified staff have not been properly instructed on hand hygiene in their training. It shows that respondents are afraid to correct fellow colleagues and lack confidence in the current training prescribed for newly qualified staff. Respondents displayed a mixer of positive and negative attitude in these statements. It might be that respondents over-reported by responding positively what is acceptable as opposed to how they genuinely felt. IPC team can recommend hand hygiene champions for each ward to solve this problem.

5.6 Practices

In relation to self-reported practices, most (87.9%) respondents reported good hand hygiene practices. Comparable in Cape Town (SA), Dramowski et al (2016) observed higher (88%) self-reported adherence on hand hygiene practices among HCWs. Contrary in a study by Arthi et al (2016), most participants reported poor hand hygiene practices

(medical -73%, nursing -57%) and only few showed good hand hygiene practice (medical -3%, nursing -5%). However, the high proportion of respondents who indicated personal compliance with hand hygiene practices is of interest.

Self-reported practices may need to be confirmed by a reliable method such as direct observation of the respondents during patient care. A study in New York found major differences between self-reported hand hygiene and observational data, though the study was unable to confirm which data collection strategy was more accurate or less biased (Larson et al 2004). However, direct observation of HCWs during patient care activity by trained and validated observers is considered as the gold standard for monitoring hand hygiene compliance (Boyce 2011). Even so, respondents had crucial gaps on some reported practices relating to forgetfulness, frequency of hand hygiene and course attendance.

Gaps in practices

For instance, some (45.6%) respondents reported missing out on hand hygiene simply because they forgot it. This was similarly found in a study by Nawab et al (2015). Furthermore, some (45.6%) respondents said the frequency of hand hygiene required made it difficult for them to carry it out as often as necessary. This means compliance to hand hygiene is compromised by forgetfulness and the frequency of the procedure. Some (55.8%) respondents reported that it was difficult for them to attend hand hygiene courses due to time pressure. Similar results were observed by Ariyaratne et al (2013). It means respondents miss hand hygiene training because they lack time to attend.

However, respondents said IPC teams had a positive influence on their hand hygiene, and that IPC notice boards reminded them to perform hand hygiene. This shows that respondents value IPC teams and IPC reminder posters. Continued use of promotional and instructional materials was considered useful for reminding staff of the need to perform hand hygiene in Malaysia (Birks et al 2011). Abdella et al (2014) found that the presence of IPC committees was positively associated with hand hygiene compliance of HCWs. These responses indirectly indicate that respondent's compliances was

influenced by various factors amongst them, the frequency (time) of hand hygiene, forgetfulness, IPC teams, IPC reminders and hand hygiene course attendance. Top three (3) reasons for not practicing hand hygiene in a teaching hospital in Ghana included; heavy patient load; forgetfulness and lack of time (Amissah et al 2013). In order for HCWs to encourage good practices regarding hand hygiene, it is important to address these issues with hospital management.

5.7 Association between KAP and selected predictors (independent variables)

KAP and gender

In this study, there was no statistical relationship between respondent's KAP and gender. Likewise, Ango et al (2017), Zakeri et al (2017) and Langoya et al (2015) did not find association between knowledge and gender. In contrast, Elkhawaga and El-Masry (2017) in Egypt, demonstrated the role of gender on hand hygiene when they found better knowledge and self-reported practice in females than male students in their study. Mu'taz et al (2016) however, found significant difference between male and female only in reported practices. Interestingly, the study by Langoya et al in Sudan was dominated by male participants.

KAP and age

Statistical significant relationship was found between respondent's KAP and age. Langoya et al (2015) also, found a significant association between age and knowledge score, whereas Mu'taz et al found association between age and attitude score. In the current study, this implied that younger (<40 years) respondents are more knowledgeable but then again, the older respondents had better attitude and practices. This might mean the younger professionals recall theory better, whilst the older professionals have more practical experience.

KAP and professional category

There was no significant association between respondent's knowledge and attitude on hand hygiene and professional category. Comparable Mu'taz et al (2016) and Langoya et al (2015), likewise did not find significant difference in their studies. However Zhou et

al (2014) in China and Ekwere et al (2013) in Nigeria, both found that nurses had significant better knowledge on hand hygiene than doctors. On the contrary, Ansari et al (2015) in India, found doctors had better knowledge of hand hygiene than nurses. In our study, the other professionals combined (clinical), had more knowledge than nurses although not statistically significant. Perhaps smaller groups of health professionals like allied and medical professionals, were easily accessible to educate on hand hygiene.

Significant association was however observed between respondent's practices and professional category in the present study. It meant nurses had better hand hygiene practices than other HCWs. However Dramowski et al (2016) at Tygerberg Hospital, did not find significant difference between doctors and nurses self-reported practice on hand hygiene. Overall, although nurses were less knowledgeable in the current study, it appears they have more positive attitude and good practices than other professionals. These findings were comparable to Ansari et al (2015).

KAP and clinical discipline/ward

In the present study, no significant association was found between respondent's KAP and clinical discipline/ward. Comparable, Zakeri et al (2017) did not find association between knowledge and clinical department. However, in a study by Nabavi et al (2015), knowledge on hand hygiene was significantly better among the obstetrics and gynecology medical residents when compared to the others. In the same study, surgery and internal medicine residents showed better attitudes toward hand hygiene than the residents of other specialties. In the current study this finding might demonstrate the coverage of hand hygiene training/education and similar KAP of professionals in each discipline. However, disciplines were merged to allow better comparison. This might have affected the results.

KAP and clinical experience

Statistical significant relationship was observed between respondent's knowledge and attitude, and years of clinical experience. Mu'taz et al (2016) found statistically significant differences among groups of years of experience in compliance (practices) and attitude score. Work experience and previous training on hand hygiene were found to be the two

main predictors of knowledge among participants in Iran (Asadollahi et al 2015). However in the present study, respondents with greater than 10 years clinical experience were less knowledgeable. This finding could be that the knowledge on hand hygiene is still fresh or better recalled by the younger professionals as compared to the older professionals. Those with less work experience can also recall knowledge from undergraduate training better than those with >10 years work experience.

KAP and training

The study did not find significant association between hand hygiene training (in the last 3 years or undergraduate) and knowledge. Furthermore, no association was observed between respondent's KAP and undergraduate training. Comparable, no significant association was observed in Ghana, Iran and Sudan (Bello, Asiedu, Adegoke et al 2011; Asadollahi et al 2013; Langoya et al 2015; Ekwere et al (2013). However, Nabavi et al (2015) and Azmeer et al (2015) found training to be significantly associated with knowledge of hand hygiene. This means there was no difference in the knowledge of those who received training and those who did not.

Nevertheless training in the last 3 years was significantly associated with only attitude and practices. In Ethiopia, those who were trained had 2.6 times more compliance than those who were not trained (Abdella et al 2014). It means trained respondents had more positive attitude and good practices than untrained respondents. The result indicate a gap in both undergraduate and in-service education and training. It might also mean respondents had different sources of training.

Khanal et al (2017) in Nepal found 86.3% of HCWs had received information on hand hygiene from the hospital, while the rest obtained the information from books, internet, and friends. However, in a study in Ghana, formal training in class was regarded as the main source of information influencing medical and allied students' knowledge on preventive measures for HCAs (Bello et al 2011). Ansari et al (2015) noted a significant improvement in the KAP score for both doctors and nurses after the training sessions.

This highlights the importance of training HCWs repetitively using various methods to convey current knowledge on hand hygiene.

5.8 Limitations

The study had some limitations. The first limitation was the convenience sampling strategy that was undertaken. Convenience sampling may create selection bias towards HCWs with an interest in hand hygiene, which may influence the results. The sample size was large, though we cannot generalise the results to this setting or anywhere else.

The second limitation was during data collection. Data collection was through a self-administered questionnaire, which allows the respondent to check others responses or discuss the answers as well as document the expected response rather the actual response. Therefore the responses were self-reported and subjective in nature. Self-reporting may allow for over-reporting bias, particularly for attitude and practices. Respondents tend to over score socially desirable behaviour, which can lead to overestimated attitude and practices. However, this can be overcome by conducting direct observation of the practices by a trained observer to record the actual practices.

The third limitation was on recall bias. Self-reporting questionnaire is prone to this bias as some respondents might not recall/remember certain information (e.g. undergraduate hand training). The fourth limitation was the study design. Due to the cross-sectional nature of this study, temporal relationship could not be established between the exposure and outcome. We therefore could not perform regression analysis in this regard.

5.9 Conclusion

The study indicates that respondents have moderate knowledge, positive attitude and good practices on hand hygiene. However, they have knowledge gaps on HCAs, WHO 5 moments for hand hygiene and ABHR. Noteworthy, they have remarkable misconceptions on ABHR indication and effectiveness. The study shows that some respondents had not received any undergraduate or in-service training on hand hygiene.

However, no association was found between training and hand hygiene knowledge. Knowledge was only associated with age and years of clinical experience.

Although respondents had positive attitude, they had negative attitude on hand hygiene during emergencies and towards newly qualified staff. Positive attitude was associated with age and training in the last 3 years. Similarly, most respondents had good practices. However, there were practice gaps related to forgetfulness and time to attend hand hygiene training. Practices were associated with age, professional category, years of clinical experience and training in the last 3 years. These findings suggests deficiencies in both undergraduate training and in-service training. They further highlight the need to review and improve on current hand hygiene education and training. Respondent's variety in KAP scores and associated factors indicate that a multimodal, multifaceted improvement approach should be undertaken to address the gaps in knowledge, attitude and practices.

5.10 Recommendations

We recommend implementation of the WHO multimodal hand hygiene improvement intervention approach to improve HCW's knowledge, attitude and practices on hand hygiene. A combination of interventions which include training and education, observation and feedback, reminders in the workplace, system change and institutional safety climate should be implemented. HCW's knowledge can be improved by a combination of educational strategies such as slide presentations, interactive sessions, training films, internet, and hand hygiene brochures and pocket leaflets. Emphasis should be on the gaps identified during the study such as HCAs, moments for hand hygiene and ABHR. Education and training should be conducted during orientation and in-service as stipulated by the SA IPC policy under the IPC programme. Evaluation of HCW's knowledge and attitude using the WHO knowledge and perception survey tools is also recommended. Undergraduate training can be addressed at national level as recommended by SA IPC policy strategy 2007.

The IPC team can strengthen monitoring and evaluation of hand hygiene practices by conducting practical sessions to train HCWs and IPC champions on hand hygiene techniques and indications. IPC team should use the WHO's five (5) moments for hand hygiene as a training tool. The team and champions should conduct direct observation by means of the standardised tool recommended by the NDoH and WHO. Performance feedback should be communicated to HCWs to encourage future participation. All these must be offered to all health professionals within respective clinical disciplines.

Reminder posters on "How to handrub", "How to hand wash" and WHO's 5 moments should be displayed on the ward notice boards and at basins. The posters will serve as visual reminders to encourage HCWs to practice hand hygiene and form part of system change. Hospital management should ensure constant availability of hand hygiene resources such as ABHR that contain emollient and managers should assist IPC teams by availing their staff during hand hygiene training.

At National and provincial level, a surveillance system is needed to monitor hand hygiene compliance and HCAs. This will ensure proper reporting of HCAs and interventions aimed at reducing HCAs (e.g. hand hygiene compliance). Lastly, further KAP studies using a combination of monitoring methods such as qualitative surveys and direct observation are warranted to validate reported practices.

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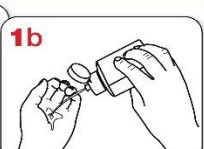
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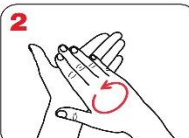
ANNEXURE 1: How to handrub and hand wash

How to Handrub? with alcohol-based formulation

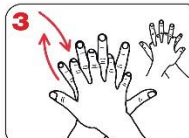
1a 

1b 

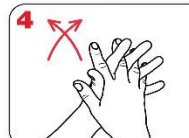
Apply a palmful of the product in a hand and cover all surfaces.

2 

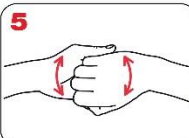
Rub hands palm to palm.

3 

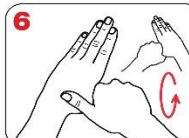
right palm over left dorsum with interlaced fingers and vice versa.

4 


palm to palm with fingers interlaced.

5 


backs of fingers to opposing palms with fingers interlocked.

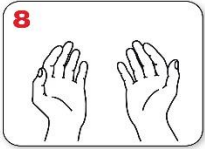
6 

rotational rubbing of left thumb clasped in right palm and vice versa.

7 


rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.

 **20-30 sec**

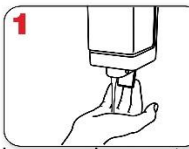
8 

...once dry, your hands are safe.


How to Handwash? with soap and water

0 


Wet hands with water.

1 

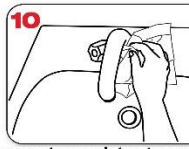
apply enough soap to cover all hand surfaces.

8 


rinse hands with water.

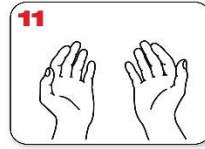
9 

dry thoroughly with a single use towel.


10 

use towel to turn off faucet.

 **40-60 sec**


11 

... and your hands are safe.



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH




World Health Organization


ANNEXURE 2: WHO five (5) moments for hand hygiene

Your 5 Moments for HAND HYGIENE

1	BEFORE PATIENT CONTACT	WHEN? Clean your hands before touching a patient when approaching him or her WHY? To protect the patient against harmful germs carried on your hands
2	BEFORE AN ASEPTIC TASK	WHEN? Clean your hands immediately before any aseptic task WHY? To protect the patient against harmful germs, including the patient's own germs, entering his or her body
3	AFTER BODY FLUID EXPOSURE RISK	WHEN? Clean your hands immediately after an exposure risk to body fluids (and after glove removal) WHY? To protect yourself and the health-care environment from harmful patient germs
4	AFTER PATIENT CONTACT	WHEN? Clean your hands after touching a patient and his or her immediate surroundings when leaving WHY? To protect yourself and the health-care environment from harmful patient germs
5	AFTER CONTACT WITH PATIENT SURROUNDINGS	WHEN? Clean your hands after touching any object or furniture in the patient's immediate surroundings, when leaving - even without touching the patient WHY? To protect yourself and the health-care environment from harmful patient germs



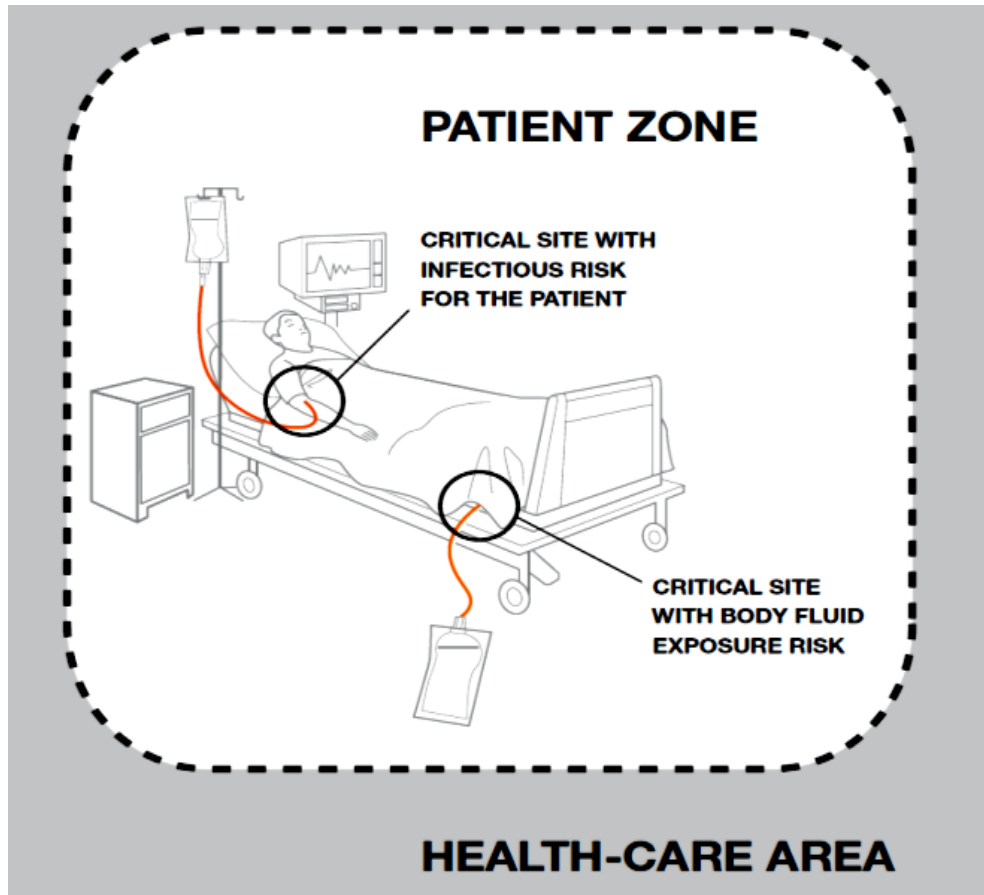
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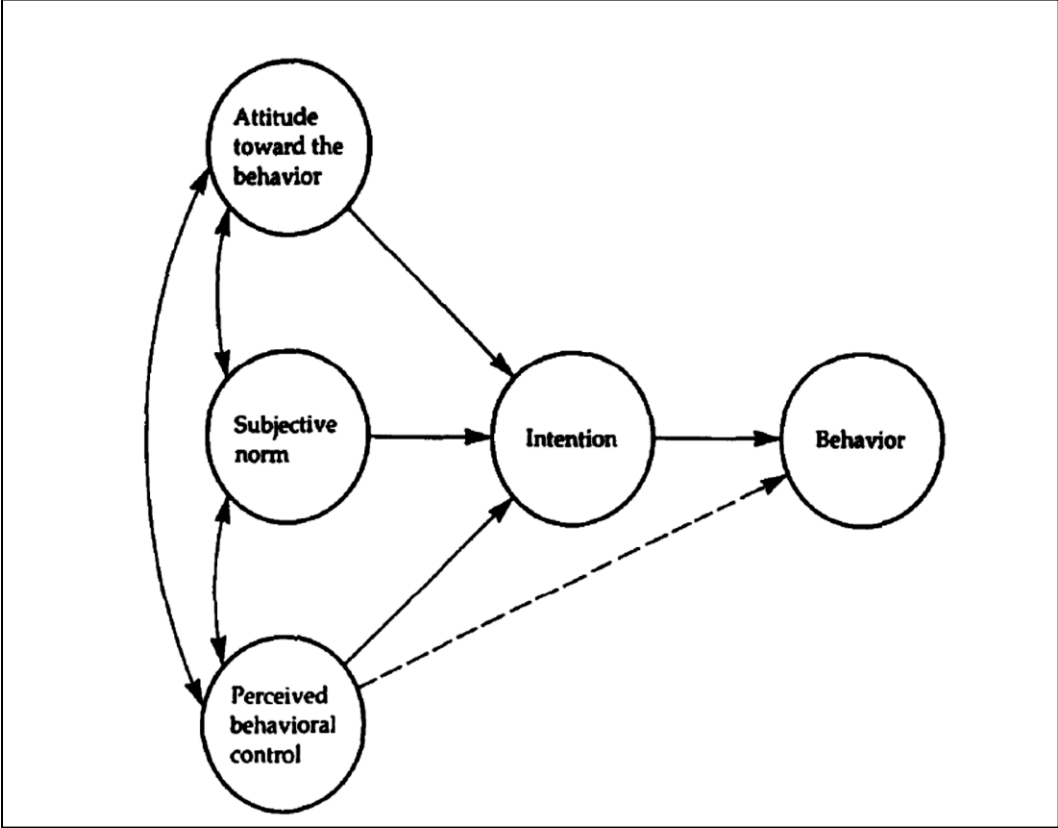
World Health Organization

DEPARTMENT OF HEALTH

ANNEXURE 3: Patient zone and health care area (WHO 2009)



ANNEXURE 4: Theory of planned behaviour (Ajzen 1991)



ANNEXURE 5: Morgan and Krejcie table (1970)

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION									
N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size
"S" is sample size.

ANNEXURE 6: Questionnaire

Questionnaire on Hand Hygiene Knowledge, Attitude and Practices (KAP) among Health Care Workers of Pietersburg tertiary hospital.

Instructions: Tick only one answer to each question/answer Yes/No or True/False.

Please read each question carefully and answer appropriately.

SECTION A: DEMOGRAPHIC INFORMATION										
Gender	Male	Female								
Age (in years)										
Age group	<small><20 Years</small>	20-29 Years	30-39 Years	40-49 Years	>50 Years					
Profession category	Medical professional			Nursing professional			Allied professional			
Rank: Medical	Intern	Community service	Medical officer		Registrar		Specialist	Student		
Rank: Nursing	Enrolled nurse assistant		Enrolled nurse	Professional nurse			Student nurse		Other	
Allied	Physiotherapy	Occupational therapy	Dietician	Speech hearing	Radiographer	Pharmacy	Radiotherapy	Other		
Years of clinical experience	<small><5 YEARS</small>			<small>5-10 YEARS</small>			<small>>10 YEARS</small>			
Clinical discipline Ward	Emergency unit		High Care		Intensive care unit		Nephrology/Renal		Dental	
	Internal medicine	Obstetrics & gynae	Paediatrics	Oncology	Radiology	Anaesthesia theatre		Rotation/mixed		
Other surgical disciplines	Ear, Nose and throat	Orthopaedic	Plastic surgery	Cardiothoracic		Neurosurgery	Urology	General surgery		
SECTION B: TRAINING										
Training	-Did you receive formal training in hand hygiene in the last three (3) years? YES/NO -Did you receive formal undergraduate training on hand hygiene? YES/NO									
Hand hygiene technique used	-Do you routinely use an alcohol-based hand-rub for hand hygiene? YES/NO -Do you routinely use soap and water to hand-wash for hand hygiene? YES/NO									
SECTION C: KNOWLEDGE										
Knowledge	<p>This section is designed to explore your knowledge related to hand hygiene and health care-associated infections (HCAIs)</p> <p>K1. Which of the following is the main route of cross-transmission of potentially harmful germs between patients in a health-care facility? (tick one answer only)</p> <p>a) <input type="checkbox"/> Health-care workers' hands when not clean</p> <p>b) <input type="checkbox"/> Air circulating in the hospital</p> <p>c) <input type="checkbox"/> Patients' exposure to colonised surfaces (i.e., beds, chairs, tables, floors)</p> <p>d) <input type="checkbox"/> Sharing non-invasive objects (i.e., stethoscopes, pressure cuffs, etc.) between patients</p> <p>K2. What is the most frequent source of germs responsible for health care-associated infections? (Tick one answer only).</p> <p>a) <input type="checkbox"/> The hospital's water system</p> <p>b) <input type="checkbox"/> The hospital air</p> <p>c) <input type="checkbox"/> Germs already present on or within the patient</p>									

- d) The hospital environment (surfaces)
- K3. Which of the following hand hygiene actions prevent transmission of germs to the patient?
- a) Before touching a patient Yes No
- b) Immediately after a risk of body fluid exposure Yes No
- c) After exposure to the immediate surroundings of a patient Yes No
- d) Immediately before a clean/aseptic procedure Yes No
- K4. Which of the following hand hygiene actions prevents transmission of germs to the health-care worker?
- a) After touching a patient Yes No
- b) Immediately after a risk of body fluid exposure Yes No
- c) Immediately before a clean/aseptic procedure Yes No
- d) After exposure to the immediate surroundings of a patient Yes No
- K5. Which of the following statements on alcohol-based hand rub and handwashing with soap and water are true?
- a) Handrubbing is more rapid for hand cleansing than handwashing True False
- b) Handrubbing causes skin dryness more than handwashing True False
- c) Handrubbing is more effective against germs than handwashing True False
- d) Handwashing and Handrubbing are recommended to be performed in sequence True False
- K6. What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? (tick one answer only)
- a) 20 seconds
- b) 3 seconds
- c) 1 minute
- d) 10 seconds
- K7. Which type of hand hygiene method is required in the following situations?
- a) Before palpation of the abdomen Rubbing Washing None
- b) Before giving an injection Rubbing Washing None
- c) After emptying a bedpan Rubbing Washing None
- d) After removing examination gloves Rubbing Washing None
- e) After making a patient's bed Rubbing Washing None
- f) After visible exposure to blood Rubbing Washing None
- K8. Which of the following should be avoided, as associated with increased likelihood of colonisation of hands with harmful germs?
- a) Wearing jewellery Yes No
- b) Damaged skin Yes No
- c) Artificial fingernails Yes No
- d) Regular use of a hand cream Yes No

ATTITUDE

Attitude

- This section is designed to explore your attitudes towards Hand hygiene
- A1. I adhere to correct hand hygiene practices at all times
 Strongly agree Agree Disagree Strongly disagree
- A2. I have sufficient knowledge about hand hygiene
 Strongly agree Agree Disagree Strongly disagree
- A3. Sometime I have more important things to do than hand hygiene
 Strongly agree Agree Disagree Strongly disagree
- A4. Emergencies and other priorities make hygiene more difficult at times
 Strongly agree Agree Disagree Strongly disagree
- A5. Wearing gloves reduce the need for hand hygiene
 Strongly agree Agree Disagree Strongly disagree

	<p>A6. I feel frustrated when others omit hand hygiene <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>A7. I am reluctant to ask others to engage in hand hygiene <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>A8. Newly qualified staff have not been properly instructed in hand hygiene in their training <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>A9. I feel guilty if I omit hand hygiene <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>A10. Adhering to hand hygiene practices is easy in the current setup <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p>
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PRACTICES

<p>Practice</p>	<p>P1. Sometime I miss out hand hygiene simply because I forget it <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>P2. Hand hygiene is an essential part of my role <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>P3. The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>P4. Infection prevention team have a positive influence on my hand hygiene <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>P5. Infection prevention notice boards remind me to do hand hygiene <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p> <p>P6. It is difficult for me to attend hand hygiene courses due to time pressure <input type="checkbox"/> Strongly agree <input type="checkbox"/> Agree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly disagree</p>
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ANNEXURE 8: University ethics approval



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 4029, Fax: (015) 268 2306, Email: Abdul.Maluleke@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE CLEARANCE CERTIFICATE

MEETING: 02 November 2017

PROJECT NUMBER: TREC/382/2017: PG

PROJECT:

Title: Hand hygiene knowledge, attitude and practices among health care workers of Pietersburg Tertiary Hospital, Polokwane, Limpopo Province

Researcher: ME Setati

Supervisor: Dr NM Muvhango

Co-Supervisor: Dr FLM Hyera
Mr MA Poopedi

School: School of Medicine

Degree: MMED in Public Health Medicine


PROF TAB MASHEGO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: REC-0310111-031

Note:

- i) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.
- ii) The budget for the research will be considered separately from the protocol.
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

ANNEXURE 9: Limpopo department of health approval



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REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH

Enquiries: Stols M.L (015 293 6169)

Ref:4/2/2

Setati ME (LP_201711 014)
PO Box 196
Ladanna
0704

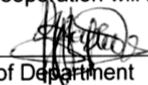
Greetings,

RE: Hand Hygiene Knowledge, Attitude and Practices among Health Care Workers of Pietersburg Tertiary Hospital, Polokwane, Limpopo Province

The above matter refers.

1. Permission to conduct the above mentioned study is hereby granted.
2. Kindly be informed that:-
 - Research must be loaded on the NHRD site (<http://nhrd.hst.org.za>) by the researcher.
 - Further arrangement should be made with the targeted institutions, after consultation with the District Executive Manager.
 - In the course of your study there should be no action that disrupts the services.
 - After completion of the study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
 - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
 - The above approval is valid for a 3 year period.
 - If the proposal has been amended, a new approval should be sought from the Department of Health.
 - Kindly note, that the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated.


Head of Department

11/12/2017
Date

18 College Street, Polokwane, 0700, Private Bag x9302, POLOLKWANE, 0700
Tel: (015) 293 6000, Fax: (015) 293 6211/20 Website: <http://www.limpopo.gov.za>

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ANNEXURE 10: Pietersburg hospital approval



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DEPARTMENT OF HEALTH AND SOCIAL DEVELOPMENT

Enquiries: Mr MA Poopedi
Manager: Clinical Research
University of Limpopo - School of Medicine
aniaspoopedi@gmail.com

Ref: PMREC24JanUL2018A

Date: 24 January 2018

Protocol Title:

Hand hygiene knowledge, attitude and practices among health care workers of Pietersburg tertiary hospital, Polokwane, Limpopo province.

Candidate Name : Dr ME Setati

Department : Public Health Medicine

Assessment Outcome : **Approved**

Kind regards

Dr FLM Hyera

Chair of Research: Polokwane/Mankweng Complex

Head: Public Health Medicine

University of Limpopo - School of Medicine