FACTORS ASSOCIATED WITH HAND HYGIENE COMPLIANCE BY HEALTHCARE PROVIDERS AND STUDENTS AT THE NEWBORN UNIT OF MOI TEACHING AND REFERRAL HOSPITAL, ELDORET, KENYA

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THIS THESIS IS SUBMITTED IN PARTIAL FULFILLMENT OF THE MASTER OF MEDICINE IN CHILD HEALTH AND PAEDIATRICS, MOI UNIVERSITY, ELDORET, KENYA.

DECLARATION

Declaration by the Candidate

This research thesis is my original work and has not been presented for a degree in any other university. No part may be reproduced without prior permission of the author or Moi University.

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DEDICATION

I dedicate this thesis to my family. To my husband, Isaac Masoni, you are my greatest supporter. Thanks for stepping into my roles and taking care of our children while I burnt the midnight oil. My lovely daughters; Samora- Alice Nassanga, Sophie- Allisone Nabulungi and, Stephanie Nanteza, this is to show you that you can achieve anything you put your mind to. To my father, Major (Rtd) Maurice Mudi, thanks for putting me through school and instilling in me the virtue of hard work. To my beloved mother, Florence Mudi, thanks for your constant prayers and encouragement.

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ABSTRACT

BACKGROUND: Hand Hygiene (HH) is recognized by the Centers for Disease Control as the single most important factor in the prevention of healthcare- associated infections. However, according to the World Health Organization estimates, compliance to HH among HCP is 39% and has not improved despite promotion of the five critical moments of HH. Studies have shown behavior- change theory based interventions, with the Theory of Planned Behaviour (TPB), being likely to yield better compliance as a psychology framework which identifies predictors of HH.

OBJECTIVE: To assess the level of and identify the factors associated with compliance with HH practices by HCP and students at the MTRH NBU using the TPB.

METHODS:A hospital-based cross-sectional study was conducted in the NBU of MTRH between January 2019 to December 2019.The target population was HCP and students attending to neonates in the NBU and only those who consented were studied. Participants who had any skin condition that prevented them from using either the soap or alcohol- based hand disinfectant provided in the unit at the time of the study were excluded.Consecutive sampling was done for all participants.Data collection tools included the WHO HH observation form followed by a standard TPB questionnaire that assessed Attitude, Subjective Norm and Perceived Behavioural control towards HH. Descriptive statistics for continuous variables and frequency listings for categorical data. Fisher's exact and Pearson's Chi-Square to test for associations among sociodemographic characteristics and TPB variables with compliance to HH. A p-value of <.05 was considered statistically significant at 95% confidence interval.

RESULTS: Seventy-six HCP and students were included. Majority was female, 68.42% (52/76). The overall HH compliance was 26.31% (n=76), (95% CI: 16.87%, 37.68%). Compliance was highest among Paediatricians at 100% (4/4), with the least among students and interns, 0% (0/32). Qualified staff (Paediatricians, Paediatric Surgeons and Nurses) were more compliant (X^2 = 11.43; p = .001) and had higher attitude (X^2 = 13.69; p = .001) scores than all trainees (Registrars, Interns and Students). Trainees had both a lower desire to know the HH protocol, (X^2 = 6.78; p = .009) and lower desire to be seen as responsible by performing HH (X^2 = 7.34; p = .007).

C**ONCLUSION**: Hand hygiene compliance was lower than the World Health Organization global estimate. A higher median score of attitude among qualified staff was significantly associated with compliance.

RECOMMENDATION: Hand hygiene needs to be improved across most cadres. All trainees who attend to neonates should be taught the hand hygiene protocol and the importance of being responsible for their actions in order to improve their attitude towards hand hygiene.

LIST OF ABBREVIATIONS

HCAI Healthcare-associated Infections

HCP Healthcare providers

HH Hand hygiene

HR Hand Rub

HW Hand Wash

IREC Institutional Research and Ethics Committee

MTRH Moi Teaching and Referral Hospital

NBU Newborn Unit

TPB Theory of Planned Behaviour

WHO World Health Organization

OPERATIONAL DEFINITIONS

1. Hand hygiene action is the response to the hand hygiene indication(s); it can either be a positive action by performing hand rub or hand wash, or a negative action by missing hand rub or hand wash.

2. Hand hygiene indication is a reason that motivates a hand hygiene action such as before touching a patient, after touching a patient, after body fluid exposure risk, before an aseptic technique and, after touching patient surroundings.

3. Hand hygiene opportunity is defined by at least one hand hygiene indication.

4. Compliance with hand hygiene refers to the cleansing of hands with soap and water or the use of alcohol-based hand disinfectant for all the moments of hand hygiene occurring in one hand hygiene opportunity.

5. Consultants are medical doctors who have attained a Master of Medicine degree in Child Health and Paediatrics as well as those who hold a Master of Medicine degree in Paediatric Surgery.

6. Registrars are medical doctors who are pursuing a Master of Medicine degree in Child Health and Paediatrics as well as those pursuing a Master of Medicine Degree in Surgery.

7. Medical Officer Interns are medical doctors who have attained a Bachelor of Medicine and Bachelor of Surgery degree and undergoing mandatory one- year training under supervision by consultants.

8. Clinical Officer Interns are health care providers who have attained a Diploma in Clinical Medicine undergoing mandatory one- year training and supervision by Consultants.

9. Nursing Officers are healthcare providers who have attained a Degree or Diploma in Nursing.

10. Nutritionists are healthcare providers who have attained a Degree or Diploma in Nutrition.

11. Student refers to those pursuing Bachelor of Medicine and Bachelor of Surgery degree as well as those pursuing a Degree or Diploma in Nursing.

12. Qualified Healthcare Providers refers to Paediatricians, Paediatric surgeons ,Nurses and the Nutritionist

13. Trainee Healthcare Providers refers to Registrars in both Paediatrics and Surgery,Interns and students

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Hand hygiene (HH) refers to the cleansing of hands by the use of soap and water or alcohol-based hand disinfectant. It has been identified as the single most important measure in the prevention of hospital-based spread of infection and transmission of drug-resistant infections (CDC. 2002).

The World Health Organization (WHO) has been instrumental in the campaign for HH through an annual initiative that is evidence-based known as 'My Five Moments of Hygiene' (WHO. 2009). In this, the recommended times at which healthcare providers (HCP) should clean their hands are given. These include: before touching a patient, before aseptic procedures, after body fluid exposure, after touching a patient and, after touching a patient's surroundings. This is part of a major global effort to improve HH (WHO.2009).

HH reduces transmission of hospital-acquired infections as was shown by the University of Geneva experience where an increase in HH to 66% from baseline was associated with the reduction of infection transmission (Pittet et al., 2000). There was a call for researchers to identify reasons for poor compliance and design interventions that target these factors (Lautenbach et al.2011).

To improve compliance, there have been a variety of interventions that focused on an individual's HH practice. However, most of these interventions did not show significant improvement in compliance (Whitby et al., 2007),(Gould, Moralejo, Drey, & Chudleigh, 2010). Changing human behavior is a complex task that requires a clear understanding of factors that influence the specific behavior. Biological, environmental, educational and, cultural factors may influence behavior. As a preliminary step in

planning an intervention targeted at behavior change, these factors should be evaluated. Research has shown that one of the best ways of understanding behavior is the use of a theoretical framework that helps one to explain or predict the specific behavior. A systematic review of interventions to improve HH concluded that behavior change theory is a promising tool (Srigley et al., 2015). The commonest theory that has been applied to evaluate the determinants of improvement of HH is the Theory of Planned Behavior (TPB) (Ajzen, 1991).

The TPB assumes that the greatest predictor of an individual's probability of performing a specific behavior is the intention to perform that behavior. This study, therefore, aimed at using the TPB to identify the factors associated with HH compliance among HCP and students in MTRH NBU. This was done through direct observation and a structured questionnaire. It was envisaged that the findings of this study would inform the design of the right intervention to improve HH.

1.2 Problem Statement.

Interventions to improve HH that are not based on behavior change theories have been ineffective (Gould et al., 2010). This has resulted in perpetual poor HH compliance; WHO estimated the average compliance globally to be about 39% in the year 2009 (WHO, 2009).

In Kenya, compliance levels ranged from 0% to 54.1%; MTRH (Rono, 2013) 0%, Kenyatta National Hospital (Ngugi, 2012)15%, 32.5% at the Naivasha District Hospital (Isanda, 2014) and 54.1% at Ruiru District Hospital (Kamau, 2018). Locally, no study had used the behaviour change theory in evaluating the reasons for low HH compliance.

1.3 Justification for the Study

Although the WHO has recognized HH by HCP as an important component of patient safety, the compliance is generally low; (Ngugi, 2012), (Isanda, 2014), (Kamau, 2018). It had previously been reported to be at 0% in a clinical audit that was done by The Clinical Nurse Educators in all units of MTRH (Rono, 2013). The exact compliance level at MTRH NBU since then remained unknown.

Improving compliance to hand hygiene as advocated for by WHO is faced by challenges consisting of institutional and individual factors in the WHO report of the year 2011. Individual factors are those that prevent behavior change.

Interventions to improve hand hygiene that are not based on behavior change theories such as education initiatives, changing the type of hand cleansing product, or involving the HCP in choosing what hand cleansing product was to be used are reportedly ineffective (Gould et al., 2010).

The current study was therefore important in giving the background data on the status of compliance to HH and identifying the factors associated with HH practice by HCP and students using the TPB. This would provide vital information on constructs that would be used to design the right intervention to improve HH. The right intervention was bound to increase the compliance level from the 0% reported by Rono et.al., 2013 or better still improve and surpass the WHO global estimate which stands at 39% (WHO, 2009).

If this study were not done, then the status of HH compliance at the MTRH NBU that had been reported to be low would remain unknown and ineffective interventions would be used in a bid to improve this. Newborns would continue being exposed to the perpetual risk of HCAI (WHO, 2009) that has been shown in the WHO report of 2009 in Europe, to have hospital-wide prevalence rates of 4.6% to 9.3 %.

An estimated five million HCAI occurred in acute care hospitals in Europe annually contributing to 135,000 deaths per year, representing 25 million extra days of hospital stay. This corresponded to an economic burden of € 13 to 24 billion **(https:// helics.univ-lyon1.fr/helicshome.htm).**

The estimated incidence rate of HCAI in the United States of America was 4.5% in the year 2002, corresponding to 9.3 infections per 1000 patient -days and 1.7 million affected patients. This translated into an annual economic impact of US$ 6.5 billion in 2004. Approximately 99,000 deaths were attributable to HCAI.

In developing countries such as ours, difficulties of diagnosing HCAI, paucity and unreliability of laboratory data, limited access to diagnostic facilities like radiology and, poor medical record-keeping were obstacles to reliable HCAI burden estimates. Thus, the data on HCAI burden estimates was limited (WHO, 2009).

1.4 Research Question

What are the factors associated with compliance with WHO recommended hand hygiene practices among healthcare providers and students at the MTRH NBU?

1.5 Objectives

1.5.1 Broad Objective

To assess the level of and identify the factors associated with compliance with the WHO recommended hand hygiene practices by healthcare providers and students at the MTRH NBU using the Theory of Planned Behavior.

1.5.2 Specific Objectives

1. To determine the proportion of healthcare providers and students who comply with the WHO recommended hand hygiene practices in the Newborn Unit of Moi Teaching and Referral Hospital.
2. To identify the factors associated with compliance with the WHO recommended hand hygiene practices by healthcare providers and students in the Newborn Unit of Moi Teaching and Referral Hospital using the Theory of Planned Behavior.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Background

The World Health Organization (WHO) factsheet on Healthcare-Associated Infections (HCAI) has it that 7 in 100 and 10 in 100 in developed and developing countries respectively will acquire at least one HCAI. Newborns are at a peculiarly higher risk, that is, 3 to 20 times of acquiring an HCAI (WHO, 2009). This informed the development of a multimodal approach to HH improvement which included a system change that would avail water, soap and, hand rub, training and education, evaluation and feedback as well as reminders at the workplace (WHO, 2009).

As part of commitment to patient safety and reduction in HCAI, the WHO stipulated the key times at which HCP should perform HH actions, coined, 'My five moments for hand hygiene'. These include, before patient contact such as a before physical examination. Secondly, before an aseptic technique such as wound dressing and lumbar puncture. Thirdly, after body fluid exposure risk such as after drawing blood samples, clearing urine and faeces. Fourthly, after patient contact such as shaking hands or after a clinical examination. Lastly, after contact with a patient's surroundings such as changing linen or touching incubators (WHO, 2009). Despite this, the compliance to the recommended HH practice by HCP has remained unacceptably low. The WHO estimates the global compliance to be about 39% (WHO, 2009).

A review of interventions to improve HH found that those that are not based on behavior change theories are ineffective. These interventions included changing the type of hand cleansing product, involving the HCP in choosing the type of hand cleansing product as well as education programs (Gould et al., 2010).

2.2. Hand hygiene Methods

There are two modalities of performing HH. These are hand washing and Alcohol-Based Hand Disinfection. Handwashing involves the use of plain non-antimicrobial soap and water. Alcohol-based hand disinfection is a faster and more practical alternative to the use of soap and water. The effective alcohol content of the disinfectant is at least 60%. The recommendation is that alcohol-based hand disinfection should be performed for all HH indications apart from when there is body fluid exposure in which case handwashing should be done (CDC, 2002).

A systematic review of literature in 2006 in Germany found Alcohol-Based Hand Disinfection to be of better antimicrobial efficacy. Water and soap were responsible for skin irritation among healthcare workers and compliance would be improved if hand rub dispensers could be placed at strategic sites (Eckmanns et al., 2006).

2.3 Measurement of hand hygiene practices

2.3.1 Direct observation

The HCP are observed during routine patient care. This is considered the gold standard (Sax, Allegranzi, et al., 2007). It can be open observation where the HCP are aware that they are being observed or clandestine observation where the HCP are unaware. Open observation is the most direct measure of behavior but is costly and time-consuming. It may also result in behavior modification if people are aware that they are being observed and this is known as the Hawthorne effect (Hagel et al., 2015). Clandestine observation has minimal effect on behavior but has ethical issues arising from lack of disclosure.

The WHO in 2009 adopted an observational tool for assessment of HH compliance among HCP. This had been developed for use in Switzerland to assess compliance by

HCP (Sax et al., 2009) during the WHO First Global Patient Safety Challenge "Clean hands are Safer Care". In this, critical points that interrupt antimicrobial transmission are highlighted as the five moments at which HH actions should be performed. The tool was approved for use in all resource settings across the world by the WHO in 2009. The HCP are observed during routine patient care for compliance to HH by a trained observer who then records whether a HH indication is present and if it is, whether the appropriate HH action was performed. The results are interpreted based on compliance by indication to each of the five moments for HH. This is derived by dividing the total number of HH actions performed by the HCP by the total number of indications that were present for the duration the HCP was being observed. The result is converted into a percentage. Overall compliance is obtained by dividing the sum of all the HH actions per cadre by the sum of all HH indications for that given cadre. This facilitates inter-cadre comparison. However, there is no rating scale to interpret the percentage of HH compliance that has been fronted by the WHO or any other body.

2.3.2 Consumption of the amount of hand cleansing product

This is used as a surrogate measure of HH compliance. The amount of handwashing soap and alcohol-based hand rub used is positively correlated with HH practice. This is an accurate surveillance strategy but it precludes evaluation of individual behavior. At a University Hospital in France, a HH program was instituted following a baseline survey. There was an increase in the consumption of alcohol-based antiseptic and soap by 56% and 24% respectively and this was accompanied by a reduction in the rates of nosocomial infections by 397 per 1000 admissions (Christiaens et al., 2006) (Larson, Early, Cloonan et al. 2000).

2.3.3 Self- report

This can be done by the use of questionnaires. A survey conducted among nurses based in two Intensive Care Units in Nigeria found a self-reported HH compliance of 90% while that observed was 55% (Piras at al., 2016) A cross-sectional study at the Kuwait University in 6 major public hospitals was conducted in which self-administered questionnaires gave an overall self-reported compliance of 90% while the observed compliance was 33.4% (Al-Wazzan et al., 2011). In Thailand, a prospective survey of HCP HH practice found a self-reported compliance of 82.4% while that observed was 23.3% (Eiamsitrakoon et al., 2013). Although self-report is inexpensive, it has poor reliability and validity (Harris et al. 2000) (Larson et al. 2001).

2.3.4 Video monitoring

It is less costly than direct observation and ensures around the clock observation. However, it is associated with low participant acceptability because of the privacy breach. Technical hitches and power outages interrupt the monitoring (Brown et al. 1996).

2.4 Prevalence of compliance to Hand Hygiene by Direct observation.

Hand hygiene compliance is generally low and shows inter- cadre variation as demonstrated by the studies below:

HH Compliance in a hospital in the Intensive Care Unit in Saudi Arabia by direct observation revealed a 41% non-compliance rate which was positively associated with being a doctor and working in the Intermediate Care Unit (Mahfouz, El Gamal, & Al-Azraqi, 2013).

An observational cross-sectional study in a tertiary university in Turkey of HCP during routine patient care by direct observation found an overall compliance rate of 37%.

There was an inter-cadre difference. The nurses were 41.4% with doctors at 31.9%. Soap and water were used preferentially compared to alcohol-based hand gels (Karaaslan et al., 2014).

In a semi-urban teaching hospital in Nigeria, an observational cross-sectional study over a60- day period found the highest compliance to HH among senior nurses and surgeons. The highest compliance was found to be in the emergency room. HCP were more likely to be keen on HH if the was a directly observable threat to their well-being. The highest compliance was 61.8% after removing gloves and the least was 38.9% after contact with body fluids (Shobowale, Adegunle, & Onyedibe, 2016).

A prospective observational study in a teaching hospital in Kingston Jamaica in October 2016 assessing the compliance to WHO recommendations revealed a 38.9% compliance rate with no identifiable disparity among the different cadres. It was also evident that HCP were more likely to perform HH after as opposed to before contact with a patient (Nicholson et al., 2016).

Student nurses were directly observed in Norwegian University Hospital during placement. The overall compliance rate was 83.5%. The highest being after touching patient surroundings, after touching patients and, after body fluid exposure. The lowest moments were before touching patients and before aseptic techniques (Sundal et al., 2017).

A 24- hour observational study in a Nottingham University Hospital found 47% compliance among doctors and 75% in nurses. As concerns the specific moments, 100% before aseptic technique, 93% after body fluid exposure, 80% after patient contact, 68% before patient contact, and 50% after patient surrounding. The staff in the early shift has a lower compliance (Randle, Arthur, & Vaughan, 2010)

A cross-sectional study at the Naivasha District Hospital in 2014 on hand hygiene practices among HCP at the maternal and neonatal units by observation found an overall compliance of 32.5%. The highest compliance was among student nurses at 38.75% followed by nurses and doctors at 37.5% and 16.25 % respectively. Barriers to HH that were cited included lack of time, lack of alcohol-based hand rub, forgetfulness, use of gloves, and short patient contact (Isanda, 2014).

A descriptive cross-sectional study on the hygiene practices among healthcare workers at the Newborn unit at the Kenyatta National Hospital using the WHO five moments for hand hygiene tool found an overall compliance of 15%; doctors had the highest compliance at 25.7%. Healthcare workers were more likely to take a hand hygiene action after an activity than before. In addition to this, 52% of healthcare workers were unaware of the five moments on hand hygiene. They cited barriers such as forgetfulness and lack of supplies (Ngugi, 2012).

A clinical audit of all units at the MTRH including the NBU in 2013 by Clinical Nurse Educators by direct observation found 0% compliance for both gloved and ungloved procedures. The explanation of this was that sinks were inconveniently located, soap was unavailable, and when there, it was frequently taken by patients (Rono, 2013).

A hospital-based study in Ruiru was conducted employing the WHO observational tool for comparison of HH practice in the Maternity wing versus the general wards. The overall compliance was 54.1%. Each HCP had 4 sessions in which he or she was assessed. The highest compliance was found among nurses and doctors. (Kamau, 2018).

All the above studies used direct observation and using the WHO observation tool to assess HH.

2.5 Effectiveness of Hand Hygiene interventions.

2.5.1 Provision of soap and alcohol-based antiseptic

HH compliance in an observational study conducted in Kansas found that placement of alcohol-based disinfectant dispensers conspicuously and close to the point of care in an Intensive Care Unit setting resulted in a statistically significant increase in product use (Thomas et al, 2009). However, a systematic review of literature on interventions to improve HH practice among HCP found that provision of moisturized soaps appeared to make little difference to handwashing behavior but providing hand rubs near patient beds led to a minimal increase in the frequency with which staff decontaminate their hands (Naikoba & Hayward, 2001).

2.5.2 Feedback of performance

The Feedback Intervention Trial was conducted in the United Kingdom and it involved a 4- weekly cycle, 20minutes per week of feedback to the HCP concerning their observed HH practice. This was followed by personalized action planning. The result was an increase of 1.4 times in the odds of hand hygiene compliance (Fuller et al., 2012).

HH compliance was found to increase by about 15% when wireless real-time feedback was adopted in various units of a hospital in Brazil (Marra et al., 2014). However, a systematic review conducted of interventions to improve HH compliance among HCP found that feedback of performance can increase levels of handwashing but if feedback was not repeated regularly, then this effect was not maintained over long periods (Naikoba & Hayward, 2001).

2.5.3 Educational campaigns

At the University of Geneva, a hospital-wide campaign was conducted over a 5 years among HCP with emphasis on bedside use of alcohol-based disinfection. This resulted in an increase in HH from 48% at baseline in the year 1994 to 66% in 1997 (Pittet et al., 2000). Naikoba et al., 2001 in a systematic review of literature that was done in Nottingham on the effectiveness of interventions aimed at improving HH compliance found that one-off educational interventions resulted in very short- term improvement in HH practice

A study was conducted in India to evaluate the short and long-term effects of a series of two HH educational awareness campaigns in a tertiary care hospital. The HH compliance was assessed by direct observation and was found to be 28.1% at baseline and increased to 42.1% after the two campaigns but dropped to 36.4% two years later. Therefore, it was concluded that educational campaigns should be conducted repeatedly if HH compliance is to be maintained (Biswal et al., 2014).

Moreover, the effectiveness of interventions to improve HH compliance of nurses in the hospital setting in a systematic review conducted in Canada found that education did improve the HH compliance but the rates showed a decrease after 3 months. Therefore, it was suggested that more effective interventions be explored (Doronina et al., 2017).

2.5.4: Reminders at the workplace

These may be in the form of posters, musical parodies, or even text messages to HCP cellphones. Text messages were used in a comparative before and after study in France. These were sent to HCP after an initial 12- month baseline observation and encouraged the staff to be more vigilant with regards to HH. This initiative increased HH compliance with an odds ratio of 1.6 (Kerbaj et al., 2017).

2.5.5: Behaviour change approach

This approach has been used in a bid to improve HH compliance. An interventional cohort study was conducted in the United States of America. The initial intervention was access to alcohol sanitizer, education, as well as audit and feedback. Subsequently, the second part of the intervention was introduced and this included positive reinforcement and annual incentives. The HH compliance improved from19% to 44% at baseline to 74% to 84% at 2 years and remained sustained at 59% to 81% during the next 6 years of the program due to the behavioral aspect of positive reinforcement (Mayer et al., 2011).

A systematic review of the effectiveness of interventions aimed at increasing HH among HCP found that educational programs, strategically placed reminders at the workplace, and feedback improved HH compliance in the short term but this was not sustained in the long term(Naikoba & Hayward, 2001).

The role of the subjective norm which is a pillar of the TPB was demonstrated in a cluster randomized control trial in the Netherlands with two arms: the control group who received education, reminders as well as feedback whilst the experimental group received what the control group had but also leader-directed strategies. The compliance increased by 14% more in the short- term in the experimental group. This was sustained by 9% more in the long term in the experimental group in the long- term (A. Huis et al., 2013).

In the year 2015, a systematic review of the effectiveness of interventions based on psychological theories of behavior to improve HH compliance among HCP concluded that behavioral theory is a promising tool for improving HH compliance (Srigley et al., 2015).

In Germany, a cluster randomized control trial was conducted in Leipzig University Hospital. This was following the observation that the HH compliance had relapsed to baseline rates 4 years after the WHO "Clean Hands is Safer Care" campaign in 2009. This study was designed to investigate whether tailor-made interventions would bring more sustainable results in HH practice. Subsequently, the control group was subjected to the non- tailor-made interventions. The experimental group was subjected to tailor-made interventions consisting of educational training sessions and feedback discussions. At baseline, the HH compliance was 54% for the experimental group and 55% for the control group. The tailored interventions increased HH compliance to 64% and 70% in the first and second years respectively. For the control group, in the first year, the HH compliance increased to 68% but reverted to 64% by the second year (von Lengerke et al., 2017).

In summary, the above studies demonstrate the superiority of behavioral interventions over the other methods in providing sustainable improvement in the HH practices and that is what informed its use in this study.

2.6 Impact of Hand Hygiene practices.

2.6.1 Positive impact

Reduction in the rates of nosocomial infections has been observed following improved HH practices. A Hand hygiene intervention program was instituted after the initial baseline assessment of compliance. During the campaign, the consumption of soap and alcohol rubs increased by 56% and 24% respectively. This was used as a surrogate measure of improved compliance. The rates of Methicillin-Resistant Staphylococcus aureus (MRSA) decreased by 397 cases per 1000 admissions (Christiaens et al., 2006).

Similarly, there was a more than 40% reduction in new MRSA infection rates when HH compliance increased from 48% to 66% in Geneva University Hospital over five years

following a hospital program encouraging the use of bedside alcohol-based hand sanitizer (Pittet et al., 2000)

In Argentina, following a multimodal HH improvement strategy consisting of education, training, and feedback done over 2 years, HH compliance increased from 23.1% at baseline to 64.5%. This was in an Intensive Care Unit setting. Nosocomial infection rates reduced from 47.55 per 1000 patient- days to 27.93 per 1000 patient-days (Rosenthal et al., 2005).

HH practices were assessed before and after an interventional study in a neonatal Intensive Care Unit in China. The baseline HH compliance was found to increase from 40% to 53% before patient contact and from 39% to 59% after patient contact. This was HH education and alcohol-based antiseptic provision. Nosocomial surveillance revealed a reduction in the rates from 11.3% to 6.2% after 6 months (Lam, Lee, & Lau, 2004).

2.6.2 Negative impact

Poor HH practices provide a nidus for growth and multiplication of disease-causing organisms on the hands of HCP and may facilitate propagation. This was seen in a prospective comparative study in Turkey in 2008 to assess the effect of ring wearing and ring types on hand contamination among nurses working in the Intensive Care Unit of a pediatric hospital was carried out. The yield of colony counts of both gram-positive and gram-negative bacteria was higher in the nurses wearing rings compared to those not (Yildirim et al., 2008). The skin beneath rings was also found to be more heavily colonized with bacteria than skin not covered by rings (Boyce & Pittet, 2002). Chipped nail polish was also associated with an increased number of organisms on fingernails that were not removed by routine handwashing (Wynd, Samstag, & Lapp, 1994).

Prolongation hospital stay may occur as a consequence of poor HH practices leading to nosocomial infections. A prospective study was conducted alongside surveillance for nosocomial infections in Cambodia Pediatric Referral Hospital. The admitted children who got nosocomial infections were identified during daily ward rounds. What was found was a nosocomial infection rate of 4.6 per 1000 patient days. This infection rate was noted to be higher in neonates. The median length of stay was 25 days in the children with nosocomial infections compared to 5 days for those without.

Unnecessary death can result from sub-optimal HH practices. A 15month cohort study in Oklahoma followed by a case-control study in the Neonatal ICU of a university-affiliated children's hospital was done following a prolonged outbreak of Pseudomonas aeruginosa colonization of the bloodstream and endotracheal tubes. An intervention was instituted by improved handwashing and restriction of the use of artificial nails. Of the neonates admitted during the study period, 10.5 % of them acquired the infection and of these, 35% died. Pseudomonas aeruginosa was cultured from three nurses, two had long fingernails and one had short natural fingernails (Moolenaar et al., 2000)

2.7 Factors associated with hand hygiene practices

2.7.1 Factors that facilitate good hand hygiene practices

Provision of soap and water as well as alcohol-based antiseptic. This was observed in a neonatal Intensive Care Unit setting in Hong Kong, China. A prospective interventional study was conducted after the baseline assessment of HCP HH compliance. The intervention involved the liberal provision of alcohol-based antiseptic. A reassessment of HH compliance after 6 months demonstrated an increase in HH compliance by 13% and 20% before and after touching patients respectively (Lam et al., 2004).

Similarly, a prospective cross-over trial of alcohol-based hand gels in two Intensive Care Unit settings and one tertiary hospital found an increase in HH compliance from 37% to 67% and 38% to 69% respectively when alcohol-based hand rubs were availed (Rupp et al., 2008). Simon et al., 2004 noted that the provision of pocket-size hand sanitizers in Bruxelles was found to increase doctors' compliance as this reduced the time taken to move from the bedside to the stationary antiseptic dispensers.

The presence of role models. The TPB framework was used to explore the HH beliefs among Australian hospital-based nurses by use of a self-administered questionnaire. The participants reported that the presence of supportive colleagues as well as doctors positively influenced their behavior (White et al., 2015). Medical students reported that they copied the behavior of their superiors during clinical practice.

The presence of role models also emerged as a theme in a focused group discussion consisting of nurses, doctors, and medical students in a study exploring the reasons for poor HH among HCP in the Netherlands working in the Intensive Care Unit (Erasmus et al., 2009).

A prospective observational study conducted in the United States in a Pediatric and Cardiac Intensive Care Unit found improvement in HH compliance among junior practitioners when they were paired with seniors who were adherent to HH. The participants were critical care fellows and new nurses who were initially assigned to a senior supervisor who was non-adherent to HH practice and the compliance noted. They were then paired with a different supervisor who was strict on HH. The overall compliance increased to 56% from 22% at baseline when they were paired with supervisors who were strictly HH adherent (Schneider et al., 2009).

2.7.2 Factors that hinder good hand hygiene practices

Self- reported barriers include irritation by hand cleansing detergents and forgetfulness that were reported in a cross-sectional study in Thailand (Patarakul, Tan-Khum, Kanha, Padungpean, & Jaichaiyapum, 2005). In the United States, an explorative study was conducted to investigate the nurses' perceptions of reasons for persistent low rates in HH compliance. What was found was that high workload, understaffing, and difficulty accessing sinks were the main barriers (Sadule-Rios & Aguilera, 2017).

Poorly located sinks and lack of soap were cited in a clinical audit at MTRH (Rono et al., 2013) while high workload in Vietnam (Salmon & McLaws, 2015) and Germany (Knoll, Lautenschlaeger, & Borneff-Lipp, 2010) was responsible for poor HH compliance. Lack of alcohol-based hand sanitizer and forgetfulness were cited as the main reasons for non-compliance to HH in a cross-sectional study on the adherence to HH protocol by clinicians and medical students at Queen Elizabeth Central Hospital in Blantyre-Malawi (Kalata, Kamange, & Muula, 2013).

The male gender was observed to be associated with poor HH compliance in a study conducted through covert observation in Australia where the female participants were found to be significantly more compliant than their male counterparts (Mortel et al.,2001). A cross-sectional study at the Naivasha District Hospital to assess the HH compliance of HCP was conducted in the newborn and maternal units. The participants also filled in self-administered questionnaires which sought to find out barriers to HH compliance. Lack of alcohol-based antiseptic, forgetfulness, and use of gloves was cited by 68(86.1%), 48(60.8%), and 51(64.65%) out of the 79 participants respectively.

Lack of role models contributed to non-compliance among nursing students in Nottingham where they felt under pressure to fit into the HH practice of their seniors in

the clinical area (Barrett & Randle, 2008).In Egypt, a lack of role models also emerged as a theme in a focused group discussion that was being conducted to explore reasons for poor HH compliance (Lohiniva et al., 2015).

2.8Theories on Behavioural approaches in changing Hand Hygiene practice

Hand hygiene varies among HCP and health care facilities. For instance, an observational study in a tertiary university in Turkey of healthcare workers during routine patient care by direct observation found an overall compliance rate of 37%. There was an inter-cadre difference with nurses at 41.4% and doctors at 31.9% (Karaaslan et al., 2014).

This variation may be due to the influence of individuals and the community on behaviour (Whitby et al., 2007). To better understand this multilevel influence, the ecological approach could be used. According to this approach, factors that influence specific health behaviors operate at multiple levels including the intrapersonal, interpersonal, organizational, community, and public policy levels (Glanz, Rimer, & Viswanath, 2008). Determinants of behavior interact and influence each other across these levels. Although the most relevant potential determinants at each level should be identified, multi-level interventions are more effective in changing behavior (Whitby et al., 2007).

2.8.1 Self- efficacy model

This refers to a person's belief in his or her ability to succeed in accomplishing a task. It reflects confidence in the ability to exert control over one's behavior. It is founded on the premise that inherent confidence in one's own ability to perform a certain behavior is a predictor that an individual will perform it (Bandura, 1977). There are four principal sources of self-efficacy: past performance outcomes, self-modeling, social

persuasion, or feedback from others and, physiological responses such a one's emotional state.

A low self-efficacy is independently associated with non-compliance to HH. A cross-sectional study conducted in a university college in Belgium to identify and describe predictors of non-compliance to HH by nurses in the Intensive Care Unit. This was by observation and the use of a self-administered questionnaire based on the self-efficacy model. Nurses who reported poor self-efficacy were found to be less compliant (Wandel et al., 2010).

2.8.2 Trans-theoretical model

This behavioral change model postulates that an individual's readiness to change behaviour change is stage-based. This includes: pre-contemplation, contemplation, preparation, action, maintenance, and termination (Prochaska et al., 1997).

Pre-contemplation refers to individuals who are not intending to take action in the foreseeable future and can be unaware that their behavior is problematic. Contemplation refers to people who are getting ready to change and are beginning to recognize that their behavior is problematic. It is at this stage that they start to look at the pros and cons of their continued actions.

In the Preparation stage, the individual is considered ready to take action in the immediate future and may begin taking small steps toward behavior change. The action stage describes people who have made specific overt modifications to their problem behavior to adopt healthy behavior.

The maintenance stage refers to a person's ability to sustain an action for at least 6 months and is working to prevent relapse.

Lastly, the Termination stage in which individuals have zero temptation and they are sure they will not return to their old unhealthy habit as a way of coping (Prochaska et al., 1997).

This model of behavior change was used to improve HH compliance in 6 Intensive Care Units in Thailand. The baseline HH compliance of the 125 nurses and nurse assistants was assessed and they were assigned a behavior change stage using a questionnaire based on the Trans-theoretical framework. Stage-based interventions were instituted and the result was an increased HH compliance among the HCP by at least 20% (Apisarnthanarak et al., 2015).

2.8.3 Theory of Planned Behaviour (TPB)

This is a framework used in Psychology to explain human behavior by linking it to beliefs (Ajzen et al., 1991)(Ajzen, 1991). According to this theory, attitude toward behavior, subjective norms, and perceived behavioral control, together shape an individual's behavioral intentions and behaviour. TPB is a well-validated model that has been applied in hand hygiene in the hospital setting (Sax et al., 2007), (Jenner et al., 2002), (O'Boyle et al., 2001), (Whitby et al., 2007). The assumption is that the immediate antecedent to target or observed behavior is the intention to perform. In the current study, the target behavior was compliance to hand hygiene. Intention is in turn predicted by attitude, subjective norm and, perceived behavioral control. Attitude refers to a person's evaluation of the suggested behavior as positive or negative. For example; performing hand hygiene in my duty as I take care of newborns is good or bad. Subjective norm is the social pressure one experiences concerning what significant others would want of them concerning performance hand hygiene behavior. For example, Paediatricians would or would not approve of my hand hygiene practice.

Perceived behavioral control is based on the individual's beliefs about whether internal and external factors may prevent or assist in the performance of the behavior. For example, lack of time might prevent me from performing hand hygiene. The influence of these three factors results in higher motivation when an individual is presented with an opportunity to perform the target behaviour. There is a manual by Francis et al., (2004) which is the basis for construction questionnaires for TPB- based research work. A high correlation of attitudes and subjective norms to behavioral intention, and subsequently to behavior has been confirmed in a meta-analysis published in the Journal of Consumer Research Sheppard et al., 1988).

This theory has been used in programs to improve HH. The influence of senior doctors and nurses on their juniors and doctors' perception of being seen as role models improved compliance independent of system constraints and HH knowledge Pittet et al., 2002). This finding supported the role of the subjective norm in the TPB model.

A cross-sectional self-reported study investigating the predictors of HH practice among Saudi nursing students found that the majority displayed a moderate attitude towards HH at 52.1%, while only a few reported a poor attitude 13.1%. Approximately 68.7%, 29.8%, and 1.5% of the respondents reported moderate, good, and poor practice of HH, respectively. Having a good attitude toward HH was therefore found to be positively correlated with better compliance with HH. Therefore, it was recommended that educational programs should be put in place to promote a good attitude towards HH (Cruz &Bashtawi, 2016).

Peer pressure and high self-efficacy were found to be strongly predictive of compliance to HH by healthcare workers in a hospital with a 10- year history of campaigning for HH. This supports subjective norm and perceived behavioral control in TPB respectively Sax et al., 2007. (Sax, Uckay, et al., 2007).

A cluster randomized control trial was conducted in the Netherlands to investigate the effect of a team and leader-directed strategies to improve HH compliance among nurses in 3 hospitals in 67 wards. The participants were divided into 2 arms. One group got the state of the art education, reminders, feedback, and adequate provision of HH products. The experimental group got what the first group received but also was subjected to leader- directed strategies. This intervention was over six months. The compliance was found to increase from 23% to 42% in the short term and maintained at 46% in the long term in the control group. The experimental group that had received leader-directed strategies increased HH compliance from 23% to 53% in the short term and the compliance was sustained at 53% in the long term which was higher than the control group. This supports the role of the subjective norm in the TPB where the leaders were viewed as role models thus increasing HH compliance in both the short and long term.

The role of the subjective norm in the TPB was demonstrated in a prospective observational study in the United States in a Pediatric facility where senior supervisors who strictly adhered to HH influenced the behavior of their juniors who viewed them as role models. The overall compliance of the juniors increased to 56% when they were paired with supervisors who were strictly HH adherent up from 22% when they were paired with supervisors who did not adhere to recommended HH practices (Schneider et al., 2009).

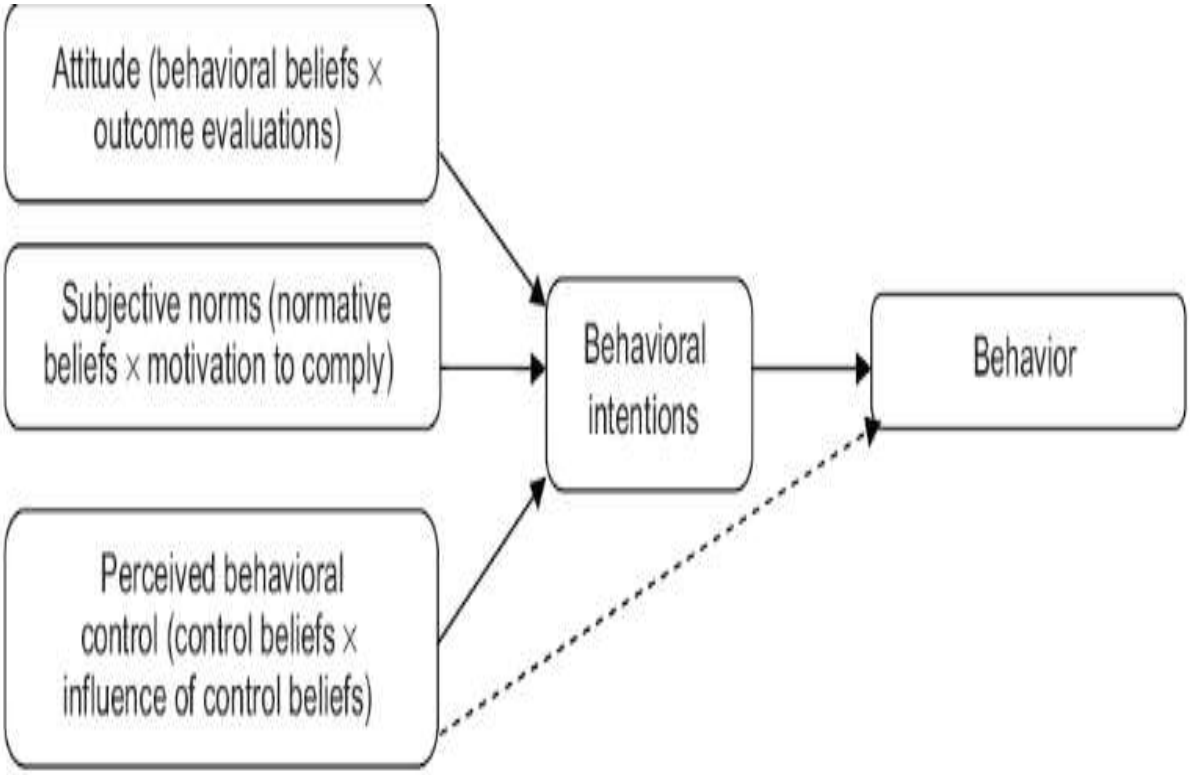
The role of peer pressure and role modeling came to light in an observational study in the United States. The study aimed to test the hypothesis that role modeling and peer pressure would impact HH practice. The participants were unaware that they were being observed. It was found that if the first person entering the room performed HH, then the mean compliance of the team was 64% compared with 45% if he did not. It

was also found that when the lead doctor was first to enter the room, the mean compliance was 66% compared to 42% when he did not (Haessler et al., 2012).

The TPB has been criticized citing that the intention to wash hands does not predict observed HH behavior (O'Boyle et al., 2001)(O'Boyle, Henly, & Larson, 2001a) where it was observed that the self-report and directly observed compliance did not correlate. However, this criticism has been dispelled by demonstrating the success of predictions made by this theory (Glanz et al., 2008); (Whitby et al., 2007) argued that the finding by O'Boyle et al., 2001 might be due to a loose definition of hand hygiene that did not differentiate between intrinsic and elective hand hygiene. Contrary to the findings by O'Boyle et al., 2001, a study in neonatal ICU found that subjective norm and self-efficacy predicted intention to perform HH (Pessoa-Silva et al., 2005). A significant relationship between intention and performance of HH was found. Therefore, they concluded that TPB successfully predicted HH behavior.

A systematic review in the year 2010 found that interventions to improve HH that are not based on behavioral theories were unlikely to produce sustained HH compliance (Gould et al., 2010).In addition to this, a systematic review of literature in the year 2012 found that in addition to knowledge and awareness, addressing social influence, attitude, self-efficacy, and intention could yield better HH compliance results Huis et al., 2012), (Huis et al., 2012). These are the constructs of the TPB which made it appropriate for this study.

2.9 Conceptual framework of TPB



Attitude refers to a person's overall evaluation of the behaviour. It has two components: beliefs about the consequences of the behaviour and the corresponding positive or negative judgments about each feature of the behaviour. Subjective norms are a person's estimate of the social pressure to perform or not perform the target behaviour.

Perceived behavioural control refers to the extent to which a person feels able to enact the behaviour. It has two components: how much a person has control over the behaviour and how confident a person feels about being able to perform or not perform the behaviour.

2.9.1: Limitations of the TPB

It assumes the person has acquired the opportunities and resources to be successful in performing the desired behavior, regardless of the intention. It also does not account for other variables that factor into behavioral intention and motivation, such as fear, threat, mood, or experience. In addition to this, it still does not take into account environmental or economic factors that may influence a person's intention to perform target behaviour. Moreover, it assumes that behavior is the result of a linear decision-making process, and does not consider that it can change over time. Finally, the time frame between "intent" and "behavioral action" is not addressed by the theory.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Design

This was a cross-sectional study. The study HCP and students were observed by participant observers only once during routine care of newborns in the MTRH NBU. There was no follow up was done. The design was chosen because this study was looking at HH compliance and the factors associated with this as outcome and exposure respectively, simultaneously and conclusions drawn.

3.2 Study Site

The study was carried out at the NBU of MTRH. The Hospital is within Eldoret town, Uasin Gishu County, 350 Kilometers North West of Nairobi. Uasin Gishu County is mainly an agricultural region with both large scale and small- scale farming. It has a mixed urban, peri-urban, and rural population of varying economic power (County, 2014).

MTRH is ranked as a tier 4 health facility by the Ministry of Health serving as a teaching hospital for Moi University School of Medicine, Nursing, Public Health, and Dentistry. Other institutions that utilize this facility include Kenya Medical Training Center (KMTC), Eldoret, and University of Eastern Africa Baraton School of Nursing. MTRH is also a training center for medical, clinical and, nursing officer interns. It is the second-largest referral facility in Kenya and serves as the main referral hospital for the Western part of Kenya and North rift and had a catchment population of approximately 13 million people (a third of the Kenyan Population).

The hospital is an 800- bed capacity tertiary hospital. Services provided range from primary to specialized care. The hospital’s newborn unit is located in the Riley Mother

and BabyHospital wing was opened in 2009. At the time of the study, the NBU had a capacity of 60-beds with six functional incubators and fifty baby cots. There were five subunits in the unit. Nursery A in which preterm babies who required incubator care were accommodated. Nursery B and C accommodated newborns who were born in MTRH. Newborns born before arrival at MTRH were accommodated in Born Before Arrival rooms one and two (BBA 1 and BBA 2).

The NBU of MTRH was where all neonates who presented to the hospital and require admission were taken care of. At the time of the study, it had an average occupancy of 70 babies at any given time. Daily ward rounds were done between 9:00 a.m and 1:00 p.m. led by the consultant assisted by the registrars. Medical students had clinical exposure by clerkship and ward work.

The total number of HCP and students in the NBU stratified into cadres was as follows: 5 Paediatricians, 3 Pediatric surgeons, 12 registrars in Pediatrics, 6 registrars in Pediatric Surgery, 20 nurses, 3 medical officer interns, 3 clinical officer interns,2 nutritionists and 7 nutritionist interns. The medical students were 15 while the nursing students were 10. This gave a total of 86 HCP and students. The cleaners in the unit were 3 in number.

The full complement of HCP on a typical weekday included1 Paediatrician, 1 Pediatric surgeon, 12 Paediatric registrars, 3 medical officer interns, 3 clinical officer interns, and 2 nutritionists. There were 5 nurses and 10 nursing students in each of the three shifts, that is, morning, afternoon, and at night. On average, there were usually about 10 medical students in NBU who were usually mostly present between 9 a.m. and 1 p.m after which they left for classes and come back later in the day and at night and assisted in the management of the patients.

On a typical day, the Paediatrician to patient ratio was 1: 70, the Paediatric surgeon to patient ratio was 1:35, the Paediatric registrar to patient ratio was 1:7, the Surgery registrar to patient ratio was 1:70, the nurse to patient ratio was 1:14, nutritionist to patient ratio was 1: 35, and the medical student to patient ratio was 1:7. The medical officer intern to patient ratio was 1:35.

At night and during the weekends, 1 resident in both Pediatrics and Pediatric Surgery were on duty. 1 Pediatrician and Pediatric Surgeon and were on call and they would give guidance to the resident on duty in case of any emerging challenges.

There was always a registrar in Paediatrics who was on duty 24 hours a day to receive babies who required emergency care in Maternity and Theatre as well as conduct ward reviews**.** The consultants, registrars, clinical, and medical officer interns interacted with the newborns during physical examination and aseptic techniques such as intravenous access and lumbar puncture.

Nurses were responsible for the administration of prescribed medicine as well as monitoring the vital signs such as temperature, respiratory rate, and pulse rate. They also interacted with the newborn during aseptic procedures such as wound dressing. In addition to this, they worked alongside registrars in Paediatrics during neonatal resuscitation. Nurse students interacted with the newborn by helping the nurses in discharging their duties.

The nutritionists taught mothers the technique of expressing breastmilk and also ensured that the attachment of the newborn to the breast during feeding was appropriate. In addition to this, they facilitated the addition of breast milk fortifier to the expressed milk for the preterm babies and weigh all the newborns daily.

Hand hygiene in the NBU was performed by the use of soap and water as well as alcohol-based rubs. There was a sink in each of the five subunits in the NBU as well as liquid soap.

Alcohol-based hand disinfectant bottles were placed below the cots and on the incubators. Pictorial demonstrations of the appropriate steps involved in performing HH were pinned on the walls as well to serve as reminders. Running water was available in the unit most days of the week but in the event of an interruption of this, a pipe was connected to a reservoir tank and water was allowed to flow continuously draining into a sink located along the main corridor of the NBU until tap water supply was restored. All HCP and students needed to wash hands with soap and water upon entry into the NBU.

3.3 Study Period

The study was conducted over 6months between February 2019 to July 2019. The first three months of this period were for assessment of HH practice. This was pegged on the 3- month rotation schedule for the registrars which was the longest duration among the participants that operate on a rotation basis. The remaining 3 months were dedicated to the second part of the study which was the self-administered questionnaire.

3.4 Target Population

The target population was all the HCP (Consultant Pediatricians and Paediatric surgeons, registrars in Paediatrics and Paediatric surgery, medical and clinical officer interns, nurses and nutritionists), medical and nursing students in the NBU.

3.5 Study Population

Only healthcare providers and students who consented were studied.

3.6 Eligibility Criteria

3.6.1 Inclusion criteria

Healthcare providers and students in the MTRH NBU during the study period regardless of how long they had been stationed in the unit.

3.6.2 Exclusion criteria

Any HCP or student who had any skin condition that prevented them from using either the soap or alcohol-based hand sanitizer provided in the NBU. They were excluded at the point of filling in the TPB questionnaire.

3.7 Sample Size Determination.

The sample size was determined using an online statistical A-priori Sample Size Calculator for Multiple logistic regression (http://www.danielsoper.com/statcalc/calculator.aspx?id=1)) [accessed 27/5/2017]. The desired parameters and the minimum sample size were as shown in the table below. The parameters were as stipulated in the manual constructed by Francis et al., 2004.

Anticipated effect size	0.15
Desired statistical power	0.8
Number of predictors	3
Probability level	0.05
Minimum sample size	76

To be powered to make conclusions on the factors associated with HH compliance, the minimum sample size required was 76. At any one point, there were between 60 to 80 HCP and students in the NBU. Therefore, these HCP and students were recruited consecutively until the minimum sample size was achieved.

3.8 Sampling Procedure

The HCP and students were sampled consecutively until the minimum sample size of 76 that was powered to conclude was achieved.

3.9 Data Collection Tools

3.9.1 Structured WHO five moments for hygiene observation form.

This is a tool that uses the evidence-based model for hand transmission of infection. It is a standardized user- friendly tool that used the "My five moments for hand hygiene" approach. It was approved for use in all healthcare settings (Sax et al.2009) for assessing compliance to hand hygiene practices by healthcare providers. It allows comparison of hand hygiene performance among professional categories in different facilities regardless of the setting. It has been used globally, regionally, and locally in Kenya for this purpose.

A trained observer makes observation of healthcare providers during routine patient care and documents in the appropriate column whether a hand hygiene action was performed or missed. An observation session is done for a minimum of 10 minutes and a maximum of 30 minutes per person being observed.

The tool provides for documentation of the facility, the setting, and the time the observation was being made. It has five columns for the five moments for HH under which the observer ticked whether an indication was present and if it was, whether the appropriate hand hygiene action was performed or missed.

In this study, HH compliance was on an all or none basis. This meant that for an individual to be considered compliant, he or she had to perform HH actions for all the HH indications that were present during the time allocated to observe him or her (**See Appendix 2).**

3.9.2 Structured self-administered questionnaire

This was developed based on TPB. This was a generic TPB questionnaire that was used to measure TPB constructs to investigate the attitudes and beliefs underlying health-related behavior. The questionnaire was based on the constructs of the TPB which assessed the intention to perform a health-related action that was influenced by attitude, subjective norm, and perceived behavioral control.

The manual for questionnaire construction was developed by Francis et al in 2004 **(See appendix 4)**and was intended to be the template for constructing questionnaires for studies that use the TPB. This was what was used to develop the self-administered questionnaire.

The questionnaire had five parts.

The first part collected the demographic data of the HCP and students including the age, gender, and professional category. The second part had questions that collected data on the general intention to perform hand hygiene. The score of intention to perform hand hygiene for an individual was the mean of the three intention scores. The third to fifth parts had questions on the three predictors of HH. Each with direct and indirect measures that have been explained below:

The third part had questions on attitude. To get the score for the direct measure of attitude, the questions that had negatively worded endpoints were recoded so that higher numbers always reflected a positive attitude to the target behavior. For example, an answer of 6 became a score of 2 for the pleasant to unpleasant scale and the good to bad scale. The overall attitude score was equal to the mean of the item scores. To get the score for the indirect measure of attitude, each behavioral belief, the belief score on the likely to unlikely scale was multiplied by the evaluation score on the extremely

undesirable to extremely desirable scale, and the resulting products were summed to create an overall attitude score. A positive score meant that overall, the participant was in favor of performing HH. A negative score meant that overall, the participant was against performing HH. The higher the score, the direct and indirect attitude of the individual towards hand hygiene performance.

The fourth part had questions that collected data on subjective norm. The score of the direct measure of the subjective norm was obtained by the mean of the item scores. The score of the indirect measure of subjective norm was the sum of the product of the normative beliefs and the corresponding motivation to comply. A Positive score implied that the participant experienced social pressure to perform HH. A Negativescore implied that the participant experienced social pressure not to perform hand hygiene.

The fifth part had questions on perceived behavioral control. The score for the direct measure of perceived behavioral control of an individual was the mean of the item scores. These scores were recoded for the items with a negative endpoint so that a high score reflected a greater level of control over the target behavior. For example, a score of 6 on an easy to difficult scale was scored as 2. The score for the indirect measures of perceived behavioral control was obtained by the sum of the product of the item scores on the unlikely to likely scale with the corresponding item score on the less likely to more likely scale. A positive score meant that the participant felt in control of performing HH while a negative score meant that the participant did not feel in control of performing HH.

The second to the fifth parts had questions whose responses were on a predetermined Likert scale.

This questionnaire was piloted at Kapsabet County Referral Hospital which had a heterogenous population similar to the target population. Reliability testing using test-retest on the developed questionnaire was done on a group of 10 healthcare providers stationed at NBU. It was administered to them and repeated in a 2- week interval to see if their understanding of the questions was the same. They gave real-time feedback as they filled it in and instrument deficiencies were addressed.

(**See Appendix 3**).

Test-retest reliability testing results of the TPB questionnaire

Variable	**ICC**	**95% CI**
Intention	0.996	(0.974,0.999)
Attitude	0.737	(0.016, 0.967)
Subjective norm	0.758	(0.091,0.972)
Perceived Behavioral Control	0.984	(0.886,0.998)

All the ICC (Inter-class correlation) was high, indicating a high degree of similarity between scores within a target and high reliability of individual target scores.

Reliability of greater than 70% is considered acceptable.

These two tools complemented each other in this study. Since direct observation is the gold standard for assessing HH, it gave the compliance for each individual and addressed the first objective of this study. On the other hand, the TPB tool identified the factors associated with HH practice through the self-administered questionnaire, addressing the second objective.

3.10 Study Procedure

One research assistant who was a Clinical Nurse Educator based in the Newborn Unit was recruited and trained for one week by the Principal Investigator on the study objectives, procedure, use of the WHO observation tool as well as ethical consideration. Both the nurse and principal investigator were stationed in the NBU for duty at the time of the study and therefore collected data actively as participant observers. This was so as not to raise suspicion and influence the behavior of HCP. Blank consent in the form of a notice pinned on the notice board informing HCP and students that their HH was being observed was undertaken for observation of HCP and students followed by debriefing during consenting for the questionnaire in which they were informed that they had been observed for their HH practice at an earlier date. Neither the timing, date nor who was making the observation was indicated in the blank consent (See Appendix 5). Blank consent was undertaken because waiver of consent had been declined by the IREC at the proposal stage citing ethical concerns.

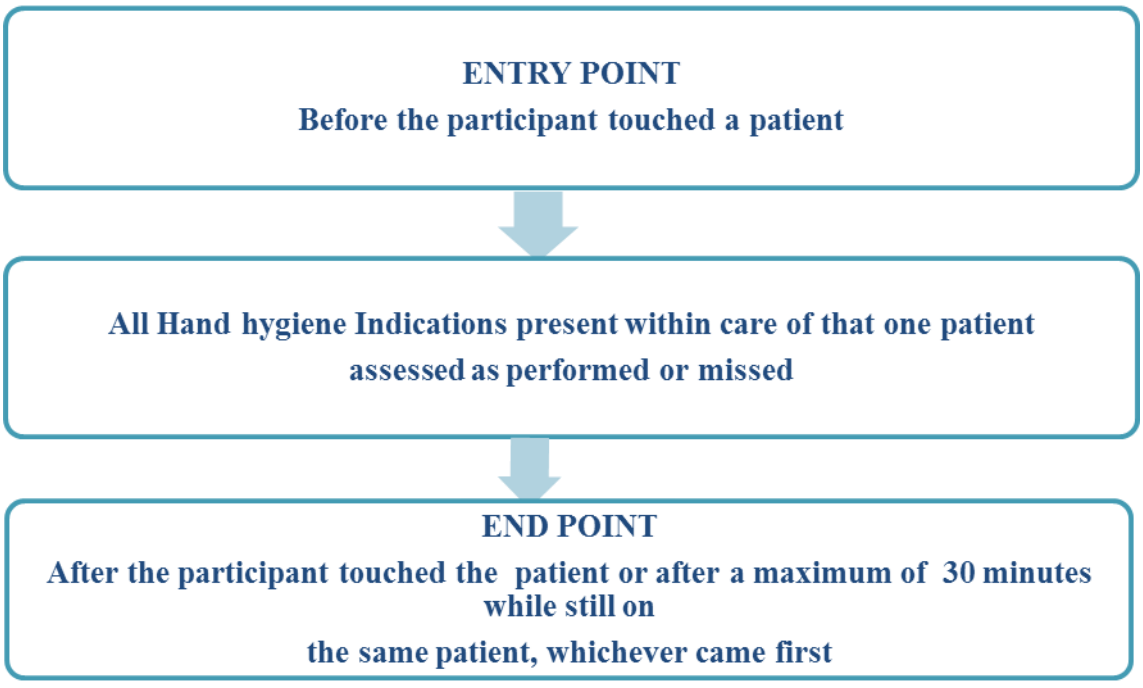
The assessment for HH practice was made between 8:00 a.m. and 5:00 p.m on Monday to Friday so as not to raise suspicion among the participants.

As a pre-requisite, the research team had to confirm the availability of water and soap as well as alcohol-based hand disinfectant before any assessment of HH practice was made. The timing of observations was unannounced and made at predetermined times known only to the research team. This was facilitated by the duty roster that was available in the unit. The observer had to be in the same room as the participant was for the assessment to be done. The observations were recorded in the appropriate column of the WHO five moments for the HH observation form as either performed or missed. Each participant had only one HH opportunity. All the five moments for HH occurring in that one opportunity were observed and documented as performed or missed.

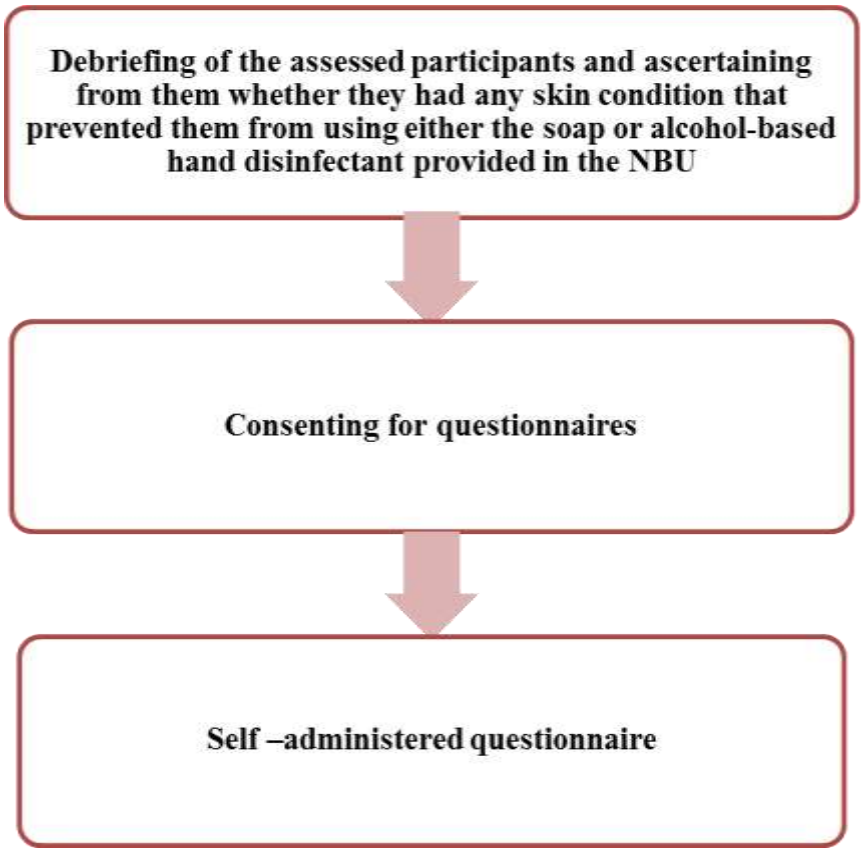
Specific identifiers were assigned to the observed HCP and students which then linked them to their respective questionnaires. This first part of the study was took 3 months. A list was created containing the names of the observed participants and their respective cadre. A team leader for each of the cadres that operate on a rotational basis was identified. The research team took the leaders' phone number in order to facilitate tracking of those observed.

The second part of the study was a self- administered questionnaire based on the constructs of the TPB to obtain data on the demographic characteristics as well as intention, attitude, subjective norm and, perceived behavioral control towards HH. This took a period of 3 months as well. The observed participants needed to consent for the second part of the study in order to fill out the questionnaire. None of them declined to consent after being informed that they had been observed and assessed at an earlier date.

3.10.1: Schema showing the study procedure for assessment of Hand Hygiene



3.10.2: Schema showing study execution of filling in TPB questionnaire



3.11: Data Management.

The data collected using the WHO hand hygiene observation tool and the TPB questionnaire was entered into an electronic database. It was then de-identified and the database password protected. This password was available only to the principal investigator and later on to the statistician for analysis. The questionnaires were kept in a safe cabinet under a lock after completion of data entry and cleaning and the key held by the principal investigator.

3.12: Data analysis.

Data was analyzed using the Statistical Package for Social Sciences (SPSS) software version 21. Categorical variables such as the Professional categories and gender were analyzed using proportions. Continuous variables such as Age were analyzed using measures of central tendency, that is, the mean and median.

Compliance with the WHO HH recommendations among the professional cadres were analyzed as a percentage.

Chi-square and Fisher's exact test were used to test associations between compliance with hand hygiene and demographic characteristics as well as TPB variables (intention, attitude, subjective norm, and perceived behavioral control).

Bivariate analysis was used to test the association between compliance and all TPB variables by the use of a median split of the scores of the TPB constructs.

The mean of the intention score was entered as a dependent variable and the mean score of the direct measures of attitude, subjective norm, and perceived behavioral control as predictor variables.

Data were analyzed at a 95% confidence interval and a p-value of < 0.05 was considered statistically significant. The data was presented using graphs and tables.

3.13 Ethical consideration

Approval was sought from the Institutional Research and Ethics Committee (IREC), Formal Approval Number 2093. Permission was sought from the Chief Executive Officer of the Moi Teaching and Referral Hospital. Blank consent was undertaken for the observational part. This was in the form of a notice pinned up on the two notice boards in the NBU that the HH practice of HCP and students was being observed as they attended to newborns (See Appendix 2). This was followed by debriefing during consenting for the questionnaires. At the time of debriefing, individual feedback of the hand hygiene compliance assessment was done. Informed written consent was sought from all the HCP, nursing, and medical students for the second part of the study which was filling in the structured questionnaire.

Data collection forms did not contain the names of the participants but had unique codes. There was neither coercion nor incentives to participate in the study. Confidentiality was maintained throughout the study and the data collected was only available to the research team for analysis purposes. The data was stored safely and shall be disposed of after the statutory duration of time.

3.14 Dissemination of results

This was through this written thesis and an oral school defense in a forum that was convened by the Moi University School of Medicine. The staff at the NBU were given group feedback of these findings and so was the MTRH administration. Besides, the findings shall be presented in national or international research meetings and published in peer-reviewed journals.

CHAPTER FOUR

4.0 RESULTS

4.1: Demographic Characteristics of the Study Participants

A total of 76 participants were included in this study. Of these, more were female, with a female to male ratio of 2.2:1. The mean age was 31.22 years (SD 8.29) with a range of 20 to 58 years. Nurses comprised the majority as shown in Table 1 below.

Table 1: Demographic Characteristics of the Study participants (n=76)

Variable		Frequency	%
Sex	Female	52	68.42
	Male	24	31.58
Cadre	Nurse	20	26.32
	PaediatricRegistrar	12	15.79
	Medical Student	12	15.79
	Nutritionist	6	7.89
	Surgery Registrar	5	6.58
	Nursing student	5	6.58
	Nurse intern	4	5.26
	Paediatrician	4	5.26
	Medical Officer intern	3	3.95
	Clinical Officer Intern	3	3.95
	Paediatric surgeon	2	2.63

4.2 Indications for Hand Hygiene Assessed.

There was the opportunity to observe all participants before and after touching a patient as well as after touching a patient's surroundings. However, not all participants had an opportunity to be observed during hand hygiene before performing an aseptic technique or after contact with body fluids as shown in Figure 1 below.

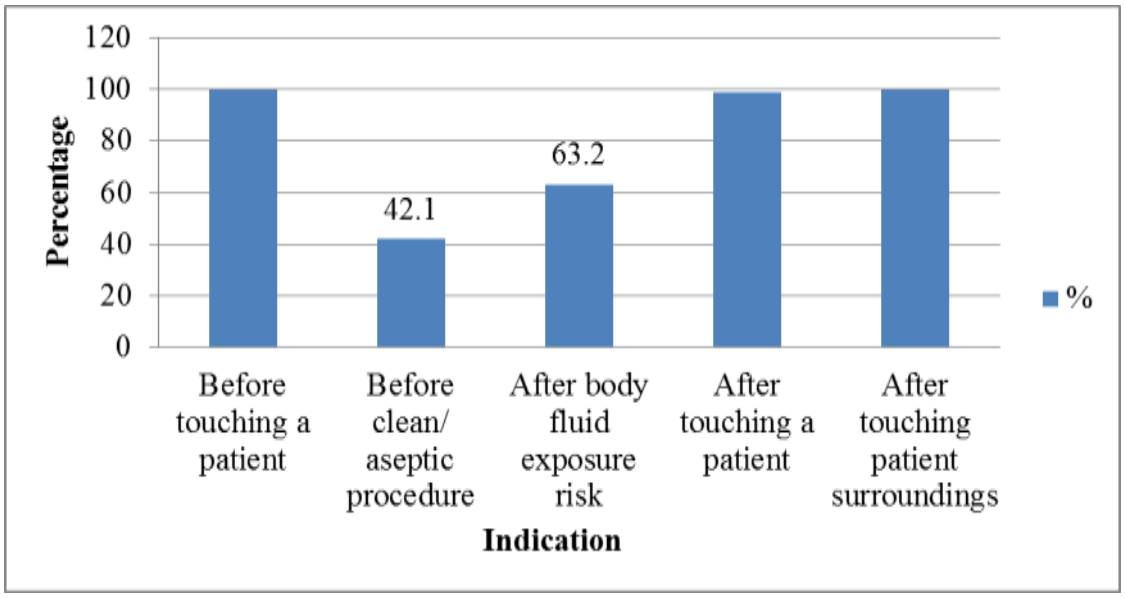


Figure1: Proportion of participants assessed for each hand hygiene indication

4.3 Compliance to all Hand Hygiene opportunities

Each participant had a varied number of hand hygiene opportunities in the one session that assessment was done for the various indications, with the maximum being 5. In total, 307 hand hygiene opportunities were assessed for the 76 participants.

4.4 Choice of Hand Hygiene Modality

Compliance with hand hygiene was observed in 184 hand hygiene opportunities out of the total 304. For these, there were two modalities of performing hand hygiene, which was, alcohol-based hand disinfection and the use of soap and water. The modality that was used in most hand hygiene opportunities was alcohol-based hand disinfection at 77.18%.

4.5: Choice of Hand hygiene modality for the Five Indications

The Hand Hygiene modality after body fluid exposure by most participants who were assessed and were found to be compliant was the use of soap and water as shown in Table 2 below:

Table 2: Choice of Hand hygiene modality (n=184)

Indication	Procedure	Frequency	%
Before touching a patient (n=59)	HW	12	15.79
	HR	47	61.84
Before clean/ aseptic procedure (n=21)	HW	0	0
	HR	21	27.63
After body fluid exposure risk. (n=28)	HW	22	28.95
	HR	6	7.89
After touching a patient(n=50)	HW	4	5.26
	HR	46	60.53
After touching patient surroundings (n=26)	HW	4	5.26
	HR	22	28.95

HW Hand Washing with soap and water

HR Hand Rub with Alcohol- based hand disinfectant

4.4: COMPLIANCE TO HAND HYGIENE

A participant was considered to be compliant with hand hygiene if he or she performed either alcohol-based hand disinfection or handwashing with soap and water for all the opportunities that were assessed. This was based on the indications that were present.

4.4.1: Overall Hand Hygiene compliance

The overall hand hygiene compliance observed was 26.3% (95%CI: 16.87%, 37.68%).

4.4.2: Compliance with each of the five specific indications

With regards to compliance with hand hygiene by the five specific indications, the highest was observed before touching a patient with the least being after touching a patient's surroundings as shown in figure 3 below.

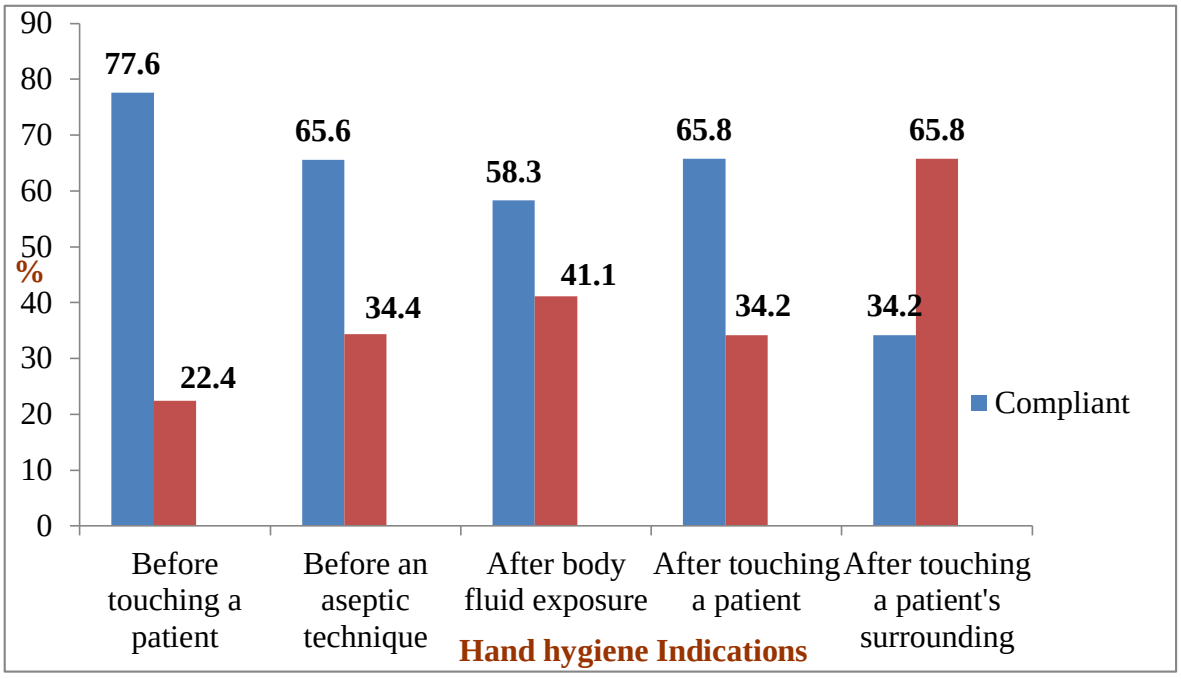


Figure 2: Hand hygiene compliance by the specific indications.

4.4.3:Compliance by cadre- specific category

The cadre-specific compliance rate was calculated as a percentage of the participants who were compliant divided by the total number of participants in that category. The highest compliance was observed among the Paediatricians with the least among the interns and medical students as shown in Table 3 below.

Table 3: Compliance by Cadre- specific category

Cadre	**Non- Compliant**	**Compliant**	**% Compliance**
Paediatrician	0	4	100
Paediatric Surgeon	1	1	50
Nurse	12	8	40
Paediatric Registrar	8	4	33.3
Surgery Registrar	4	1	20
Nursing Student	4	1	20
Nutritionist	5	1	16.67
Medical student	12	0	0
Medical Officer Intern	3	0	0
Nurse Intern	4	0	0
Clinical Officer Intern	3	0	0

4.4.4: Hand Hygiene Compliance by Gender

When compliance was looked at in terms of gender, the proportion of female participants who were compliant was higher than that of males but this was not statistically significant as shown in table 4 below.

Table 4: Compliance by Gender (n= 76).

Variable	Compliant		Total	X^2	p-value
	No	Yes			
Gender					
Female	37 (71.14)	15(28.86)	52 (68.42)	0.544	0.461 [1]
Male	19 (79.17)	5 (20.83)	24 (31.58)		

[1] **Chi-Square**

4.4.4: Hand Hygiene Compliance by age

As regards age, the participants who were above 30 years were found to be significantly more compliant as shown in table 5 below. Seven participants declined to divulge their age and this explains why n=69.

Table 5: Compliance by Age (n= 69).

Variable	Compliant		Total	Test statistic	P-value
	No(%)	Yes(%)			
Age(years)					
< 30	35(92)	3(8)	38	16.3	<0.001[2]
>30	15(48.39)	16(51.61)	31		

[2] **Fisher's exact test**

4.5: FACTORS ASSOCIATED WITH HAND HYGIENE COMPLIANCE

4.5.1: Composite Univariate analysis of factors that affect Hand Hygiene compliance

The mean score for Intention to perform hand hygiene was 6.4 (91.4%). Among the factors that could affect intention to perform hand hygiene, the highest score was in Direct Attitude (6.5, 92.9%) and the lowest was Indirect Perceived Behavioural Control (19, 12.9%). This represented the scores for all participants without stratifying them into cadres and is as shown in table 5 below.

Table 6: Composite univariate analysis of Factors that affect compliance to Hand Hygiene Compliance

Factor	Mean (% of maximum)	Median	Interquartile range	
			25%	75%
Intention	6.4(91.4)	7	6.3	7
Direct Attitude	6.5(92.9)	7	6.4	7
Indirect Attitude	176 (69.8)	184	153	204
Direct Subjective norm	5(71.4)	5.5	4.8	6.5
Indirect Subjective Norm	19 (70.3)	21.5	14	27
Direct Perceived Behavioral control	4 (57.1)	4.8	4	5.5
Indirect Perceived Behavioral control	19(12.9)	14.5	3.3	27

4.5.2: Correlation of Intention to perform Hand Hygiene and factors that influence it.

Analysis of significant prediction of compliance by intention showed no correlation between the two (X^2 4.14; P= .844). Direct attitude, indirect attitude and, indirect subjective norm had a positive correlation with the intention to comply with hand hygiene.However, the strength of correlations for all the three were low but indirect attitude had the highest effect as shown in table 6 below.

Table 7: Correlation of Intention to perform hand hygiene and factors that influence it.

	Kendall's tau	P- value
Direct Attitude	.211	.037
Indirect Attitude	.228	.013
Direct Subjective Norm	.036	.701
Indirect subjective Norm	.191	.046
Direct perceived behavioural control	.009	.923
Indirect Perceived behavioural control	.107	.239

4.5.3: Association of TPB beliefs with compliance to Hand Hygiene.

Given that intention was rated as positive by most participants, further analysis of the factors that would affect compliance was done by the use of the median split to divide the participants into those with low or high intention. Compliance with hand hygiene was not significantly different between those with low compared to high intention (p, 0.09). Similarly, having a low direct or indirect attitude towards hand hygiene, low-median subjective norm and, low-median perceived behavioural control did not significantly influence hand hygiene compliance (p,>.05) as shown in table 7 below.

Table 8: Association of intention and other TPB beliefs with compliance to hand hygiene.

Factor	Median Split	Non-compliant	Compliant	Fisher's Exact Test	P-value
Intention:	Low	19	3	2.57	0.091
	High	37	17		
Direct Attitude:	Low	30	6	2.44	0.098
	High	25	12		
Indirect Attitude	Low	29	9	.35	0.371
	High	26	11		
Direct Subjective Norm	Low	23	9	.09	0.48
	High	33	11		
Indirect Subjective Norm	Low	29	9	.27	0.397
	High	27	11		
Direct Perceived Behavioral Control	Low	32	11	.028	0.536
	High	24	9		
Indirect Perceived Behavioral Control	Low	29	10	.019	0.549
	High	27	10		

4.5.4: Comparison of behavioural beliefs that affect compliance to hand hygiene between Paediatricians and Trainee Paediatricians (Paediatric Registrars)

In the sub-analysis of Paediatricians and Paediatric Registrars, it was found that compliance was significantly higher among Paediatricians. In addition to this, Paediatricians had a significantly higher indirect attitude compared to the Paediatric registrars as shown in table 8 below.

Table 9: Association of factors associated with compliance with hand hygiene among Paediatricians versus Trainee Paediatricians (Paediatric Registrars)

Factor	Median Split	Paediatricians	Paediatric Registrars	Fisher's Exact Test	P-value
Compliance	Non- compliant	0	8	5.33	0.038
	Compliant	4	4		
Intention:	Low	0	2	0.76	0.55
	High	4	10		
Direct Attitude:	Low	1	6	0.762	0.392
	High	3	6		
Indirect Attitude	Low	0	9	8.182	0.011
	High	4	2		
Direct Subjective Norm	Low	2	7	0.085	0.608
	High	2	5		
Indirect Subjective Norm	Low	3	7	0.356	0.511
	High	1	5		
Direct Perceived Behavioral Control	Low	4	7	2.42	0.181
	High	6	5		
Indirect Perceived Behavioral Control	Low	2	2	1.78	0.245
	High	2	10		

4.5.5: Comparison of Qualified staff/ Faculty and Trainees as regards Compliance with Hand Hygiene and factors that affect it.

The participants were then dichotomized into Qualified staff versus Trainees based on whether one was in the NBU as an employee of Moi university/MTRH or undertaking training at any level. Qualified staff (Paediatricians, Paediatric Surgeons and, Nurses) had significantly higher compliance to HH compared to all participants that were in training (Registrars, Interns, and Students). Qualified staff had a significantly higher direct attitude compared to Trainees as shown in table 9 below.

Table 10: Comparison of Qualified staff/Faculty and Trainees as regards compliance with Hand Hygiene and factors that affect it.

		Qualified staff / Faculty	**Trainees**	**Test statistic (X^2)**	**p-value**
Compliance	Non-compliant	13	43	11.43	0.001
	Compliant	13	7		
Intention	Low	8	14	0.01	0.501
	High	18	36		
Direct Attitude	Low	4	32	13.69	0.001
	High	19	18		
Indirect Attitude	Low	12	26	0.324	0.632
	High	14	23		
Direct Subjective Norm	Low	8	24	2.1	0.221
	High	18	25		
Indirect Subjective Norm	Low	11	24	0.93	0.234
	High	15	25		
Direct Perceived Behavioral Control	Low	16	27	0.396	0.351
	High	10	23		
Indirect Perceived Behavioral Control	Low	15	24	0.643	0.288
	High	11	26		

4.5.6: Sub- analysis by comparison of components of Attitude versus Compliance with Hand Hygiene between Qualified staff / Faculty and Trainees.

Since median scores of Attitude were lower among Trainees, further sub-analysis was done on the individual components of Attitude. Compared to trained faculty, a significant number of trainees thought that hand washing was not good and unpleasant activity. In the indirect measures of attitude, trainees were significantly less likely to desire to know the hospital's HH protocol (X^2=6.778; p= .009) and being viewed as a responsible person if one followed the HH protocol (X^2 7.34; P= .007).

Table 11: Comparison of components of attitude between Qualified staff / Faculty and Trainees.

Component of attitude	Test Statistic(X^2)	P- value
Performing hand washing is good	5.59	.018
Performing hand hygiene is worthless	.337	.562
Performing hand washing is unpleasant	6.22	.013
Performing hand hygiene is harmful to me and the patient	.89	.345
I know the hospital's handwashing protocol;	6.778	.009
Believe hospital's handwashing protocol reduces cross-infection	1.73	.189
Believe that following the handwashing protocol protects one from serious infection;	1.32	.250
Following the handwashing protocol protects patients from serious infection;	2.15	.142
I am responsible for reducing the risk of cross-infection in my patients;	2.96	.085
Patients have a right to expect high hand hygiene standards from me	0.005	.945
Offensive odour/ material is removed from my hands if I wash them	0.41	.522
By following the handwashing protocol, I will be viewed as a responsible health worker or student	7.34	.007
The availability of antibiotics to treat infection means that I don't need to wash my hands as much	2.47	.116
I don't believe handwashing is necessary after minimal contact with a physically clean patient	3.22	.073

CHAPTER FIVE

5.0 DISCUSSION

5.1. COMPLIANCE TO HAND HYGIENE

5.1.1: Overall compliance to Hand Hygiene

Slightly more than a quarter of the participants were compliant with hand hygiene.

There have been reports of lower compliance rates from other studies. At the Kenyatta National Hospital, an observational study of HH practice found a compliance rate of 15% which was mainly ascribed to inadequate hand-hygiene facilities (Ngugi, 2012). At the Moi Teaching and Referral Hospital (MTRH), an observational study by Rono et al (2013) conducted by the Clinical Nurse Educators in all units of the hospital including the NBU reported 0% compliance. Rono's study had a similar methodology to the current study in which compliance was assessed by participant observers. It also had a similar definition of compliance to hand hygiene which was on an all or none basis. At the time of the study, it was reported that there was a general lack of handwashing facilities and supplies (Rono, 2013).

The improved compliance may have been occasioned by improved infrastructure in terms of the consistent provision of soap and water as well as alcohol-based hand disinfectant at the time of the current study. The policy then was a bottle of alcohol-based hand disinfectant per incubator or cot.

A similar compliance rate (23.55%) was reported in Malawi (Kalata et al., 2013). This might have been observed as a result of similarity in the study population which were both heterogeneous consisting of consultants, registrars, interns, nurses, and students. In addition to this, both studies employed a similar methodology of direct observation of HH practice.

The compliance reported in this study was lower than the global estimate which stands at 39% (WHO, 2009). Two local studies conducted by covert observation reported

higher compliance rates. At the Ruiru Sub-county Hospital, the overall hand hygiene compliance was 54.1%(Kamau, 2018) and the study done in the Naivasha District Hospital found an overall compliance of 32.5% (Isanda, 2014). The difference between our findings and those in the two studies in Naivasha and Ruiru could have been occasioned by the fact that the current study had a more stringent definition of compliance to hand hygiene which was on an all or none basis. This meant that to be considered compliant, the participant had to perform hand hygiene actions for all HH indications assessed in one session. In contrast, in the two studies by Isandaet al (2014) and Kamau et al (2018), each participant had four HH sessions to be assessed, and compliance was calculated as a percentage of the number of performed actions divided by the total number of HH indications.

Similarly, the observed compliance was lower than the 55% reported in a Nigerian study Piras et al., (2016). However, the Nigerian study population was limited to qualified nurses. This was in contrast with the current study which had a heterogeneous population. Karaaslan et al (2014) in an observational study on HH compliance in a Paediatric and Neonatal Intensive Care Unit in Turkey reported a higher rate of 37%, however, her participants were aware they were being observed because consent was sought directly from them and this could have biased the study.

The foregoing findings show that the local practice of HH has improved remarkably over time in-keeping with global trends (Global Hand Washing Partnership, 2018). However, despite the availability of HH facilities and supplies, the rate still falls below the global estimate. There is room for improvement guided by the factors behind non-compliance.

5.1.2: Compliance to HH by indication

Slightly more than three-quarters of the participants were compliant to HH before touching a patient. The least compliance was observed after touching a patient's surroundings, comprising one-third of the participants. This could be a result of the continuous health promotion messages in the NBU that lay more emphasis on performing HH before touching a patient as a key component of patient safety. In addition to this, the routine practice was that all HCP and students needed to wash their hands upon entry into the NBU.

In a similar study, White et al (2015) found that nurses least complied with HH after touching a patient's surroundings. The study in Naivasha by Isanda et al (2014) found the highest compliance (53%) after body fluid exposure and the least compliance to be before an aseptic technique. Similarly, the study at Ruiru reported the highest compliance after body fluid exposure (Kamau, 2018). The reason for this might have been that it was a reflection of self-protection and preservation as opposed to patient safety.

In Istanbul Karaaslan et al., (2014) found equal compliance of 43.2% both before and after touching a patient. The explanation could be the fact that in 2009, the Ministry of Health of Turkey had begun a HH campaign, called "Danger in Your Hands," throughout the country to improve hand hygiene compliance in all healthcare settings. This equal compliance might have reflected greater awareness of all HH indications among the HCP.

Studies have shown increased compliance with HH in circumstances where HCP perceive they are protecting the patients or themselves (Jenner et al., 2002) and less compliance in apparently clean procedures (White et al., 2015). It can be argued that more gains will be made if HH after apparently clean procedures is emphasized.

5.1.3: Compliance by Cadre- specific category of participants

In the current study, the highest HH compliance was observed among the Paediatricians. Both the Kenyatta National Hospital (Ngugi, 2012)and Naivasha District Hospital studies (Isanda, 2014) found the highest compliance among doctors at 25.7% and 57.8% respectively. Similarly, **t**he Istanbul study found the highest compliance among qualified HCP; nurses at 41.4% followed by doctors at 31.9% (Karaaslan et al., 2014). This finding could be indicative of qualified HCP'shigher awareness of the hand hygiene protocol and subsequent application of their knowledge. This could also be a result of their need to role model to the other members of the clinical team in as far as HH is concerned.

In the current study, the least compliance was found among nurse interns, nurse students, medical students, medical officers and, clinical officer interns. It is not known why students in this study had such poor compliance. One possible explanation is that they had a poor attitude towards HH compliance given that they had a significantly lower desire to know the NBU HH protocol as well as to be seen as responsible through the act of HH when compared to the qualified staff.

In contrast, in Naivasha District Hospital nurse students had the highest compliance (Isanda et al., 2014). This was because HH compliance formed part of their clinical assessment and this may have resulted in higher compliance.

These findings, therefore, present an opportunity for improving hand hygiene compliance because the target population for intensive awareness and implementation campaign was identified.

5.1.4: Compliance by age

Slightly more than two- thirds of those who were non-compliant were 30 years old and below. This could be explained by the fact that this is the age bracket in which the bulk of the trainee participants, that is, students and interns were. From the compliance by cadre- specific participant category results, they were all found to be non-compliant.

None of the local studies reported their findings in terms of compliance by age of participants (Ngugi, 2012),(Isanda, 2014) and (Kamau, 2018).

5.1.5: Compliance by gender

There was no statistically significant difference in compliance between males and females. This was different from a Saudi study in which being male was significantly associated with self-reported HH compliance. This may have been occasioned by cultural differences in terms of gender socialization whereby in Saudi, males are socially dominant compared to females. Consequently, they were expected to display a positive image with every action. Gender role differences are distinct within Saudi Arabia. Male Saudis have a considerably more stable and clearer personal identity compared to females. They have higher confidence in accomplishing tasks and worry less about their behavior and style of doing things. On the other hand, female Saudis have lower self-confidence and are more emotionally vulnerable than males (Cruz & Bashtawi, 2016).

5.1.6: Indications for Hand Hygiene

All participants were assessed for hand hygiene before and after touching a patient. Only 4 in 10 of the participants were assessed for HH before performing an aseptic technique. The explanation for this is that in the current study “before touching a

patient" indication was the entry point for the assessment of hand hygiene behavior for the HCP and students. Hand Hygiene before an aseptic technique was the least assessed because aseptic techniques at the NBU were mostly performed by qualified nurses and Registrars.

5.1.7: Choice of Hand Hygiene Modality

As regards the choice of HH modality, there was preferential use of alcohol-based hand disinfectant compared to handwashing with soap and water among the participants who were compliant to HH. The explanation for this could be the fact that HH by alcohol-based hand disinfection is faster and more practical to perform. In addition to this, in the current study, there was ease of access to alcohol-based hand disinfectant since the policy at the NBU at the time of data collection was one bottle of alcohol-based hand rub per cot or incubator. This was similar to what was observed in the Ruiru study (Kamau, 2018)and at the Naivasha District Hospital study (Isanda, 2014). There, the self-reported preference of alcohol-based hand disinfection was 55.5% and 54.5% respectively. These findings were different from those in the observational study in Turkey (Karaaslan et al., 2014) at a tertiary university where there was preferential use of soap and water. It was established from the participants in that study that they got unpleasant irritation on their hands from the alcohol-based hand disinfectant present at the facility at that time. They also acknowledged that they were unaware of the benefits of Alcohol-based hand disinfectant over the use of soap and water.

5.2: FACTORS ASSOCIATED WITH HAND HYGIENE COMPLIANCE

5.2.1:Compliance versus Intention to perform, Attitude, Subjective Norm, and Perceived Behavioural Control.

There was a high score on the intention to perform HH. Similarly, attitude and subjective norm had high scores indicating general positivity. As per behavioral theories, a high score on motivators of behavior is expected to lead to the performance of the respective activity. However, in this study, there was no correlation between Hand Hygiene Compliance and intention to perform hand hygiene. In the current study, direct and indirect attitude and indirect subjective norm could be used to predict one's intention to perform HH. However, the other elements of the TPB do not predict intention. Similarly, perceived behavioural control failed to directly predict compliance to HH.. The TPB model could not be used to predict the observed compliance with HH. Studies that have reported prediction of compliance to HH using the TPB have largely relied on reported rather than directly observed HH. .

In a study of 120 nurses, O'Boyle et al (2001) found that there was a high correlation between intention to perform HH and self-reported HH but not observed HH. There was a poor correlation between self-reported and observed hand hygiene leading to the conclusion that internal motivation factors are not good predictors of observed HH (O'Boyle, 2005).

Tai et al (2009), in a cross-sectional study of nurses and doctors providing direct patient care in four hospitals in Hong Kong, through an anonymous questionnaire survey, reported a 7-fold increase in self-reported HH compliance when a participant had good perceived behavioral control and subjective norm. Dixit et al (2012) in their qualitative study on attitudes and beliefs about hand hygiene among paediatric residents in a tertiary facility in Edmonton, Canada, reported a correlation between TPB

constructs and self-reported compliance with HH. In their cross-sectional study, Cruz et al., (2016) in Saudi Arabia looked at predictors of hand hygiene practice among Saudi nursing students from self-report and found that HCP with good attitude were more likely to be compliant to HH. Similar findings were reported by Kalata et al (2013) who found that a positive attitude was associated with higher odds of reported hand hygiene compliance.

In contrast, studies that have used observed hand hygiene such as the current study have failed to replicate the prediction value of the TPB. A study among healthcare workers in Australia found that TPB variables were associated with self-reported but not observed HH practice(White et al., 2015). Similar results were reported by O'Boyle (2001) who further found that observed compliance to HH was correlated with the intensity of activity in the nursing units. The findings of this study are, therefore, not surprising because observed rather than self-reported behavior was assessed. Another possible explanation of the current findings is that in intention, attitude, and perceived behavioral control most participants scored so highly that it became difficult to divide adequate numbers into two groups for statistical analysis.

5.2.2: Hand Hygiene compliance among Qualified and trainee HCP

Hand Hygiene compliance was significantly higher among qualified compared to trainee HCP. Compared to their trainees(Paediatric Registrars), Paediatricians had significantly higher compliance and indirect attitude scores. Similarly, all qualified HCP (Paediatricians, Paediatric Surgeons, and Nurses) had significantly higher compliance to hand hygiene compared to all trainees (Registrars, Interns, and students). Of all the TPB constructs, there was a significantly higher attitude score among the qualified HCP compared to trainees. Similar results have been reported in other studies before. A hospital-based study investigating adherence to hand hygiene protocol by

clinicians and medical students at Queen Elizabeth Central Hospital, Blantyre- Malawi found that qualified clinicians had a significantly higher compliance compared to medical students (Kalata et al., 2013). Nursing and medical students were also found to have a poor attitude and compliance to HH in hand hygiene at a Tertiary Health Care Centre in Raichur, India (Nair et al.,(2014). A hospital-based study among nursing students in Jordan also found a significant difference in HH compliance between those with higher attitude scores towards HH (Omar et al., 2015). Even among trainees, it has been shown that those with higher attitude had higher compliance with HH. In one study it was found that medical students had a lower attitude (12.9 versus 51%) and lower compliance to HH (19.6 versus 62.1) compared to nursing students (Nair at al., 2014). Similarly, nursing students in Saudi who had higher scores for attitude were found to have significantly higher compliance levels (Cruz & Bashtawi, 2016).

The explanation for this observation in the current study was drawn from the findings of sub-analysis of the components of attitude whereby the trainees had a significantly lower desire to know the HH protocol compared to qualified staff. In addition to this, the trainees had a significantly lower desire to be seen as responsible people by performing HH.

The foregoing findings suggest that to improve compliance, trainees should be targeted and the focus should be on improvement of attitude towards HH.

CHAPTER SIX

6.0 STUDY LIMITATION, CONCLUSION AND RECOMMENDATIONS

6.1:Study Limitation

One limitation in this study was potential bias from the Hawthorne effect in which participants could have known that they were under observation and modified their HH behaviour. This was mitigated in three ways: First, by unannounced timing of observations. Secondly, the principal investigator and the research assistant were stationed in the NBU for duty at the time of the study. The data was therefore collected actively by participant observers. This meant that they were not viewed as "strangers" who would otherwise potentially influence the behaviour of the HCP. Thirdly, blank consent was undertaken for the observational part of the study which preceded the self-administered questionnaires. It, however, did not contain the time, date or, the name of who was to conduct the observation for assessment of HH.

6.2:Conclusion

1. The overall observed hand hygiene compliance among healthcare providers and students in the Newborn Unit of Moi Teaching and Referral Hospital was lower than the World Health Organization global estimate.
2. The Theory of Planned behaviour model failed to predict observed hand hygiene compliance. However, qualified staff had significantly higher compliance and attitude towards hand hygiene compared to all trainees.

6.3: Recommendations

Hand hygiene compliance needs to improve overall across most of the cadres. In addition to this, among all the trainees, Attitude change should be the focus. To achieve this attitude change, all trainees in the Newborn Unit should be taught the Hand Hygiene protocol and the importance of being responsible for their actions.

A study should be done to construct a TPB questionnaire that would better capture predictors of observed as opposed to self-reported compliance to hand hygiene.

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APPENDICES

APPENDIX 1: CONSENT FORM

Researcher: My name is Dr. Grace Mudi. I am a qualified medical doctor, registered with the Kenya Medical Practitioners and Dentists Board. Currently, I am pursuing Master of Medicine in Child Health and Pediatrics degree in Moi University School of Medicine. I would like to recruit you into my research which is titled "Factors associated with Hand Hygiene Compliance by Healthcare Providers at the MTRH NBU. This study will involve filling in a questionnaire and observation of Hand Hygiene Practice. Please note that your hand hygiene practice has already been observed.

Purpose: This study will seek to determine the factors associated with hand hygiene among healthcare providers and students at the Newborn unit.

Benefits: The findings of this study will facilitate tailoring the right intervention that will improve hand hygiene by healthcare providers and students in the Moi Teaching and Referral Hospital Newborn Unit.

Risks: There are no anticipated risks to the participants attributable to this study.

Confidentiality: All information obtained in this study will be treated with utmost confidentiality and shall not be divulged to any unauthorized person.

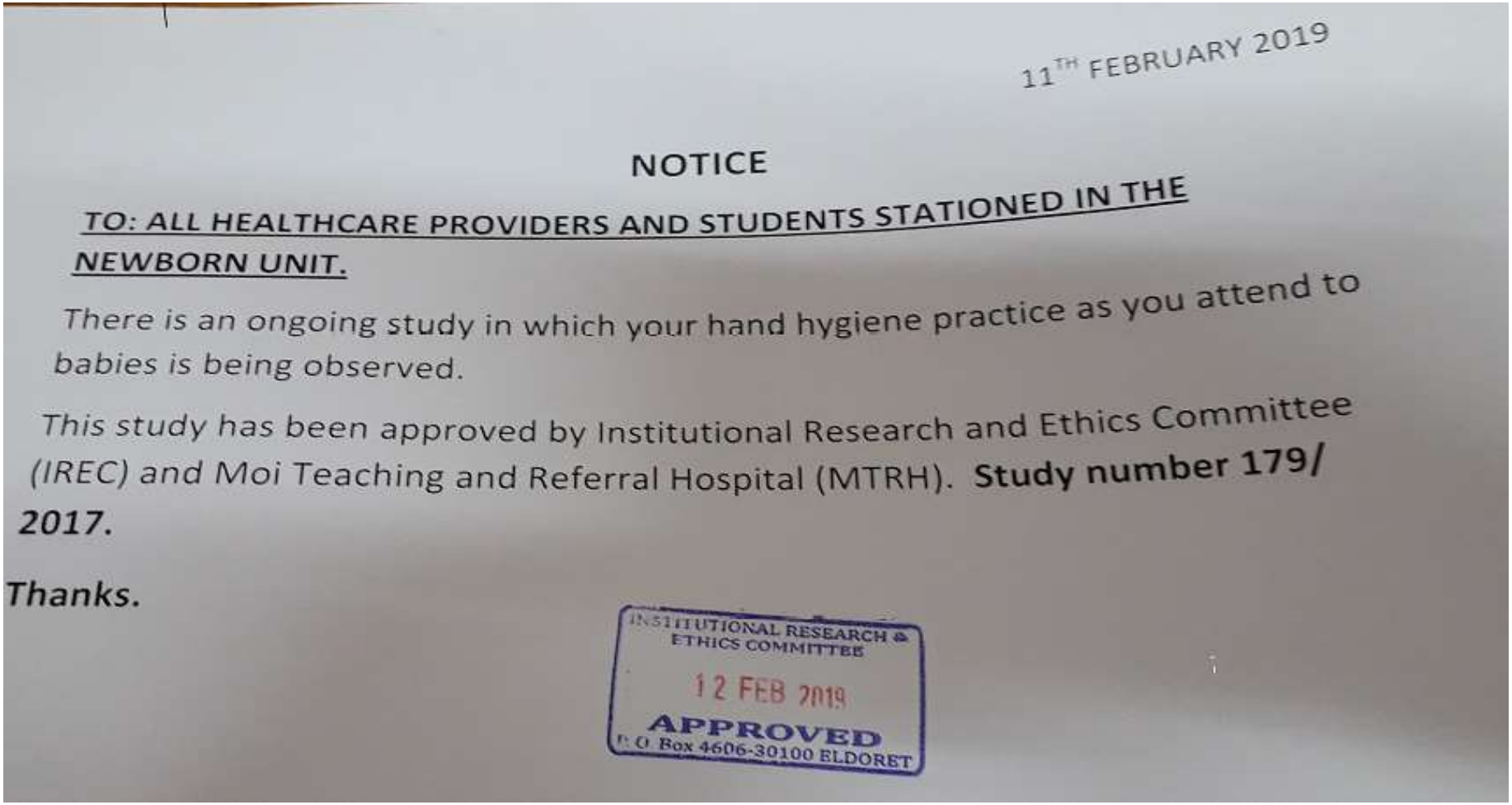
Right to Refuse: Participation in this study is voluntary, there is freedom to refuse to take part. This study has been approved by the Institutional Research and Ethics Committee (IREC) of Moi University/Moi Teaching and Referral Hospital Formal Approval Number 2093.

Sign if you agree to take part in the study

Participant ……. Date…….. Signature…….

Researcher ……. Date……. Signature…….

APPENDIX 2: BLANK CONSENT



11TH FEBRUARY 2019

NOTICE

TO: ALL HEALTHCARE PROVIDERS AND STUDENTS STATIONED IN THE NEWBORN UNIT.

There is an ongoing study in which your hand hygiene practice as you attend to babies is being observed.

This study has been approved by Institutional Research and Ethics Committee (IREC) and Moi Teaching and Referral Hospital (MTRH). **Study number 179/ 2017.**

Thanks.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
12 FEB 2019
APPROVED
P. O. Box 4606-30100 ELDORET

APPENDIX 3: HAND HYGIENE OBSERVATION FORM

	Code:			**Cadre** :			**Time:**			**Setting:**	**Date**:				
	Before touching a patient			**Before clean/ aseptic procedure**			**After body fluid exposure risk**			**After touching a patient**			**After touching patient surroundings**		
	Indic	**HW**	**HR**	**Indic**	**HW**	**HR**	**Indic**	**HW**	**HR**	**Indic**	**HW**	**HR**	**Indic**	**HW**	**HR**
1															

APPENDIX 4: THEORY OF PLANNED BEHAVIOURQUESTIONNAIRE

CODE:_____

STUDY TITLE : FACTORS ASSOCIATED WITH HAND HYGIENE COMPLIANCE BY HEALTHCARE PROVIDERS AND STUDENTS IN THE NEWBORN UNIT OF MOI TEACHING AND REFERRAL HOSPITAL, ELDORET,KENYA.

SECTION A

1. Age _____

2.Gender (**tick one only**) Male ( ) Female ( )

3.Category (**tick one only**)

Consultant ( ) Registrar ( ) Nurse ( ) Medical student ( ) Nursing student ( )

Medical officer intern ( ) Clinical officer intern ( ) Nutritionist ( )

SECTION B – Circle your response

1. I expect to perform hand hygiene before and after seeing a patient.	Strongly disagree 1 2 3 4 5 6 7 Strongly agree
2. I want to perform hand hygiene before and after seeing a patient.	Strongly disagree 1 2 3 4 5 6 7 Strongly agree
3. I need to perform hand hygiene before and after seeing a patient	Strongly disagree 1 2 3 4 5 6 7 Strongly agree

SECTION C

Part 1 Performing hand hygiene during my duty of attending to newborns is

1. Good 1 2 3 4 5 6 7 Bad
2. Worthless 1 2 3 4 5 6 7 Useful
3. Pleasant (for me) 1 2 3 4 5 6 7 Unpleasant (for me)
4. Harmful (to patient and to me) 1 2 3 4 5 6 7 (beneficial to patient and me)

Part 2 – Section (i)

Circle your response	**Response**
a)I know the hospital's handhygiene protocol;	Unlikely 1 2 3 4 5 6 7 Likely
b)The hospital's handhygiene protocol reduces cross-infection	Unlikely 1 2 3 4 5 6 7 Likely
c)Following the hand hygiene protocol will protect me from serious infection;	Unlikely 1 2 3 4 5 6 7 Likely
d)If I follow the handhygiene protocol I will protect my patients from serious infection;	Unlikely 1 2 3 4 5 6 7 Likely
e)if I follow the handhygiene protocol I will protect my family from serious infection;	Unlikely 1 2 3 4 5 6 7 Likely
f)I am responsible for reducing risk of cross-infection in my patients;	Unlikely 1 2 3 4 5 6 7 Likely
g)It is my role to influence hand hygiene behavior in my colleagues;	Unlikely 1 2 3 4 5 6 7 Likely
h)Patients have a right to expect high hand hygiene standards;	Unlikely 1 2 3 4 5 6 7 Likely
i)Offensive odour/material is removed from my hands if I wash them;	Unlikely 1 2 3 4 5 6 7 Likely
j)By following the handhygiene protocol, I will be viewed as a responsible health worker or student;	Unlikely 1 2 3 4 5 6 7 Likely
k)The availability of antibiotics to treat infection means that I don't need to clean my hands as much;	Unlikely 1 2 3 4 5 6 7 Likely
l)I don't believe handhygiene is necessary after minimal contact with a physically clean patient	Unlikely 1 2 3 4 5 6 7 Likely

Section (ii) **Circle your response**	**Response**
a)Knowing the hospital's handhygiene protocol is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
b)Reducing cross infection is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
c)Protecting myself from serious infections is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extreme desirable
d)Protecting patients from serious infection	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
e)Protecting myself and others from serious infection is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
f)Reducing risk of cross infection in my patients is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
g)Influencing hand hygiene behaviour in my colleagues is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
h)Patients having a right to expect high hand hygiene compliance is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
i)Removing offensive odour/material from my hands is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
j)Being viewed as responsible viewed as a responsible health worker or student is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
k)the availability of antibiotics to treat infection means that I don't need to wash my hands as much;	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable
l)Not performing hand hygiene after minimal contact with physically clean patients is	Extremely undesirable -3 -2 -1 0 +1 +2 +3Extremely desirable

SECTION D – Circle your response

Part 1

1.Most people who are important to me in the wards think that I should practice hand hygiene	Strongly disagree 1	2	3	4	5	6	7 Strongly agree
2.It is expected of me that I practice hand hygiene in the course of my duty	Strongly disagree 1	2	3	4	5	6	7 Strongly agree
3.I feel under social pressure to practice hand hygiene in the course of my duty.	Strongly disagree 1	2	3	4	5	6	7 Strongly agree
4.People who are important to me want me to practice hand hygiene	Strongly disagree 1	2	3	4	5	6	7 Strongly agree

Part 2

Circle your response	**Response**
a)Mothers with babies in the NBU think I	Should not -3 -2 1 0 1 2 3 Should Practise hand hygiene
b)Consultants would	Disapprove -3 -2 -1 0 1 2 3 Approve Of my hand hygiene practice
c)My colleagues	Do not -3 -2 -1 0 1 2 3 Do Practise hand hygiene
d)Mothers with babies in the NBU think I	Not at all -3 -2 -1 0 1 2 3 Very much Practise hand hygiene
e) Consultants would	Not at all -3 -2 -1 0 1 2 3 Very much Of my hand hygiene practice
f)My colleagues	Not at all -3 -2 -1 0 1 2 3 Very much Practice hand hygiene

SECTION E- Part 1- Circle your response

1.I am confident that I could comply to hand hygiene if I wanted to

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2.Compliance to hand Hygiene is

Easy 1 2 3 4 5 6 7 Difficult

3.The decision to comply to hand hygiene is out of my control

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

4.Whether I comply to hand Hygiene or not is entirely up to me

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Part 2	**Response**
a)Hand hygiene procedures are time-consuming to be strictly adhered to	Unlikely -3 -2 -1 0 1 2 3 4 5 6 7 Likely To comply with hand hygiene
b)I do not comply to hand hygiene as I should because of the workload.	Unlikely -3 -2 -1 0 1 2 3 4 5 6 7 Likely To comply with hand hygiene
c)I do not comply to hand hygiene as I should because hand washing solution irritates my hands	Unlikely -3-2 -1 0 1 2 3 4 5 6 7 Likely To comply with hand hygiene
d)When time is inadequate I don't comply to hand hygiene	Less likely-3 -2 -1 0 1 2 3 4 5 6 7more likely To comply with hand hygiene
e)When the is a lot of workload I do not comply to hand hygiene	Less likely-3 -2 -1 0 1 2 3 4 5 6 7more likely To comply with hand hygiene
f)When hand washing solution irritates my hands I am	Less Likely -3 -2 -1 0 1 2 3 4 5 6 7 more likely To comply with hand hygiene

APPPENDIX 5: TPB QUESTIONNAIRE TEMPLATE BY FRANCIS.

4 MEASURING BEHAVIOURAL INTENTIONS

Key:	ⓘ ⓘ ⓘ	very time consuming (allow weeks)
	ⓘ ⓘ	quite time consuming (allow days)
	ⓘ	not very time consuming (allow hours)

This section describes three methods of measuring intentions. We have called Method 1 Intention Performance, because in some situations, it would be possible to observe actual performance using the same measurement scale, and this direct comparability could be useful for some studies. In the TPB literature, where most research has been about individual's own health-related behaviour (e.g. smoking, exercise), Generalised Intention (Method 2) is most commonly used. When investigating the behaviour of health care professionals, Intention Simulation (Method 3) could be a more valid proxy measure for actual behaviour, because it more closely approximates 'real' situations that require complex clinical decisions. However, it is time consuming and should be prepared with great care, or it may be misleading. A thorough conceptual analysis and review of Intention Simulation, carrying the appropriate warnings, is presented by Jones, Gerrity and Earp (1990).

In general, the methods used to measure intentions should be guided by researchers' judgements about which types of questions seem to make sense for the behaviour and sample under investigation.

4.1 Method 1: Intention performance

ⓘ

4.1.1 Procedure

Use a single item in the format shown in Box 4.1

Box 4.1

Given 10 patients presenting with back pain for the first time, how many patients would you expect to refer for an x-ray?

0 1 2 3 4 5 6 7 8 9 10

4.1.2 Scoring

For this single item measure, the number circled is the behavioural intention score.

4.2 Method 2: Generalised intention

ⓘ

4.2.1 Procedure

Adequate internal consistency can be demonstrated using three items. We suggest using the format shown in Box 4.2[2].

Box 4.2

1. I expect to refer patients with lower back pain for an x-ray

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2. I want to refer patients with lower back pain for an x-ray

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. I intend to refer patients with lower back pain for an x-ray

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

[2] There is a research literature that discusses the conceptual differences between these three questions, although empirically, there is very considerable response consistency between these items. See Armitage and Conner (2001) for a discussion of this issue.

4.2.2 Scoring

Calculate the mean of the three intention scores.

5 MEASURING ATTITUDES

Key: ① ① ① very time consuming (allow weeks)
① ① quite time consuming (allow days)
① not very time consuming (allow hours)

5.1 Direct measurement of attitude

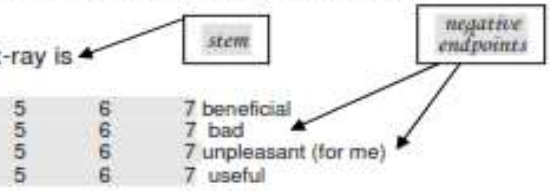
①

5.1.1 Procedure

- Direct measurement involves the use of bipolar adjectives (i.e. pairs of opposites) which are evaluative (e.g. *good – bad*).
- Ideally, use about four items following a single 'stem' which defines the behaviour under investigation (see Box 5.1)[4].
- Include instrumental items (whether the behaviour achieves something e.g. *useful–worthless*) and experiential items (how it feels to perform the behaviour e.g. *pleasant – unpleasant*)[5].
- Include the *good – bad* scale if it is appropriate to the topic, as it captures overall evaluation.
- Arrange the items so that the ends of the scales are a mix of positive and negative endpoints.[6] (See Box 5.1)

Box 5.1[7] *Example: A patient presents with lower back pain. The target behaviour is referring the patient for x-ray.*

Referring a patient with acute lower back pain for x-ray is



harmful	1	2	3	4	5	6	7 beneficial
good	1	2	3	4	5	6	7 bad
pleasant (for me)	1	2	3	4	5	6	7 unpleasant (for me)
worthless	1	2	3	4	5	6	7 useful

5.1.2 Scoring

- Recode the items that have negatively worded endpoints on the right, so that higher numbers then always reflect a positive attitude to the target behaviour (e.g. for *'pleasant – unpleasant'*, an answer of 6 becomes score of 2; a score of 4 remains a 4).
- It is important that the attitude items have high internal consistency, i.e. that scores on these items correlate highly with each other (see Section 9.3). You may decide to omit items from the scale to improve internal consistency.

- Calculate the mean of the item scores to give an overall attitude score.

5.2 Indirect measurement of attitude: measuring behavioural beliefs and outcome evaluations

5.2.1 Stages of Development

A. ① ② ③ Conduct an elicitation study to elicit commonly held beliefs: Identify the content of behavioural beliefs that are shared by the target population.
B. ① ② Construct questionnaire items to assess the strength of behavioural beliefs.
C. ① Construct questionnaire items to assess outcome evaluations.

5.2.2 Procedure

A. Conduct an elicitation study

- Take a sample (about 25 people[8]) from the population from which you will select respondents for the questionnaire study.
- Use open-ended questions. These are normally presented in one-to-one interviews, but could also be in focus group or questionnaire form. Give participants a few minutes to list their thoughts in response to structured questions (Box 5.2).
- Content analyse the responses into themes (behavioural beliefs) and label the themes extracted. To increase the validity of the analysis, at least two researchers should do this independently. List the themes in order, from most frequently mentioned to least frequently mentioned.

Box 5.2 Example: Your patient has Type 2 diabetes. The target behaviour is taking the patient's blood pressure. Please take a few minutes to list your thoughts about the following questions:

What do you believe are the ***advantages*** of measuring the patient's blood pressure?
What do you believe are the ***disadvantages*** of measuring the patient's blood pressure?
Is there anything else you associate with measuring the patient's blood pressure?

B. Construct questionnaire items to assess the strength of behavioural beliefs

- Select the behavioural beliefs most often listed and convert these into a set of statements. These statements should reflect the beliefs which might affect the behaviour of the target population (see Box 5.3 for question and response formats). Inclusion of **75%** of all beliefs stated should give adequate coverage of the belief 'population'.
- Pilot test these items by asking about five people from the relevant population to answer the questions and tell you whether they have any difficulty answering them. Check comprehension and clarity. If necessary, modify the wording of the questions.

Box 5.3.1 *Question format, **behavioural** beliefs*		*Box 5.3.2* *Response format, **behavioural** beliefs*[9]							
a	If I measure blood pressure (BP), I will feel that I am doing something positive for the patient.	Unlikely	1	2	3	4	5	6	7 Likely
b	It causes a lot of worry and concern for the patient if they are found to have high BP.	Unlikely	1	2	3	4	5	6	7 Likely
c	If I measure BP, I will detect any problems at an early stage.	Unlikely	1	2	3	4	5	6	7 Likely
d	If I measure BP, I've got to see some patients more often.	Unlikely	1	2	3	4	5	6	7 Likely

C. Construct questionnaire items to assess outcome evaluations

Convert each of the belief statements[10] into the form of an incomplete sentence. By completing the sentence (using the set response format), the participant expresses a positive or negative evaluation of the belief statement. (See Box 5.4 for question and response formats.)

Box 5.4.1 *Question format, outcome evaluations*		*Box 5.4.2* *Response format, outcome evaluations*[11]							
e	Doing something positive for the patient is:	Extremely undesirable	-3	-2	-1	0	+1	+2	+3 Extremely desirable
f	Causing a lot of worry and concern for the patient is:	Extremely undesirable	-3	-2	-1	0	+1	+2	+3 Extremely desirable
g	Detecting problems for these patients at an early stage is:	Extremely undesirable	-3	-2	-1	0	+1	+2	+3 Extremely desirable
h	Having to see some patients more often is:	Extremely undesirable	-3	-2	-1	0	+1	+2	+3 Extremely desirable

- Pilot test these items by asking about five respondents to answer the questions and tell you whether they have any difficulty answering them. If necessary, modify the wording.

5.2.3 Scoring

For each behavioural belief, the belief score on the unlikely-likely scale is multiplied by the relevant evaluation score on the extremely bad/extremely good scale (see Box 5.5)[12]. The resulting products across are summed all the beliefs to create an overall attitude score:

Formula 5.1 $$A = (a \times e) + (b \times f) + (c \times g) + (d \times h)$$

Where A = total attitude score
a, b, c and d are scores for each of four behavioural beliefs
e, f, g and h are scores for outcome evaluations relating to each behavioural belief

Using this method,

- a ***positive*** (+) score means that, overall, the participant is ***in favour of*** taking blood pressure readings of patients with Type 2 diabetes.
- a ***negative*** (-) score means that, overall, the participant is ***against*** taking blood pressure readings of patients with Type 2 diabetes.

Box 5.5 Example, scoring procedure

a	If I measure blood pressure (BP), I will feel that I am doing something positive for the patient.	Unlikely	1	2	3	4	***5***	6	7	Likely
B	It causes a lot of worry and concern for the patient if they are found to have high BP	Unlikely	1	***2***	3	4	5	6	7	Likely
C	If I measure BP, I will detect any problems at an early stage.	Unlikely	1	2	3	4	5	***6***	7	Likely
D	If I measure BP, I've got to see some patients more often.	Unlikely	1	***2***	3	4	5	6	7	Likely
e	Doing something positive for the patient is:	Extremely undesirable	-3	-2	-1	0	+1	+2	***+3***	Extremely desirable
F	Causing a lot of worry and concern for the patient is:	Extremely undesirable	-3	***-2***	-1	0	+1	+2	+3	Extremely desirable
G	Detecting problems for these patients at an early stage is:	Extremely undesirable	-3	-2	-1	0	+1	+2	***+3***	Extremely desirable
H	Having to see some patients more often is:	Extremely undesirable	-3	-2	***-1***	0	+1	+2	+3	Extremely desirable

Imagine that a participant has responded by circling the numbers indicated in ***bolded italics*** above.

The total attitude score is calculated as

A = (5 x +3) + (2 x -2) + (6 x +3) + (2 x -1)
= (+15) +(-4) + (+18) +(-2)
= +27

Because there are 4 items, the possible range of total scores is (7 x ±3) x 4 = -84 to +84[13]

THEREFORE, THE ATTITUDE SCORE OF THE PARTICIPANT REFLECTS A WEAK TO MODERATE **POSITIVE** ATTITUDE (i.e. **IN FAVOUR** OF MEASURING BLOOD PRESSURE)

[13] The range will of course differ if different numbers of items are used, so interpretation of weak, moderate and strong attitudes will be determined by the possible range. The important aspect of this measurement scheme is that zero represents a neutral attitude, positive scores represent attitudes in favour of the behaviour as described, and negative scores represent attitudes against the behaviour as described. Differences in range between predictor variables are acceptable for correlational analysis, but if you want to compare the absolute values of predictor variables within or across studies, it would be necessary to calculate the mean of the multiplied scores (in this case, +27/4 = +6.75, possible range -21 to +21).

6 MEASURING SUBJECTIVE NORMS

Key:	ⓘ ⓘ ⓘ	very time consuming (allow weeks)
	ⓘ ⓘ	quite time consuming (allow days)
	ⓘ	not very time consuming (allow hours)

6.1 Direct measurement of subjective norm

ⓘ

6.1.1 Procedure

- Direct measurement involves the use of questions referring to the opinions of important people in general (See Box 6.1).
- Use the first three items in the format presented in Box 6.1, and additional items if they seem appropriate and if questionnaire length is not a problem.
- Where the response format completes an otherwise incomplete sentence (e.g. I should not / I should …), arrange the items so that the ends of the scales are a mix of positive and negative endpoints (See Box 6.1). However, where an item is a complete sentence, and the responses range from 'Strongly disagree' to 'Strongly agree', endpoints should not be mixed.

Box 6.1 *Example: A patient presents with lower back pain. The target behaviour is referring the patient for x-ray.*

1. Most people who are important to me think that

negative endpoint

I should 1 2 3 4 5 6 7 I should not

refer patients who have lower back pain for x-ray.

2. It is expected of me that I refer patients who have lower back pain for x-ray.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. I feel under social pressure to refer patients who have lower back pain for x-ray.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

4. People who are important to me want me to refer patients who have lower back pain for x-ray.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

6.1.2 Scoring

- Recode the items that have negatively worded endpoints on the right, so that high scores then consistently reflect greater social pressure to do the target behaviour

- It is important that the subjective norm items have high internal consistency, i.e. that the scores on these items correlate highly with each other. (You may decide to omit items from the scale to improve internal consistency.)
- Calculate the mean of the item scores to give an overall subjective norm score

6.2 Indirect measurement of subjective norm: measuring normative beliefs and motivation to comply

6.2.1 Stages of Development

A. ⓘ ⓘⓘ Conduct an elicitation study to elicit commonly held beliefs: Identify groups, organisations and categories of individuals ('reference groups') who are likely to apply social pressure with respect to the behaviour.

B. ⓘ Construct questionnaire items to assess strength of normative beliefs with respect to each reference group.

C. ⓘ Construct questionnaire items to assess motivation to comply: Add items in standard format for assessing motivation to comply with pressure from each reference group.

6.2.2 Procedure

A Conduct an elicitation study to elicit commonly held beliefs

- Sample about 25 people from the same population from which you will select respondents for the questionnaire study. (This would be the same 25 people as those referred to in Section 5.2.2.)
- Use open-ended questions. These are normally presented in one-to-one interviews, but could also be in focus group or questionnaire form. Give participants a few minutes to list their thoughts in response to structured questions (Box 6.2).
- Content analyse the responses into themes (normative beliefs) and label the sources of social pressure extracted. At least two researchers should do this independently. List these sources in order, from most frequently mentioned to least frequently mentioned.

Box 6.2 *Example: Your patient has Type 2 diabetes. The target behaviour is measuring the patient's blood pressure (BP). Please take a few minutes to list your thoughts about the following questions:*

Are there any individuals or groups who would ***approve*** of your measuring the patient's BP?
Are there any individuals or groups who would ***disapprove*** of your measuring the patient's BP?
Is there anything else you associate with measuring the patient's blood pressure?

B. Construct questionnaire items to assess strength of normative beliefs

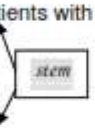
- Select the reference groups (or individuals) most often listed and convert these into the 'stems' of normative belief items (see Box 6.3). Inclusion of **75%** of the groups or individuals listed should give adequate coverage of the sources of social pressure.

- Items may reflect what important people *think* a person should do (*injunctive* norms) or what important people *actually* do (*descriptive* norms). Box 6.3 illustrates the difference between these types of items.

Box 6.3 *Imagine that the elicitation study has identified three sources of social pressure: patients with Type 2 diabetes; diabetologists; and other GPs.*

Injunctive items (what important people *think* a person should do)

1. Patients with Type 2 diabetes think I



should not -3 -2 -1 0 +1 +2 +3 should measure their blood pressure.

2. Diabetologists would

disapprove -3 -2 -1 0 +1 +2 +3 approve of my measuring patients' blood pressure.

Descriptive items (what important people *actually* do)

3. Other GPs

do not -3 -2 -1 0 +1 +2 +3 do measure the blood pressure of their patients with diabetes.

C. Construct questionnaire items to assess motivation to comply

- Convert each of the sources of social pressure into the form of a statement about the importance of the various sources of social pressure. (See Box 6.4.) By answering the questions, the participant indicates the strength of motivation to comply with each reference group or individual.

Box 6.4

1. Patients' approval of my practice is important to me

Not at all 1 2 3 4 5 6 7 Very much

2. What diabetologists think I should do matters to me

Not at all 1 2 3 4 5 6 7 Very much

3. Doing what other GPs do is important to me

Not at all 1 2 3 4 5 6 7 Very much

- Pilot test these items by asking about five respondents to answer the questions and tell you whether they have any difficulty answering them. If necessary, modify the wording of the questions.

6.2.3 Scoring

For each normative belief, the belief score on the should/should not or do/do not scale is multiplied by the score relating to the not at all/very much scale (See Box 6.5)[14]. The resulting are summed products across all the beliefs to create an overall subjective norm score:

Formula 6.1 $N = (a \times d) + (b \times e) + (c \times f)$

Where N = total subjective norm score
a, b and c are scores for each of the three normative beliefs
d, e and f are scores for motivation to comply relating to each source of social pressure

Using this method,

- a ***positive*** (+) score means that, overall, the participant experiences social pressure ***to*** measure the BP of patients for with diabetes.
- a ***negative*** (-) score means that, overall, the participant experiences social pressure ***not to*** measure the BP of patients for with diabetes.

Box 6.5 Example, scoring procedure

a	Patients with Type 2 diabetes think I … measure their blood pressure.	Should not	-3	-2	-1	0	***+1***	+2	+3	Should
b	Diabetologists would ……. of my measuring the BP of these patients.	Disapprove	-3	-2	-1	0	+1	+2	***+3***	Approve
c	Other GPs ….. measure the BP of these patients.	Do not	-3	-2	-1	0	+1	***+2***	+3	Do
d	Patients' approval of my practice is important to me.	Not at all	1	2	3	***4***	5	6	7	Very much
e	What diabetologists think I should do matters to me.	Not at all	***1***	2	3	4	5	6	7	Very much
f	Doing what other GPs do is important to me.	Not at all	1	***2***	3	4	5	6	7	Very much

Imagine that a participant has responded by circling the numbers indicated in **bold** above.

The total normative belief score is calculated as

$$N = (+1 \times 4) + (+3 \times 1) + (+2 \times 2)$$
$$= (+4) + (+3) + (+4)$$
$$= +11$$

The possible range of total scores is -63 to +63. THEREFORE,
THE NORMATIVE BELIEF SCORE OF THE PARTICIPANT REFLECTS FAIRLY WEAK **POSITIVE** SOCIAL PRESSURE (i.e. **TO MEASURE** PATIENTS' BLOOD PRESSURE).

7 MEASURING PERCEIVED BEHAVIOURAL CONTROL

Key:	① ① ①	very time consuming (allow weeks)
	① ①	quite time consuming (allow days)
	①	not very time consuming (allow hours)

7.1 Direct measurement of perceived behavioural control (PBC)

①

7.1.1 Procedure

- Items should reflect people's confidence that they are capable of performing the target behaviour. This can be achieved assessing the person's self-efficacy and their beliefs about the controllability of the behaviour.

- Self-efficacy is assessed by asking people to report
  a) how difficult it is to perform the behaviour.
  b) how confident they are that they could do it. (See Box 7.1)

- Controllability is assessed by asking people to report
  a) whether performing the behaviour is up to them. (See Box 7.1)
  b) whether factors beyond their control determine their behaviour.

- Remember that where the response format completes an otherwise incomplete sentence (e.g. difficult / easy), arrange the items so that the ends of the scales are a mix of positive and negative endpoints. (See Box 7.1.) However, where an item is a complete sentence, endpoints should not be mixed.

Box 7.1

Self-efficacy

negative endpoint

1. I am confident that I could refer my patients for x-ray if I wanted to
   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2. For me to refer my patients for x-ray is
   easy 1 2 3 4 5 6 7 difficult

Controllability

4. The decision to refer for x-ray is beyond my control.
   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

5. Whether I refer for x-ray or not is entirely up to me.
   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

7.1.2 Scoring

- Recode the items that have negative endpoints on the right, so that high scores then consistently reflect a greater level of control over the target behaviour.
- It is important that the subjective norm items have high internal consistency, i.e. that scores on these items correlate highly with each other. (You may decide to omit items from the scale to improve internal consistency.)
- Calculate the mean of the item scores to give an overall perceived behavioural control score

7.2 Indirect measures of PBC: Measuring control beliefs and their perceived power to influence behaviour

7.2.1 Stages of Development

A. ① ① ① Conduct an elicitation study to elicit commonly held beliefs: Identify the content of control beliefs which are shared by the target population about the behaviour.
B. ① ① Construct questionnaire items to assess the strength of these control beliefs
C. ① Construct questionnaire items to assess the power of these control factors to influence the behaviour

7.2.2 Procedure

A. Conduct an elicitation study to elicit commonly held beliefs

- Sample about 25 people from the same population from which you will select respondents for the questionnaire study. (Again, this would be the same 25 people as those referred to in Sections 5.2.2 and 6.2.2.)
- Use open-ended questions. These are normally presented in one-to-one interviews, but could also be in focus group or questionnaire form. Give participants a few minutes to list their thoughts in response to structured questions (Box 7.2).
- Content analyse the information into themes (control beliefs) and order and label the themes extracted. At least two researchers should do this independently. List the themes in order from most frequently mentioned to least frequently mentioned.

Box 7.2 *Example: Your patient has Type 2 diabetes. The target behaviour is taking a patient's blood pressure. Please take a few minutes to list your thoughts about the following questions:*

What factors or circumstances enable you to measure the blood pressure of a patient with diabetes?

What factors or circumstances make it difficult or impossible for you to measure the blood pressure of a patient with diabetes?

Are there any other issues that come to mind when you think about measuring the blood pressure of a patient with diabetes?

B Construct questionnaire items to assess the strength of control beliefs

- Select the beliefs most often listed and convert these into a set of statements. These statements should reflect the beliefs which might make it difficult to perform (or not perform) the target behaviour. (See Box 7.3 for question and response formats). Inclusion of **75%** of all beliefs listed should give adequate coverage of the belief 'population'.

Box 7.3 *Imagine that the elicitation study has identified a control factor to do with patients being inappropriately dressed for BP measurement; another to do with feeling rushed when measuring BP in the consultation; another about uncomfortable cuffs on BP machines.*

1. Patients with diabetes come to the consultation inappropriately dressed to have their BP measured.
Unlikely 1 2 3 4 5 6 7 Likely

2. When I am measuring BP in the consultation I feel rushed.
Unlikely 1 2 3 4 5 6 7 Likely

3. The cuffs on the BP machines are uncomfortable for patients.
Unlikely 1 2 3 4 5 6 7 Likely

C Construct questionnaire items to assess the power of these factors to influence the behaviour

Convert each of the control belief statements into the form of an incomplete statement about whether this makes it more or less likely that the person will do the target behaviour, or whether it makes the behaviour easier or more difficult to do. (See Box 7.4.)

Box 7.4

1. When patients with diabetes come to the consultation inappropriately dressed to have their BP measured, I am
less likely -3 -2 -1 0 +1 +2 +3 more likely
to measure their BP.

2. Feeling rushed in the consultation makes it
much more difficult -3 -2 -1 0 +1 +2 +3 much easier
to measure patients' BP.

3. When the cuffs on the BP machine are uncomfortable for patients, I am
less likely -3 -2 -1 0 +1 +2 +3 more likely
to measure patients' BP.

- Pilot test these items by asking about five respondents to answer the questions and tell you whether they have any difficulty answering them. If necessary, modify the wording.

7.2.3 Scoring

For each control belief, the belief score on the unlikely/likely scale is multiplied by the score relating to the relevant item on the less likely/more likely scale or the much more difficult/much easier scale (See Box 7.5). The resulting products are summed across all beliefs to create an overall perceived behavioural control score:

Formula 7.1 $PBC = (a \times d) + (b \times e) + (c \times f)$

Where PBC = total perceived behavioural control score.
a, b and c are scores for each of three control beliefs.
d, e and f are scores for control belief power relating to each control belief.

Using this method,

- a ***positive*** (+) score means that, overall, the participant ***feels in control of*** measuring patients' blood pressure.
- a ***negative*** (-) score means that, overall, the participant ***does not feel in control of*** measuring patients' blood pressure.

Box 7.5 Example, scoring procedure

a	Patients with diabetes come to the consultation inappropriately dressed to have their BP measured.	Unlikely	1	2	3	4	***5***	6	7	Likely
b	When I am measuring BP in the consultation I feel rushed.	Unlikely	1	2	***3***	4	5	6	7	Likely
c	The cuffs on the BP machines are uncomfortable for patients.	Unlikely	1	***2***	3	4	5	6	7	Likely
d	When patients with diabetes come to the consultation inappropriately dressed to have their BP measured, I am ..... to measure BP.	Less likely	***-3***	-2	-1	0	+1	+2	+3	More likely
e	Feeling rushed in the consultation makes it ..... to measure patient's BP.	More difficult	-3	***-2***	-1	0	+1	+2	+3	Easier
f	When the cuffs on the BP machines are uncomfortable for patients, I am ..... to measure BP.	Less likely	***-3***	-2	-1	0	+1	+2	+3	More likely

Imagine that the participant has responded by circling the numbers indicated in ***bolded italics*** above.
The total perceived behavioural control score is calculated as

PBC = (5 x -3) + (3 x -2) + (2 x -3)
= (-15) + (- 6) + (- 6)
= - 27

The possible range of total scores is -63 to +63. THEREFORE,
THE PBC SCORE OF THE PARTICIPANT REFLECTS A **MODERATE** LEVEL OF **NEGATIVE** CONTROL, i.e. MEASURING PATIENTS' BLOOD PRESSURE IS FAIRLY DIFFICULT.

8.6 Main study: Practical issues

8.6.1 What sample size is needed?

Required sample size is determined by statistical power analysis. This requires the specification of the study design and the expected effect size (Everitt, 1996). It is reasonable to assume at least a moderate effect size (i.e. multiple R of around 0.3; Cohen, 1988) for TPB studies using a multiple regression approach. Generally, a sample size of 80 would be acceptable. Note that response rates are often around 50%, so you need to send out 160 questionnaires to achieve this sample size unless you have reasons for thinking that the response rate will be better than 50%.

Note that it is important to establish the representativeness of the sample, either by reporting a very high response rate or by comparing the known characteristics of responders and non-responders.

8.6.2 Other aspects of survey methodology that need to be kept in mind

- Approval is probably required from the relevant research ethics committee before the commencement of the project. In the UK, compliance with research governance structures is also required.
- When the questionnaire is mailed to research participants, it should be accompanied by an appropriate cover letter.
- Reminder letters should be sent out to non-responders two weeks after the questionnaires are mailed. A further reminder letter after a further two weeks will probably result in a further small increase in the response rate.
- It would be appropriate to close the data set after two months from the time of mailing the questionnaire.
- Readers may already be very familiar with these procedures, or may wish to consult the following references for further details:

9.3 Main Analysis

- Analysis using the direct measures of the predictor variables

Use the 'recode' command to recode any negatively worded responses. After this, conduct an item analysis on the items relating to the direct measures, to establish internal consistency. If all internal consistency co-efficients are acceptable (> 0.6 as a rough guide), it is appropriate to include all the items in the composite variables.

Use 'compute' commands to create the composite variables for the direct measures. Remember to define these new variables clearly so that the variable labels will be included in the output files.

Using a multiple regression procedure, enter intention as the dependent variable, and the direct measures of attitude, subjective norm and perceived behavioural control as the predictor variables.

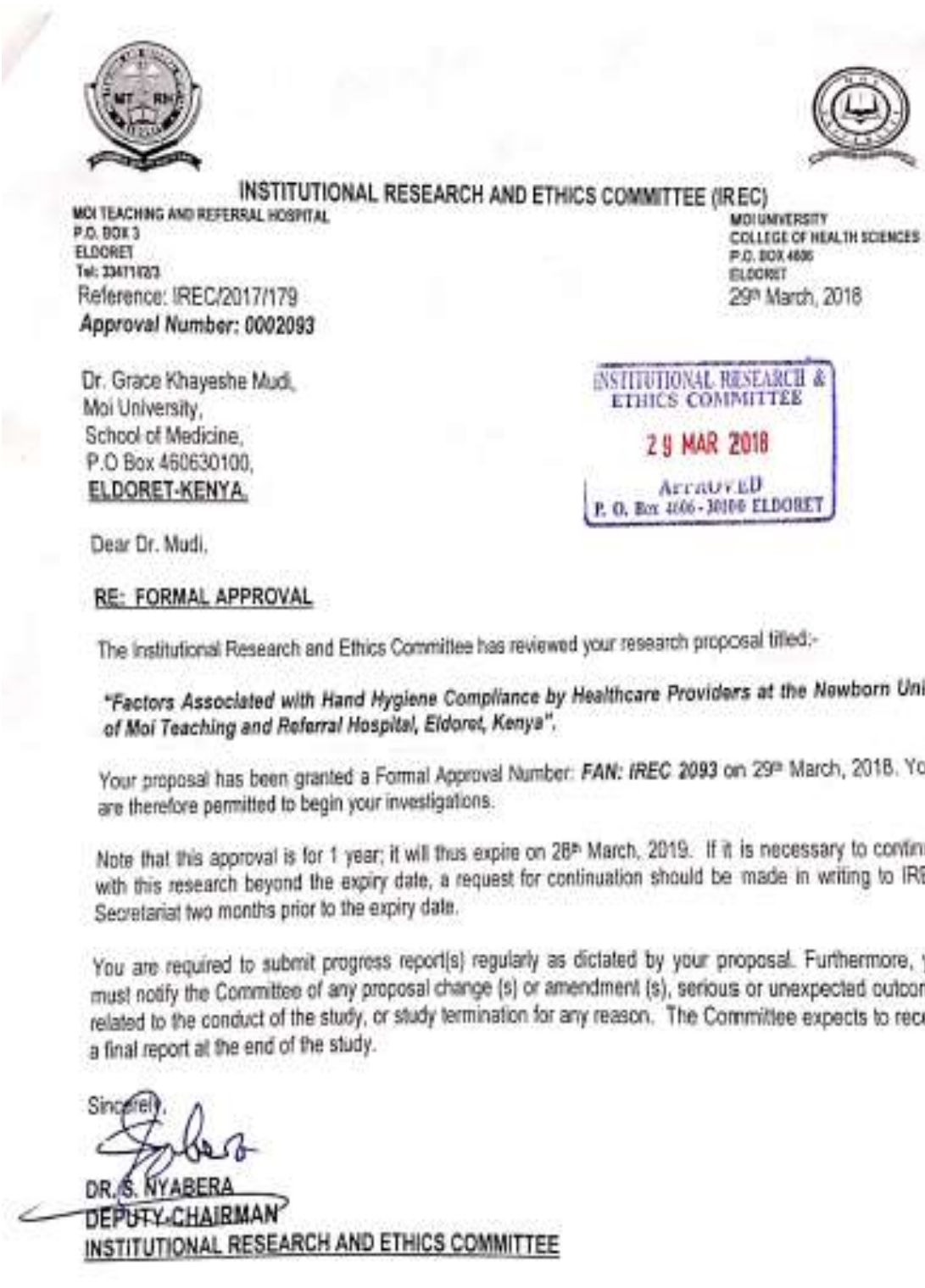
- Analyses using the indirect measures

Weight (multiply) each behavioural belief by the score for the relevant outcome evaluation to create a new variable that represents the weighted score for each behavioural belief. Similarly, weight each normative belief by the score for motivation to comply and each control belief by the score representing the influence of the control belief. Then sum the weighted beliefs to create a composite score for attitude, subjective norm and perceived behavioural control. It is a good idea to calculate a series of simple bivariate correlations between direct and indirect measures of the same construct, to confirm the validity of the indirect measures. (Low correlations would likely be a result of indirect measures that were poorly constructed or did not adequately cover the breadth of the measured construct.)

Using a multiple regression procedure, enter directly-measured attitude scores as the dependent variable, and the sum of the weighted behavioural beliefs as the predictor variables. Use a similar approach to predict directly measured subjective norms and perceived behavioural control.

You may be interested in determining the specific beliefs that have the greatest influence on intentions. To do this, dichotomise the intention variable either using a median split (i.e. low intenders versus high intenders) or by classifying cases on a zero/greater than zero basis (i.e. non-intenders versus intenders). Use a series of t-tests or discriminant analyses to identify the beliefs that discriminate between the two groups.

APPENDIX 6: INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC) APPROVAL



INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
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ELDORET

Reference: IREC/2017/179
Approval Number: 0002093

29th March, 2018

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
29 MAR 2018
APPROVED
P. O. Box 4606 - 30100 ELDORET

Dr. Grace Khayeshe Mudi,
Moi University,
School of Medicine,
P.O Box 460630100,
ELDORET-KENYA.

Dear Dr. Mudi,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Factors Associated with Hand Hygiene Compliance by Healthcare Providers at the Newborn Unit of Moi Teaching and Referral Hospital, Eldoret, Kenya".

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 2093*** on 29th March, 2018. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 28th March, 2019. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

DR. S. NYABERA
DEPUTY-CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

APPENDIX 7: PERMISSION FROM MOI TEACHING AND REFERRAL HOSPITAL

An ISO 9001:2015 Certified Hospital

MOI TEACHING AND REFERRAL HOSPITAL

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Nandi Road
P.O. Box 3 – 30100
ELDORET, KENYA

Ref: ELD/MTRH/R&P/10/2/V.2/2010

5th April, 2018

Dr. Grace Khayeshe Mudi,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Factors Associated with Hand Hygiene Compliance by Healthcare Providers at the Newborn Unit of Moi Teaching and Referral Hospital, Eldoret, Kenya".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

01/04/18

DR. WILSON K. ARUASA, *MBS*
CHIEF EXECUTIVE OFFICER
MOI TEACHING AND REFERRAL HOSPITAL

cc - DCEO, (CS)
- Director of Nursing Services (DNS)
- HOD, HRISM

All correspondence should be addressed to the Chief Executive Officer