

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH

Assessment of Hand Hygiene Practice and associated factors among undergraduate medical students in the College of Health Sciences; Addis Ababa University, Tikur Anbessa Specialized Hospital, Ethiopia

BY

KASSAHUN YIMAM (BSc.)

ADVISOR: ABABI ZERGAW (PhD)

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List of Acronyms

ABHR: Alcohol Based Hand Rub

AOR: Adjusted Odds Ratio

CDC: Center of Disease Control

COR: Crude Odd Ratio

HAI: Hospital Acquired Infections

HBC: Hepatitis C Virus

HBS: Hand Hygiene Belief Scale

HBV: Hepatitis B Virus

HCW: Health Care Worker

HHP: Hand Hygiene Practice

HHQ: Hand Hygiene Questionnaire

MOH: Ministry of Health

MRSA: Methicillin Resistant Staphylococcus Aureus

TASH: TikurAnbessa Specialized Hospital

WHO: World Health Organization

Abstract

Back ground: Hand hygiene is an important measure to prevent and control infection particularly in developing countries, the identification of several risk factors associated with poor hand hygiene compliance is of extreme importance.

Objective: to assess hand hygiene practices and associated factors among undergraduate medical students on clinical year in Addis Ababa University; Tikur Anbessa Specialized Hospital, Ethiopia.

Method: Institution based quantitative cross sectional study design was used to assess the practice and associated factors that influence hand hygiene practices among undergraduate clinical year medical students. A total of 257 medical students were included and selected by simple random sampling. Data collection was made by using self-administered structured and pre-tested questionnaire. EPI INFO version 3.5.1 epidemiological software package was used for editing, cleaning and coding. Descriptive statistics, logistic regression analysis were done to see association of dependent and independent variable and confounding factors and analysis of variance (one- way ANOVA) were done to see variation in hand hygiene practice. Variables with 95% confidence interval and P value < 0.25 during the bivariate analysis were included in the multivariate logistic regression analysis.

Result: A total of 257 questionnaires were completed. Only 48% indicated that alcohol based hand rub is effective for less than 60 seconds. Overall compliance of hand hygiene was found to be 59% (95 % CI (53.3, 65.0)). Demographic and most environmental factors had no association with hand hygiene compliance among medical students only factors: knowledge (AOR [95%CI] = 2.1 [1.06, 4.14]), sex 'female (AOR [95%CI] = 1.88 [1.05, 3.35]) and beliefs: (AOR [95%CI] = 2.71 [1.5, 4.87]) were significantly associated with the hand hygiene compliance.

Conclusion: Good hand hygiene compliance was indicated "after" caring for a patient; whereas poor hand hygiene compliance was reported "before" having direct contact with a patient and there were no variation in hand hygiene practice and were significant difference in knowledge and belief among groups of medical students in different educational year.

I. Key word: hand hygiene practice; beliefs, knowledge; medical student

Introduction

1.1 Background:

Hand hygiene is a general term that applies to either hand washing with plain soap and water, antiseptic soap and water, antiseptic hand rub or surgical hand antisepsis. One of the most significant, current discussions in healthcare delivery in hospitals is healthcare associated infection (HAI), sometimes called hospital acquired infection (1) or nosocomial infections, which is ‘any infection that a person develops as a result of treatment in a hospital’ (2).

The World Health Organization (WHO) strongly emphasize the essential need for hand hygiene during health care delivery, to avoid possible infection and subsequent complications; hence, the ‘Clean Care is Safe Care’ programme was launched by WHO in 2005 as part of the ‘First Global Patient Safety Challenge’ (3). With this regard in Ethiopia has also launched the SAVE LIVES: Clean Your Hands campaign under the leadership of the Ministry of Health (4).

In the developed world infection prevention programs that include hand-hygiene as a basic means have been implemented in every single hospital decades ago but this is not yet true for many countries in the developing world where infection control policies are not in place or poorly funded (5); nosocomial infection and colonization by Methicillin Resistant Staphylococcus Aureus have become increasingly common during the past two decades (6). Although hand hygiene methods are widely publicized and simple (7), the prevalence of these infections continues to rise and poses a challenge to healthcare providers. Healthcare associated infections due to poor hand hygiene has been linked to an unacceptably high level of morbidity, mortality and healthcare costs (8). In developing countries health care associated infection prevalence is found to be as high as 19% (9).

Hand hygiene should be considered before invasive procedures, after contact with contaminated devices or materials, and with high risk, infectious patients. Moreover, claim that hand hygiene should be advocated before beginning work, at the end of work, and after visiting the rest room (10).

Recent studies have found low awareness level regarding hand hygiene among medical students and certified healthcare providers (7, 11). With this regard; raising awareness of hand hygiene standards during undergraduate education may affect the behavior of graduate students upon entering professional life and contribute to the reduction of nosocomial infection rates (12). However, few studies have been undertaken among medical students (trainees) in Ethiopia (13).

1.2 Statement of the problem

The provision of healthcare worldwide is always associated with a potential range of safety problems and patients remain vulnerable to unintentional harm in hospitals because of poor hand hygiene (14).

Over 1.4 million people worldwide suffer from infections acquired in hospital(15). The burden is substantial in developed countries, where it affects from 5% to 15% of hospitalized patients in regular wards and as many as 50% or more of patients in intensive care units (16).In developing countries, the magnitude of the problem remains underestimated or even unknown largely because HAI diagnosis is complex and surveillance activities to guide interventions require expertise and resources(17).

HAI is also a major public health problem in Ethiopia and their prevention has been made a priority as reported by a study on 1383 obstetrics and gynecologic patients at a referral hospital in north west Ethiopia, 246 (17.8%) developed hospital acquired infections (18). In hospital and clinical setting, a high proportion of patients are infected with bacteria and viruses, which cause a continued threat to the health of clients and increase cost to the patient as well as to the healthcare system. In addition, without adequate infection prevention practices like proper use of gloves or proper hand washing, healthcare workers are at increased risk of acquiring infection, most commonly HIV/AIDS, Hepatitis A and C, as well as other common bacterial and viral infections(19).

Although hand hygiene is recognized as the core element to reduce healthcare-associated infections and enhance patient safety, it is still not consistently practiced (20, 21).

In health care settings, compliance to hand hygiene recommendations is the single most important practice for preventing the transmission of pathogens in health care and directly contributes to patient safety (22).

Research conducted to date, has documented hand hygiene compliance rates for medical students ranging between 8% and 52%.While compliance rates have increased in recent years for medical students, they are still well below the recommended hand hygiene guideline(23).

As different literatures stated that medical students tend to be poor compliers for hand hygiene guidelines than other health care disciplines on clinical attachment; medical students' undergraduate education, lack of knowledge of hand hygiene guidelines and of the impact of hand hygiene on HAI rates influence their hand hygiene compliance once they graduate and join the workforce. The influence may be related to the actual education itself or to the sense of the importance placed on hand hygiene. This study aimed to fill this gap and assess undergraduate medical students' hand hygiene practice and associated factors, in their clinical year.

1.3 Rationale of the study

Globally millions of people suffer from infections acquired in hospitals(15).

On top of these, unless appropriate hand hygiene practice is not in place among medical students, it justifies that they can be the source of infection for clients.

Yet, very few studies were conducted among medical students. Therefore; this study was designed to assess the level and associated factors of hand hygiene compliance among medical students.

So, this study aims to contribute in filling information gaps on the hand hygiene practice issue that uses for prevention of both medical students and patients from getting hospital acquired infections so that morbidity, mortality and unnecessary excess medical costs are minimized; in addition it can also serve as base line information to undertake studies on similar settings.

2. Literature review

Hand hygiene was thought to be a key factor in reducing hospital acquired infection (24). The battle with HAI started when the Hungarian obstetrician, Semmelweis, observed that puerperal fever was more common on a maternity ward, where physicians and medical students provided care to women in labour, than it was on the ward where midwives assisted deliveries. He noted that physicians and medical students were contaminating their hands while performing autopsies and later attending the examination of women without hand washing (24).

Despite high magnitude of HAI and the importance of adherence to infection control policies, proper hand hygiene practice has remained unacceptably low (8). Hand hygiene compliance rates in different developed countries rarely exceed 50% (25). For instance, figures show that in the USA it is 50%, in Switzerland 42% and in the UK 32% (26). Hence, poor compliance has resulted in high morbidity and mortality. In the USA, there are between 1.7 and 2 million people who contract HAI and 88 to 99 thousand deaths are attributed to HAI annually. Furthermore, HAI affects nearly 10% of hospitalized patients and presents major challenges in healthcare facilities. Consequently, annual medical expenses have increased in the USA to approximately \$ 4.5 billion (8).

In Canada approximately 8 thousand patients die from HAI annually. Canadian hospitals spend up to \$100 million per year treating patients with HAI (1). European countries also have a high percentage of HAI: in the UK, for example, each year approximately 9% of people admitted to hospital contract HAI; this is one of the highest percentages in Europe (27). The estimated number of deaths due to HAI among hospitalized patients in the UK is 500 patients annually (26). The situation is even worse in developing countries including Ethiopia, where resources and facilities are limited.

Hand hygiene is the single most clinical and cost effective measure for reducing the risk of transmission of infectious diseases in healthcare setting worldwide (28). Its impact on the reduction of these diseases has been estimated to be about 50% (21).

A great deal of research has been conducted examining factors influencing health care workers' compliance with hand hygiene guidelines, there is little research on undergraduate medical students' hand hygiene practice and associated factors in the Ethiopian setting.

Hand hygiene prior to and following patient contact is a key infection control strategy included in many official national and international infection control guidelines (29).

Most infection control programs in developing countries with limited resources are understaffed and hand washing depends mostly in having soap, towels, and sinks available (30). Poor compliance with

hand hygiene is common among HCWs (30). A number of factors have been reported to contribute to poor hand hygiene compliance including limited availability and accessibility of hand hygiene facilities such as sinks, time required to perform hand hygiene, patient's condition, effects of hand hygiene products on the skin and inadequate knowledge of the guidelines heavy workloads, performing activities with cross-transmission, glove use, discourage (21); In developing settings, inadequate access to soap and water, and limited provision of sinks are hindrance to perform hand hygiene at the points of care (14).

In an observational study, which measured the rates of compliance of hand hygiene before and during implementation of a program of hand hygiene improvement in Geneva, Switzerland; resulted in an increase in the rate of compliance from 48% to 66% over a three-year period and significant decreases in the number of hospital acquired infections from 29% to 17% and MRSA carrier or attack rate of MRSA(30).

According to researchers the results from a survey conducted across 14 developing countries to evaluate the problem and size of HAI, showed a wide range of nosocomial infection, from 3 – 13.4% in different hospitals (31). However, another study conducted in developing countries, have reported a higher rate of HAI, 6 – 27%(14). In our setting, as reported by a study on 1383 obstetrics and gynecologic patients at a referral hospital in North West Ethiopia, 246 (17.8%) developed hospital acquired infections (12). A study done by Nigat project and Engender Health in Ethiopia showed that health care workers didn't usually wash their hands on arrival to workplace and before putting on glove; even though, it is well practiced between clients before leaving workplace (32).

Knowledge of hand hygiene and medical students

While there are many studies and interventions that have assessed the knowledge base of medical students, there is a much smaller body of literature on hand hygiene practices and associated factors among medical student on clinical rotation. For example, in a French study of 350 students, including 107 medical students, nursing students had a better overall score compared to medical students in the knowledge of hand hygiene, standard precautions and nosocomial infections (33).

Researchers examined the infection control knowledge of third year medical students. The mean hand hygiene knowledge score was 52.3% and 58% of them did not know the correct indications for the use of alcohol-based hand gel and showed that male students practiced hand hygiene less often than their female counterparts only during the first observation period (prior to intervention).During the second observation period (after intervention), no significant differences were found (34).

In Birmingham, UK, medical students were assessed for their knowledge of HAI, of which 48% participated. This study assessed knowledge of hand hygiene, the use of gloves, venipuncture. Just under half felt that not enough emphasis was placed on infection prevention and control. Again, on assessment of knowledge of nearly 500 medical students in Iran, scores were approximately 66% (35). Practice rather than knowledge alone is a better assessment of on-going behavior and in a study of medical students carrying out their final medical exams, only 9% of students used an alcohol hand gel on day 1, before there was a notice instructing this, compared with 27% after a notice had been put up in the examination area on day 2, 40% medical students felt that their compliance with hand hygiene was at least 80%, whereas observed practice indicated otherwise (36). Hand hygiene promotion does not only rely upon the implementation of interventions, it also requires an improved understanding of medical students' knowledge and practices of hand hygiene (37).

Hand hygiene practices and medical students

In Saudi Arabia the average awareness regarding the positive indications of hand hygiene was 56%. Rests of the 44% of students were either not sure or unaware of the indications of hand hygiene; only 29% of students were able to identify all the five indications for hand hygiene in the questionnaire, with regard to gender, hand hygiene was performed by male students on 24 out of 144 occasions (compliance—16.7%) and by females on 17 out of 96 occasions (compliance—17.7%) resulting in average compliance of 17% indicates that females had better hand hygiene practices than males(38) and different scholars has been noted as there was no association between hand hygiene practice and HCWs' age (34, 37, 39).

In a Greek study on practices of hand hygiene found that nursing students scored higher overall in terms of knowledge but the delivery of education on hand hygiene was different between medical and nursing students. Nursing students had more lectures, tutorials and lecture notes compared to the medical students, and there was a greater use of published guidelines, posters and the internet amongst nursing students (40).

In Hong Kong among respondents, 70% of the nurses and 49% of the physicians perceived that over 15% of patients would suffer from healthcare-associated infections. A total of 79% of the nurses and 68% of the physicians believed that more than 5% of patients would die as a result of healthcare-associated infection. A total of 60% of the nurses and 46% of the physicians acknowledged that over 75% of healthcare-associated infections could be prevented by optimal hand hygiene practices,

although 36% of the nurses and 23% of the physicians claimed that six to ten hand cleansing times per hour would be necessary (41).

It is therefore important that practitioners are provided with appropriate education, training and support to enhance knowledge, understanding and skills in order to increase the safety and quality of care delivered to patients (42). To overcome barriers of hand hygiene compliance, it is widely acknowledged that hand hygiene education is the cornerstone of effective practice (43). However, factors associated with poor hand hygiene during clinical years' of training has not been investigated.

In conclusion several studies indicated that failure to perform appropriate hand hygiene is considered to be the leading cause of health care-associated infections and the spread of multidrug-resistant microorganisms. Healthcare-associated infections are associated with substantially increased health care costs and patient mortality.

Factors influencing hand hygiene compliance

Factors that may influence poor compliance to hand hygiene have been determined objectively in several epidemiological and observational studies. In the survey conducted so far, investigators identified predictors of poor compliance to recommended hand hygiene measures during routine patient care.

Predicting variables include professional category, working in an intensive-care unit, being male hospital ward, time of day/week, and type and intensity of patient care, skin irritation caused by hand hygiene agents, inaccessible hand hygiene supplies, interference with HCW-patient relationships, patient needs perceived as a priority over hand hygiene, wearing of gloves, forgetfulness, lack of knowledge of guidelines, lack of recognition of hand hygiene opportunities during patient care, and lack of awareness of the risk of cross-transmission of pathogens, insufficient time for hand hygiene, high workload and understaffing, lack of role models and lack of scientific information showing a definitive impact of improved hand hygiene on HAI rates, lack of knowledge about the appropriateness, efficacy and understanding of the use of hand hygiene and skin care protection agents contribute to poor hand hygiene performance.

At the institutional level; the lack of written hand hygiene guidelines, available or suitable hand hygiene agents, skin care promotion/agents or hand hygiene facilities, lack of culture or tradition of adherence, and the lack of administrative leadership, sanctions, rewards or support, lack of institutional priority for hand hygiene, lack of institutional safety climate, and lack of active participation in hand-

hygiene promotion at individual or institution level, and lack of an institutional safety climate constitute barriers to good hand hygiene compliance (44).

According to United States Centers of Disease Control and Prevention Control (CDC) and WHO, ~~Hand~~ hygiene is the single most important means of preventing the spread of infection.”(45)

The CDC guideline specifies that hand hygiene should occur with any patient contact and HCW’s hand should be washed with a non-antimicrobial soap and water or, an antimicrobial soap and water when hands are visibly soiled, or contaminated. If hands are not visibly soiled, HCW’s can use an alcohol-based hand rub for routinely decontaminating hand in clinical situations as described in literature

The CDC (2009) guidelines make a number of recommendations in relation to hand hygiene, these are:

- Visibly dirty hands should be cleansed via hand washing with water and soap or an antiseptic agent, because hand rubs whilst having an antiseptic action, do not remove soil from the hands. The rinsing action of hand washing is required in this instance.
- Routine hand washing, for example prior to patient contact, requires hands to be washed for a minimum of 15 seconds with water and an antiseptic agent.
- Health care workers should use hand creams to reduce the incidence of skin damage, as damaged skin harbors more microorganisms than undamaged skin.
- Health care workers should not use hot water to wash their hands as it has a drying, damaging effect on the skin.
- After application of an alcohol-based hand rub, the hands should be rubbed together until dry.
- Following hand washing, the skin can be dried with paper towel or single use cloth towel, but multiple-use cloth towels of the hanging or roll type should be avoided.
- If hands are not visibly soiled or contaminated with blood, body fluids or other proteinaceous material, alcohol-based hand rubs should be used prior to and following direct patient contact, prior to donning and after removing gloves, prior to non-surgical insertion of invasive devices, following contact with bodily excretions and wound dressings, and after contact with inanimate objects in the immediate vicinity of the patient.

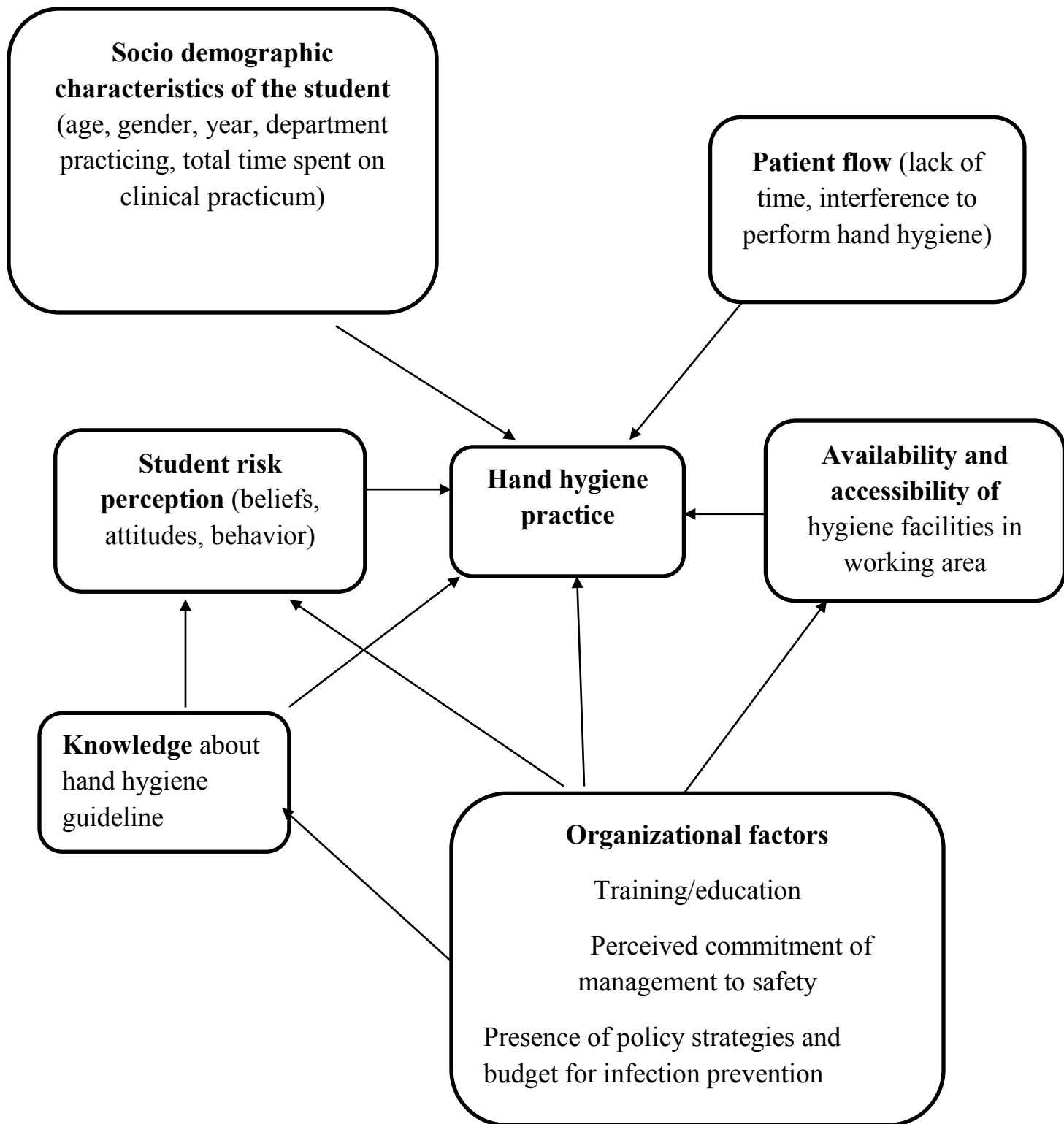


Figure 1 Conceptual framework adopted from social cognitive theory (46)

3. Objective

3.1 The general objective was to assess hand hygiene practice and associated factors among undergraduate medical students in the College of Health Science, Addis Ababa University, Tikur Anbessa Specialized Hospital.

3.2 The specific objectives were

1. To assess the level of self-reported hand hygiene practice.
2. To identify factors associated with hand hygiene practice.
3. To describe hand hygiene practice variation across years.

4. Methods

4.1 Study Design

Institution based quantitative cross sectional study design was conducted to assess hand hygiene practice and associated factors among undergraduate medical students in Tikur Anbessa Specialized Hospital.

4.2 Study Area

The study was conducted in the College of Health Science; Addis Ababa University, Tikur Anbessa Specialized Hospital in the country's oldest University from February to April 2014.

The College of Health Sciences (CHS), Addis Ababa University (AAU) is a professional health Sciences College, established in 2009/10 is comprised of four schools and one teaching hospital. The four schools are the School of Medicine (SOM), the School of Pharmacy (SOP), the School of Public Health (SPH) and the School of Allied Health Sciences (SAHS).

The CHS currently has over 4500 students, and employs over 500 full-time faculty members. The College currently offers 9 undergraduate and over 60 postgraduate programs. Tikur Anbessa Specialized Hospital (TASH) is the teaching hospital of the College. TASH is the largest specialized hospital in Ethiopia, with over 700 beds, and serves as the training center for undergraduate and postgraduate medical students, dentists, nurses, midwives, pharmacists, medical laboratory technologists, radiology technologists, and others who shoulder the health problems of the community and the country at large.

4.3 Source population

All undergraduate medical students on clinical years Addis Ababa University, College of Health Science, at Tikur Anbessa Specialized Hospital was the source population.

4.4 Study population

Undergraduate medical students who are registered and performing clinical practice in different wards of Tikur Anbessa Specialized Hospital were included and selected in the study because medical students on clinical years those from third year upto internship were more likely to have received most of their education, finished their year of medical studies including education in the subject of hand hygiene and microbiology and all of them had already had patient contact.

4.4.1 Inclusion criteria:

Those students who are registered and on clinical practice at TASH during the study period

4.4.2 Exclusion criteria:

Those students who were not in the study area due to various reasons like withdraw after registration and not sign the informed consent was excluded.

4.5 Sample size determination

The sample (n) required for the study is calculated using a single proportional formula with the following assumption:

Confidence level; 95%

Power = 80%

D = Margin of error (Precision) =0.05)

Deff= Design effect =1

$$n = \frac{(Z_{\alpha/2})^2 \times P \times (1-P)}{d^2}$$

n = sample size

$Z_{\alpha/2}$ = Z value at ($\alpha = 0.05$) = 1.96

P = Proportion

Medical students mean hand hygiene beliefs score of 78.8 %-P₁, compliance of hand hygiene was found to be 38.8%-P₂, knowledge score of 51.2 %,-P₃ (29).

Therefore by considering the above assumption the sample size was calculated by using EPI-INFO version 7 statistical software's statCalc program for cross sectional study design .The sample size for different factors was calculated as follows;

Beliefs (P₁)-78.8 %=257

Practice (P₂)-38.8 %=365

Knowledge (P₃) -51.2%=384

With" Knowledge" which gives the maximum sample size becomes 384 since then -N"-total number of medical students currently registered and on clinical practice from third year -272, fourth year -182, fifth year and above -298 total 752; which is less than 10,000 by using finite correction formula.

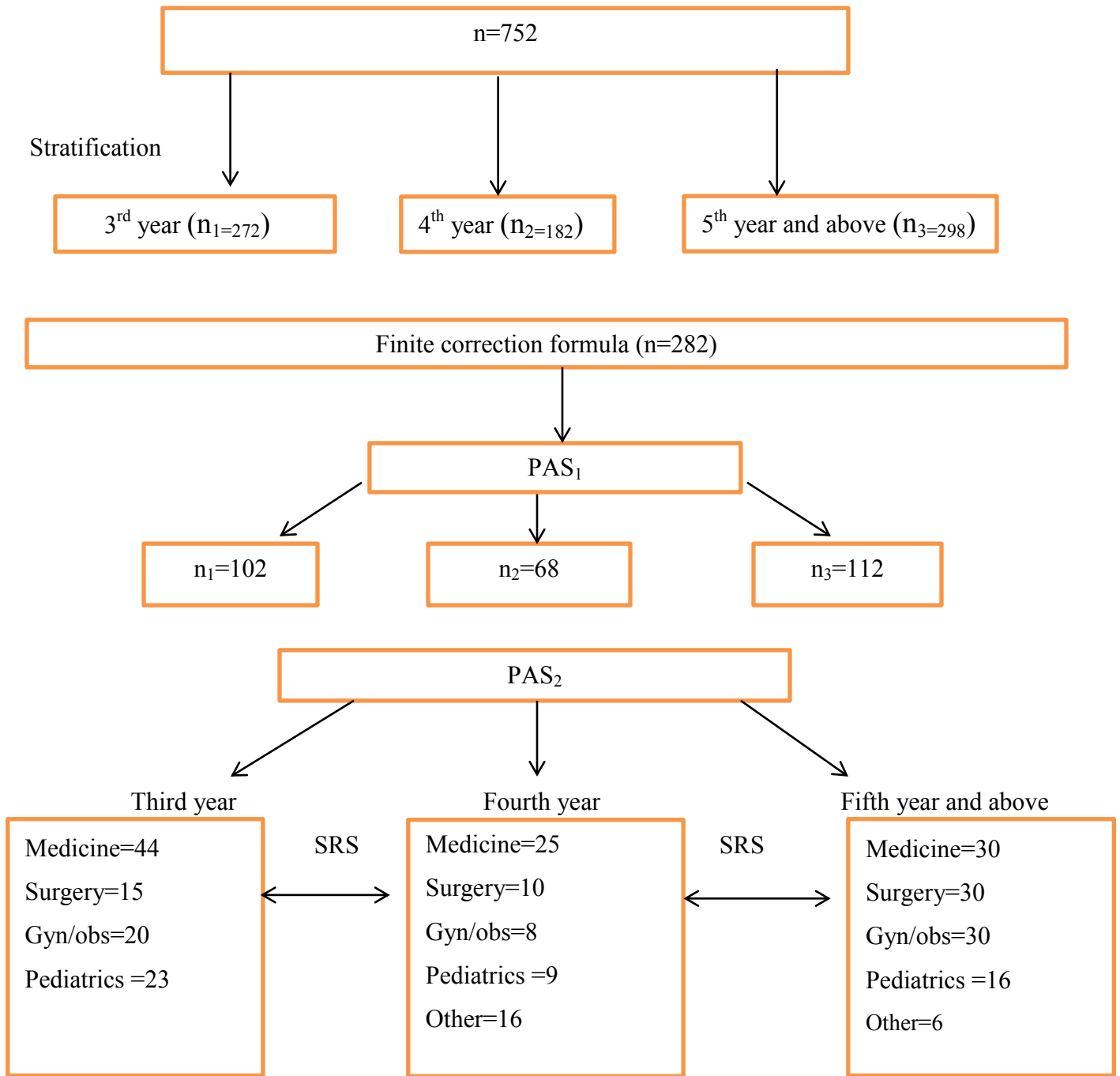
$$nf = \left(\frac{n_0}{1 + \frac{n_0}{N}} \right)$$

Where n_0 -initial sample size, n_f -final sample size; therefore the recommended sample size for Addis Ababa university medical students was 256 and with adjustment for a 10% rate of nonresponses yielded a final sample size of 282

4.6 Sampling procedure

First students were stratified according to years of clinical practicum then proportional allocation of participants in year of clinical practicum and department practicing; those eligible participants were selected by simple random sampling from each department (Medicine, Surgery, Pediatrics, Obstetrics and Gynecology, other/Ophthalmology, Dermatology/).

Figure 2. Schematic representation of sampling procedure



NB: a).PAS₁: proportional allocate to size for years.
 b).PAS₂: proportional allocate to size for department.
 c).SRS: stratified random sampling.

4.7 Data collection

English language is media of instruction in higher education institute in Ethiopia; English version structured questionnaire was used (Annex-I). Data were collected by two diploma nurse and two supervisors who have Bsc. in environmental health using pretested questionnaire in different wards; the questionnaire was filled by 257 of the participant.

Data was collected on outcome variable hand hygiene practices and associated factors; Socio-demographic factors, knowledge, beliefs predictors as depicted in the conceptual framework (Figure 1)

The questionnaire is constructed to find out how far the current hand hygiene practices were in line with standard recommended hand hygiene guidelines(16) and consists of hand hygiene knowledge (12 items) via yes/no, Students' hand hygiene practices and hand hygiene beliefs via 5-point Likert scales named the hand hygiene practices (HHP) (14 items) and hand hygiene beliefs scale (HBS) (22 items) respectively. Although in recent previous studies, questionnaire validation are described in van de Mortel (47) on this study also its reliability and validity was checked found reliability of the hand hygiene knowledge score (0.57), HBS (0.67), HHP (0.84), using Cronbach's alpha.

Across the whole sample, the scale alpha levels were between 0.57 and 0.84, which were considered acceptable to good (48) .

4.8 Operational definition

Hand hygiene: - a term that applies to hand washing, antiseptic hand wash, surgical hand antisepsis alcohol-based hand-rub before, during, and after contact with a patient.

Knowledge: - refers to medical students' information and skill have in relation to 12 questions in the questionnaire per hand hygiene guideline.

Beliefs: - are defined as subjective feelings of medical students about the validity of an idea or set of facts related to the recommended hand hygiene(49).

Hand washing: - refers to cleansing hands with water, a cleansing agent such as soap or an antiseptic solution and mechanical action.

Alcohol-based hand rub: - refers to an alcohol-containing preparation designed for application to the hands for reducing the number of viable microorganisms on the hands.

Undergraduate medical student: - refers to clinical year medical students which includes third, fourth and fifth year and above student.

Healthcare-associated infection: - is defined as an infection _that patient acquire during the course of receiving treatment which becomes evident 48 hours or more after hospital admission or within 30 days of discharge following inpatient care (50).

Hand hygiene compliance: - refers to hand hygiene practice before, during and after any contact with a patient or with the inanimate material.

Good hand hygiene compliance: - medical students who scored greater than or equal to mean score of the total hand hygiene practice questions value (51).

Poor hand hygiene compliance: - medical students who scored less than mean score of hand hygiene practice questions value (51).

Good Knowledge: - refers to medical students who scored the mean and above the mean value of the knowledge questions.

Poor knowledge: - refers to medical students who scored below the mean of the total knowledge questions value.

Positive beliefs: - refers to medical students who scored the mean and above the mean value of hand hygiene beliefs score.

Negative beliefs: - refers to medical students who scored below the mean value of hand hygiene beliefs score.

Potentially contaminated objects: - refers to materials on state of having been actually or potentially in contact with microorganisms that could be capable of producing disease or infection.

Methicillin Resistant Staphylococcus Aureus: - Bacteria that cause serious infections that are very difficult to treat due to the pathogens resistance to many commonly-prescribed antibiotics.

4.9 Variable of the study

Dependent variable: hand hygiene practice.

Independent variable: socio demographic factor; gender, age, department practicing, total time spent on practicum, knowledge and beliefs; environmental factors: availability of soap and water in working ward, availability of sink in working ward, availability of towel/tissue paper, availability of alcohol based hand rub in the ward, availability of glove in the ward and knowing presence of infection prevention committees.

4.10 Data processing and analysis

Data was entered by using EPI INFO version 3.5.1 epidemiological software package for editing, cleaning, coding, and check completeness and consistency. Finally, the data for outcome variable and some independent variable were entered in MS excel sheet to calculate overall scores and was exported to SPSS for windows version 21 for data management and analysis. Descriptive statistics, bivariate logistic and multivariate logistic regression analysis were done to see association between factors and hand hygiene practice. In addition, normality of distribution and equality of variance were checked before one way-ANOVA with Post Hoc Bonferroni test were computed to determine whether there were significant differences in mean hand hygiene practice, knowledge and beliefs scores across clinical year student.

Crude odds ratio with 95% confidence intervals and significance level at $P < 0.05$ were used to see the association between factors and hand hygiene practice. Variables with 95% confidence interval and P value at < 0.25 during the bivariate analysis were included in the multivariate logistic regression analysis to see the relative effect of confounding variables and interaction of variables. Adjusted odd ratios with 95% confidence interval were calculated. The data were displayed by tables and statements. Descriptive statistics (range, mean) was calculated for variables; for each of the scales, the range of scale means and sample mean scores was calculated, and the mean item scores were calculated. Recoding, transforming, and re-categorizing of variables were done to compute some of the analysis. The higher the mean of the HHP score, the more positive the student's hand hygiene practices were, the higher the mean value of the HBS score, the more positive the student's hand hygiene beliefs were. A score of more than 75% was considered good, 50-74% moderate and less than 50% poor (52). The cut off values to determine good, moderate and poor levels were taken from previously published studies with some modification to suit the purpose that was medical students who scored greater than

or equal to mean score of hand hygiene practice questions value were good and medical students who scored less than mean score of hand hygiene practice questions value were at poor levels

4.11 Data quality management

Each questionnaire was checked for completeness, missed values and unlikely responses; those incomplete questionnaires were omitted from the analysis.

Training of data collectors and supervisors on aspect of data collection tools, questioning techniques, ethical issues for two days, and role played on how to fill the questionnaire and pre testing of questionnaire on 10% sample to determine face validity and reliability; the questionnaire was developed by Center of Disease Control(16) adopted from Greek study(47) with some modification for the purpose of this study and made to ensure the quality of data.

Principal investigator and supervisors made spot-checking and reviewing the completed questionnaires by the data collectors ensures completeness and consistency of the information collected; before the actual data possessing reentry of 5% of the data to EPI INFO software package was made to maintain the data quality.

4.12 Ethical consideration

The ethical approval and clearance was obtained from the research ethics committee at the School of Public Health of Addis Ababa University. Permission to conduct this study was secured from Addis Ababa University; School of Medicine, College of Health Science. A formal letter was submitted to all participants' right to self-determination and autonomy was respected; study participants was given any information they need, verbally and in written prior to a self-administration. To this end, the right of each respondent to refuse, answer for few or all questions were respected. Omitting names of the participant from the questionnaire and as no personal details was recorded or produced on any documentation related to the study that help to assure confidentiality of the information and respondents.

Participation was voluntary and participant can withdraw from the study at any time without explanation and without penalty or loss of benefit.

4.13 Dissemination of findings

A detailed report of this study which consists of the main findings will be disseminated to Addis Ababa University; College of Health Science/ School of Medicine, Ministry of Education and Ministry of Health. In addition effort will be exerted to publish the study findings on local/ international journal.

5. Results

Socio demographic characteristics

A total of 257 medical students filled out the self-administered questions with response rate of 91%, out of which 100 (38.9%) were third year, 66 (25.7) were fourth year and 91 (35.4%) were fifth year and above. Mean age (\pm SD) of the respondents were 23.48 ± 2.5 years, 65% were male and 35% were females. Majority of the respondents 59.5% were Orthodox Christians. (Table 1)

Table 1: Distribution of socio demographic characteristics of respondents in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014 (n=257).

Variable	Frequency	Percentage (%)
Sex		
Female	90	35.0
Male	167	65.0
Age		
≤ 23	142	55.3
>23	115	44.7
Religion		
Orthodox	153	59.5
Muslim	38	14.8
Protestant	49	19.1
Other	17	6.6
Total time spent on practicum/weeks/		
≤34	100	38.9
35-94	66	25.7
95-140	91	35.4
Year		
Third	100	38.9
Fourth	66	25.7
Fifth & above	91	35.4
Department		
Medicine	97	37.7
Surgery	47	18.3
Gynecology & Obstetrics	47	18.3
Pediatrics	47	18.3
Other	19	7.4

124(48%) assured the presence of alcohol based hand rub; 39(15%) reported that the presence of individual towel or tissue paper for drying in their working area; 116(45.1%) reported availability of soap and water in working ward; 133(51.8%) reported availability of sink in working ward; 122(87.2%) reported availability of glove in the ward.

Regarding knowledge on the presence of infection prevention committees, 91(35.4%), of the respondents knew the presence infection prevention committees.

Table 2: Distribution of environmental factors among medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014(n=257).

Variable	Frequency	Percentage (%)
Hospital promoting the importance of hand hygiene		
Yes	187	72.8
No	70	27.2
Soap and water is available in the ward		
Yes	116	45.1
No	141	54.9
Sink is available in the ward		
Yes	133	51.8
No	124	48.2
Towel/tissue paper is available		
Yes	39	15.2
No	218	84.8
Alcohol based hand rub is available in the ward		
Yes	124	48.2
No	133	51.8
Glove is available in the ward		
Yes	224	87.2
No	33	12.8
Knew presence of infection prevention committees		
Yes	91	35.4
No	166	64.6

Knowledge

Overall, students' knowledge scores ranged from 0% (0/12) to 100% (12/12), and the mean score was 6.82/12 (± 0.12) or 56.8%.; 187 (72.8%) of the respondents have good knowledge on hand hygiene guideline and (27.2%) of the respondents have poor knowledge as shown in (Figure 4).

Univariate logistic regression analysis looking at the association between knowledge of WHO guidelines and quality of hand-hygiene practices is displayed on (Table 3).

It was identified that medical students who were familiar with the hand-hygiene guidelines were more likely to disinfect their hands before having any direct contact with their patients, following emptying of a drainage reservoir, and prior to and following venipuncture, following the removal of gloves after patient contact, Alcohol-based hand rubs will still be effective if applied for less than 60 seconds, following contact with the bed linen of a patient with MRSA. However, no significant impact of having knowledge was identified on other aspects of hand-hygiene indications.

The one- way between groups ANOVA results showed that level of hand hygiene knowledge had a statistically significant difference among respondents of different clinical year students ($p < 0.012$).

Post hoc comparisons using Bonferroni test showed that the mean knowledge score among third clinical year student was significantly higher than fourth and fifth year and above students, and the mean score of fifth year and above students in turn was significantly higher than fourth year students (Table7)

Table 3: Univariate analysis of comparing knowledge with appropriate hand hygiene across medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014(n=257)

Indication of Hand Hygiene	Possible response	Third year	Fourth year	Fifth year & above	Total	Hand hygiene practice		Odds Ratio (CI)
						poor/<3.79/	Good/≥3.79/	
ABHR should not be used when hands are visibly soiled.	Yes	88(38.1)	60(26.0)	83(35.9)	231(89.9)	96(91.4)	135(88.8)	0.74(0.31, 1.74)
	No	12(46.2)	6(23.1)	8(30.8)	26(10.1)	9(8.6)	17(11.2)	1
ABHR will still be effective if applied for less than 60 seconds	yes	52(41.6)	28(22.4)	45(36.0)	125(48.6)	43(41.0)	82(53.9)	1.6(1.02, 2.79)
	No	48(36.4)	38(28.8)	46(34.8)	132(51.4)	62(59.0)	70(46.1)	1
Hand hygiene is required following the removal of gloves after patient contact	Yes	86(43.4)	47(23.7)	65(32.8)	198(77.0)	74(70.5)	124(81.6)	1.8(1.03 3.33)
	No	14(23.7)	19(32.2)	26(44.1)	59(23.0)	31(29.5)	28(18.4)	1
Single-use cloth towels and paper towels are acceptable for drying hands in patient care areas	Yes	54(37.2)	33(22.8)	58(40.0)	145(56.4)	57(54.3)	88(57.9)	0.86(0.52, 1.42)
	No	46(41.1)	33(29.5)	33(29.5)	112(43.6)	48(45.7)	64(42.1)	1
Hand hygiene must be performed before patient contact, following emptying of a drainage reservoir, and prior to and following venipuncture	Yes	90(45.5)	46(23.2)	62(31.3)	198(77.0)	69(65.7)	129(84.9)	2.9(1.60, 5.32)
	No	10(16.9)	20(33.9)	29(49.2)	59(23.0)	36(34.3)	23(15.1)	1
When using ABHR to decontaminate hands they should be rubbed together until dry	Yes	46(41.1)	27(24.1)	39(34.8)	112(43.6)	38(36.2)	74(48.7)	1.6(1.005, 2.78)
	No	54(37.2)	39(26.9)	52(35.9)	145(56.4)	67(63.8)	78(51.3)	1
Handling of paperwork is not one of the recommended situations for performing hand hygiene	Yes	76(38.4)	49(24.7)	73(36.9)	198(77.0)	79(75.2)	119(78.3)	1.18(0.66, 2.13)
	No	24(40.7)	17(28.8)	18(30.5)	59(23.0)	26(24.8)	33(21.7)	1
Hand hygiene is required following contact with the bed linen of a patient with MRSA.	Yes	80(44.2)	42(23.2)	59(32.6)	181(70.4)	66(62.9)	115(75.7)	1.8(1.06, 3.15)
	No	20(26.3)	24(31.6)	32(42.1)	76(29.6)	39(37.1)	37(24.3)	1
Hand creams and lotions are recommended for health care workers' hands.	Yes	46(40.4)	29(25.4)	39(34.2)	114(44.4)	48(45.7)	66(43.4)	0.91(0.55, 1.5)
	No	54(37.8)	37(25.9)	52(36.4)	143(55.6)	57(54.3)	86(56.6)	1
Gloves should not be reused when caring for different patients.	Yes	84(43.3)	48(24.7)	62(32.0)	194(75.5)	71(67.6)	123(80.9)	0.49(0.27, 0.87)
	No	16(25.4)	18(28.6)	29(46.0)	63(24.5)	34(32.4)	29(19.1)	1
The average cost of HAI in developed countries is approximately \$10,000*.	Yes	22(39.3)	5(8.9)	29(51.8)	56(21.8)	17(16.2)	39(25.7)	1.78(0.94, 3.36)
	No	78(38.8)	61(30.3)	62(30.8)	201(78.2)	88(83.8)	113(74.3)	1
Approximately 20% of ICU develops HAI in developed countries.	Yes	33(39.3)	18(21.4)	33(39.3)	84 (32.7)	32 (30.5)	52 (34.2)	1.18(0.69, 2.02)
	No	67(38.7)	48(27.7)	58(33.5)	173(67.3)	73(69.5)	100(65.8)	1
Overall	Good Knowledge	81(81)	41(62.1)	65(71.4)	187(72.8)	65(61.9)	122(80.3)	2.5(1.42, 4.38)
	Poor knowledge	19(19.0)	25(37.9)	26(28.6)	70(27.2)	40(38.1)	30(19.7)	1

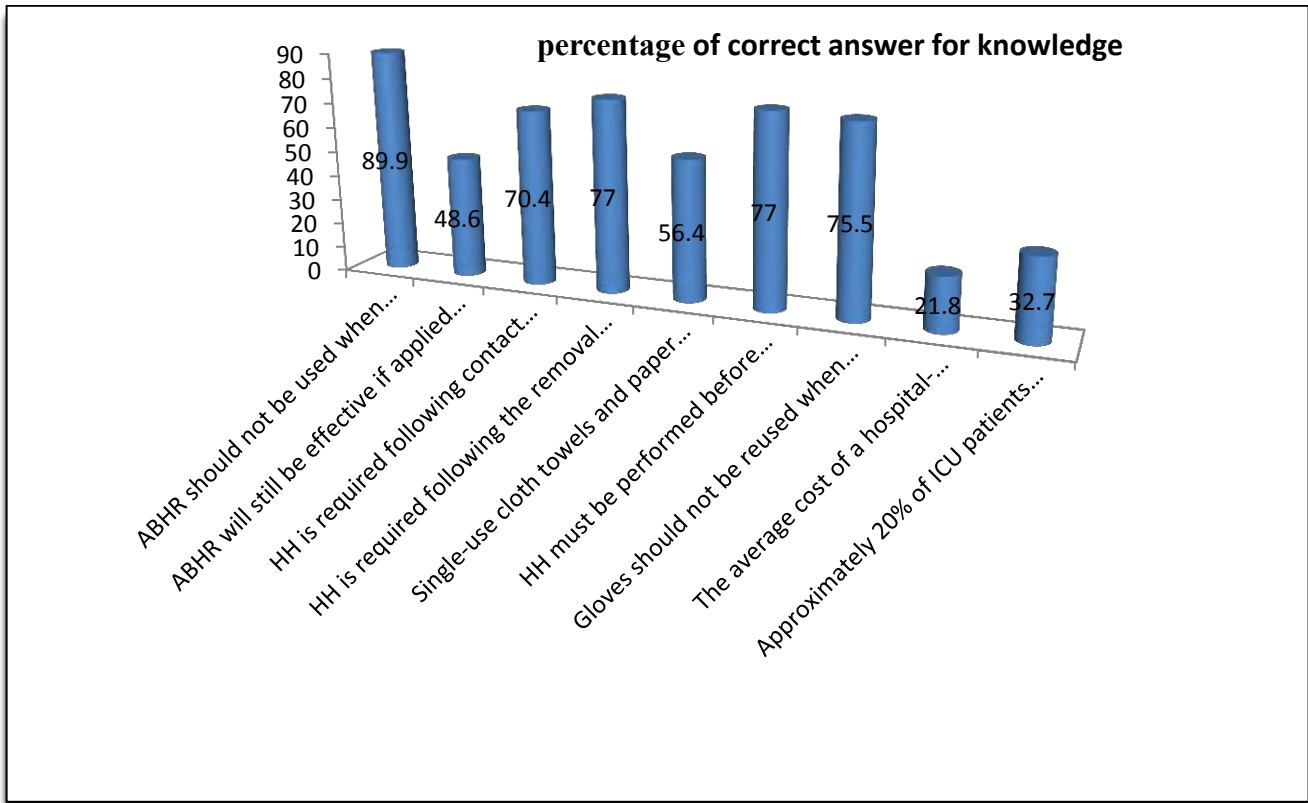


Figure 3. Percentage of hand hygiene knowledge correct answer of medical students at Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014

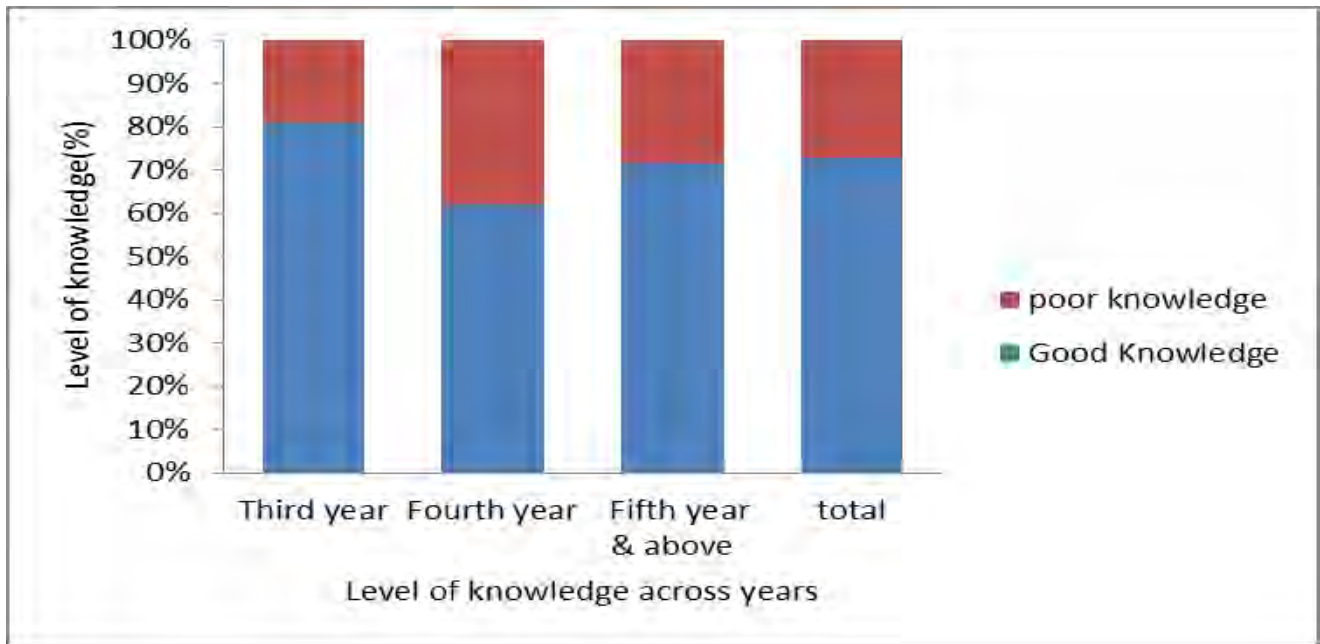


Figure 4. Percentage of overall level on knowledge of hand hygiene across medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014

Table 4:Self-reported practices of hand hygiene among medical student in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014

I cleanse my hand	Never n (%)	Some of the time n (%)	Half of the time n (%)	Mostly n (%)	Always n (%)
P1.After going to the toilet	5 (1.9)	8(3.1)	15(5.8)	105(40.9)	124(48.2)
P2.Before caring for a wound	12(4.7)	25(9.7)	38(14.8)	63(24.5)	119(46.3)
P3.After caring for a wound	6(2.3)	8(3.1)	9(3.5)	72(28.0)	162(63.0)
P4.After touching potentially contaminated Objects	4(1.6)	6(2.3)	15(5.8)	69 (26.8)	163(63.4)
P5.After contact with blood/body fluids	3(1.2)	8(3.1)	7(2.7)	54(21.0)	185(72.0)
P6.After inserting an invasive device	3(1.2)	9(3.5)	13(5.1)	106(41.2)	126(49.0)
P7. Before entering an isolation room	16 (6.2)	32(12.5)	33(12.8)	94(36.6)	82(31.9)
P8. After contact with a patient's skin	6(2.3)	24(9.3)	33(12.8)	82(31.9)	112(43.6)
P9.After exiting an isolation Room	18(7.0)	30(11.7)	41(16.0)	94(36.6)	74(28.8)
P10.Before endotracheal Suctioning	17(6.6)	17(6.6)	30(11.7)	101(39.3)	92(35.8)
P11.After contact with a patient's secretions	9(3.5)	10(3.9)	18(7.0)	54(21.0)	166(64.6)
P12.Before patient contact	27(10.5)	55(21.4)	53(20.6)	60(23.3)	62(24.1)
P13.After removing gloves	17(6.6)	24(9.3)	38(14.8)	69(26.8)	109(42.4)
P14.If they look or feel dirty	16 (6.2)	10(3.9)	20(7.8)	69(26.8)	142(55.3)

Medical students' hand hygiene practices

By using a 5-point Likert scale which required students to estimate their compliance for hand hygiene guidelines in relation to a set of 14 situations, for example, 'I cleanse my hands...after contact with a patient's skin'. Students could choose between the options Never, Some of the Time, Half of the Time, Mostly and Always.

Across the whole sample the average score on the hand hygiene practice indicated that students reported half of the time to always cleansing their hands in the indicated situations (Table 4). Students were most likely to report performing hand hygiene after contact with blood or body fluids, after going to the toilet, after insertion of an invasive device and prior to endotracheal suctioning. Students were least likely to perform hand hygiene before patient contact, after contact with patients' skin, after removing gloves and before wound care.

Only 62(24.1) % of the respondents reported to decontaminate their hands before having direct contact with the patients and only 112(43.6) % claimed to disinfect their hands after caring for the patient, 163(63.4) after touching potentially contaminated objects.

Medical students' mean scores on the hand hygiene practice ranged from zero to five on a five point scale ($\bar{x} = 3.79 \pm 0.03$); percentage mean scores for individual scale items are shown in (Table 5) and depicted in (Figure 5) and ranged from 3.29/5 (before patient contact) to 4.05/5 (after contact with blood or body fluids), overall good hand hygiene compliance was found (59.1 %) and poor hand hygiene compliance was (40.9 %) as shown on (Figure 6). Results from the one- way ANOVA showed that level of hand hygiene practice among groups of different educational year were not statistically significant ($p < 0.77$) (Table 7)

Table 5 Mean scores on practices of hand hygiene across medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014(n=257) Mean (\pm s.e.m)

I cleanse my hands	Third year	Fourth year	Fifth year & above	Total	%
After going to the toilet	4.21(0.09)	4.35(0.12)	4.37(0.06)	4.30(0.05)	86
Before caring for a wound	3.86(0.13)	4.08(0.14)	4.04(0.11)	3.98(0.07)	79.6
After caring for a wound	4.36(0.11)	4.62(0.08)	4.46(0.06)	4.46(0.05)	89.2
After touching potentially contaminated objects	4.56(0.07)	4.35(0.11)	4.49(0.08)	4.48(0.05)	89.6
After contact with blood or body fluids	4.61(0.08)	4.61(0.09)	4.57(0.07)	4.60(0.04)	92
After inserting an invasive device	4.19(0.1)	4.47(0.09)	4.40(0.05)	4.33(0.05)	86.6
Before entering an isolation room	3.61(0.13)	3.77(0.14)	3.90(0.11)	3.75(0.07)	75
After physical contact with a patient	4.12(0.1)	3.92(0.13)	4.07(0.11)	4.05(0.06)	81
After exiting an isolation room	3.54(0.12)	3.62(0.16)	3.89(0.11)	3.68(0.07)	73.6
Before endotracheal suctioning	3.88(0.11)	3.86(0.16)	3.98(0.1)	3.91(0.07)	78.2
After contact with a patient's secretions	4.45(0.09)	4.36(0.14)	4.35(0.10)	4.39(0.06)	87.8
Before patient contact	3.19(0.12)	3.42(0.15)	3.31(0.14)	3.29(0.08)	65.8
After removing gloves	4.10(0.11)	3.71(0.15)	3.79(0.13)	3.89(0.07)	77.8
If they look or feel dirty	4.40(0.09)	3.97(0.15)	4.18(0.12)	4.21(0.07)	83.6
Overall	4.07(0.06)	4.08(0.07)	4.12(0.05)	3.79(0.03)	75.8

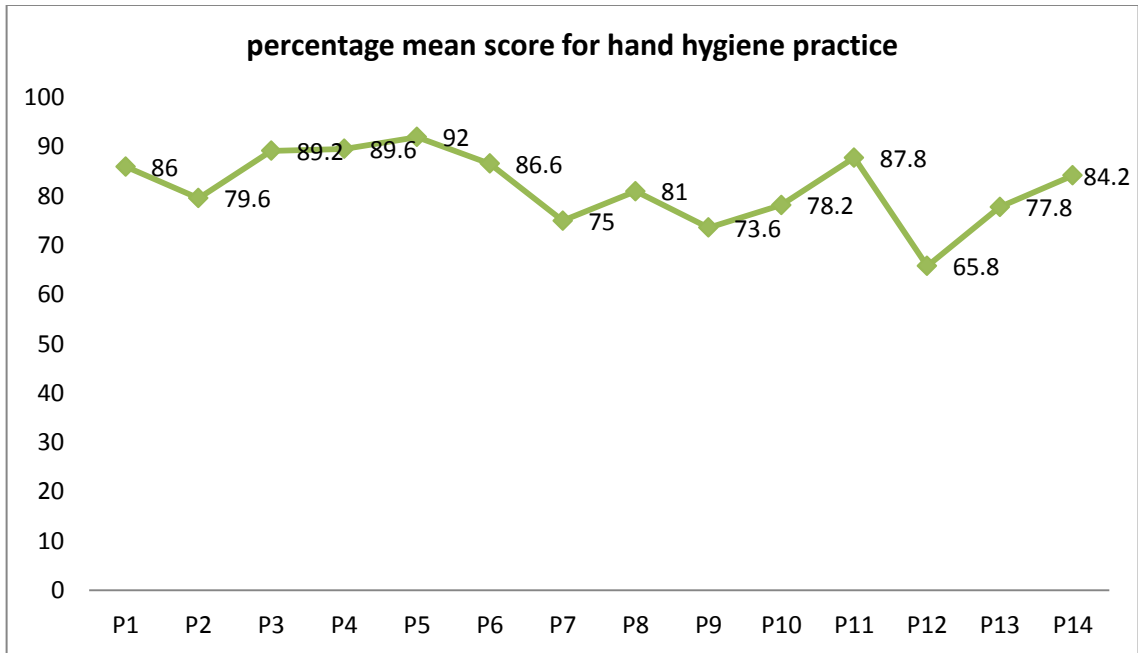


Figure 5. Percentages of mean score on practice of hand hygiene among medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014

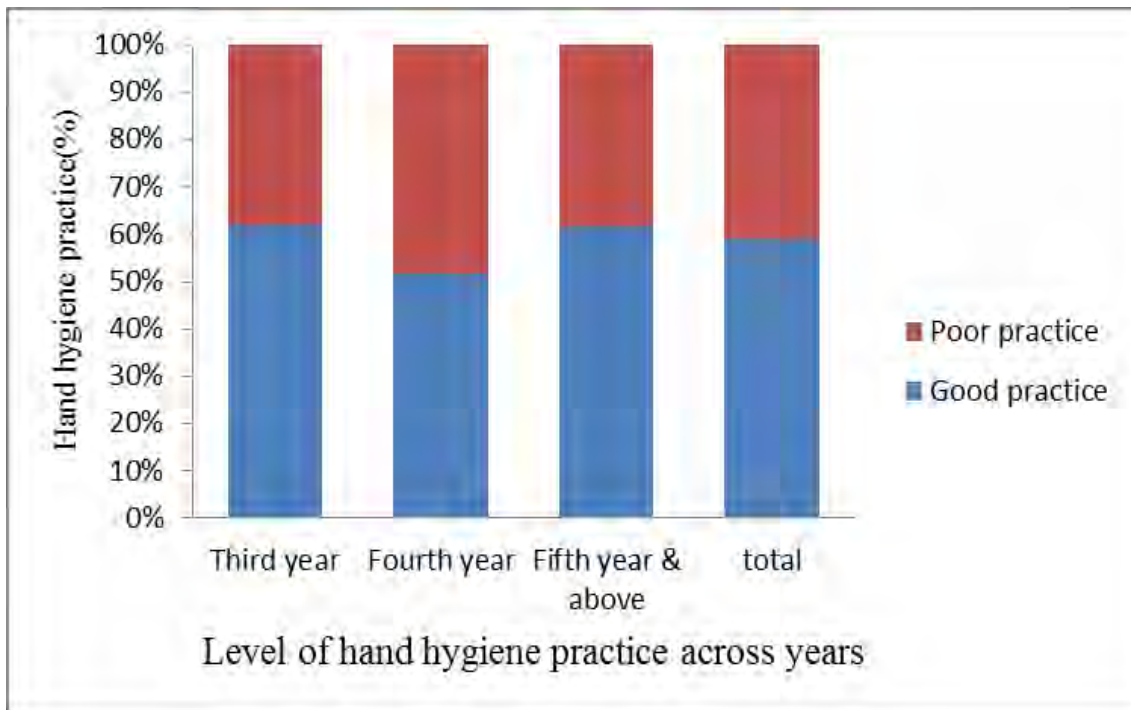


Figure 6. Percentage of overall level of hand hygiene compliance across medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014

Beliefs on medical students' hand hygiene

Students were responded on their beliefs about the importance of hand hygiene in the curriculum and the importance placed on hand hygiene in the clinical setting and by their supervisors. On the statement 'hand hygiene is considered an important part of the curriculum' the mean score across the sample was 3.84(± 0.07), medical students' scores on the HBS ranged from 1.27-4.73 on a five-point scale ($\bar{x} = 3.59 \pm 0.03$); overall 167(63%) of have positive beliefs and 95(37 %) have negative beliefs as depicted on (Figure 7); Mean scores for individual scale items are shown in (Table 6) and ranged from 2.30/5 to 4.22/5 clearly shown on (Figure 8). The one-way between groups ANOVA result showed that level of beliefs had a statistically significant difference among respondents of different educational year ($p < 0.001$). Post hoc comparison using Bonferroni test showed that the mean belief score among third year was significantly higher than fourth and fifth and above students, and the mean score of fifth year and above was in turn significantly higher than fourth year students (Table 7).

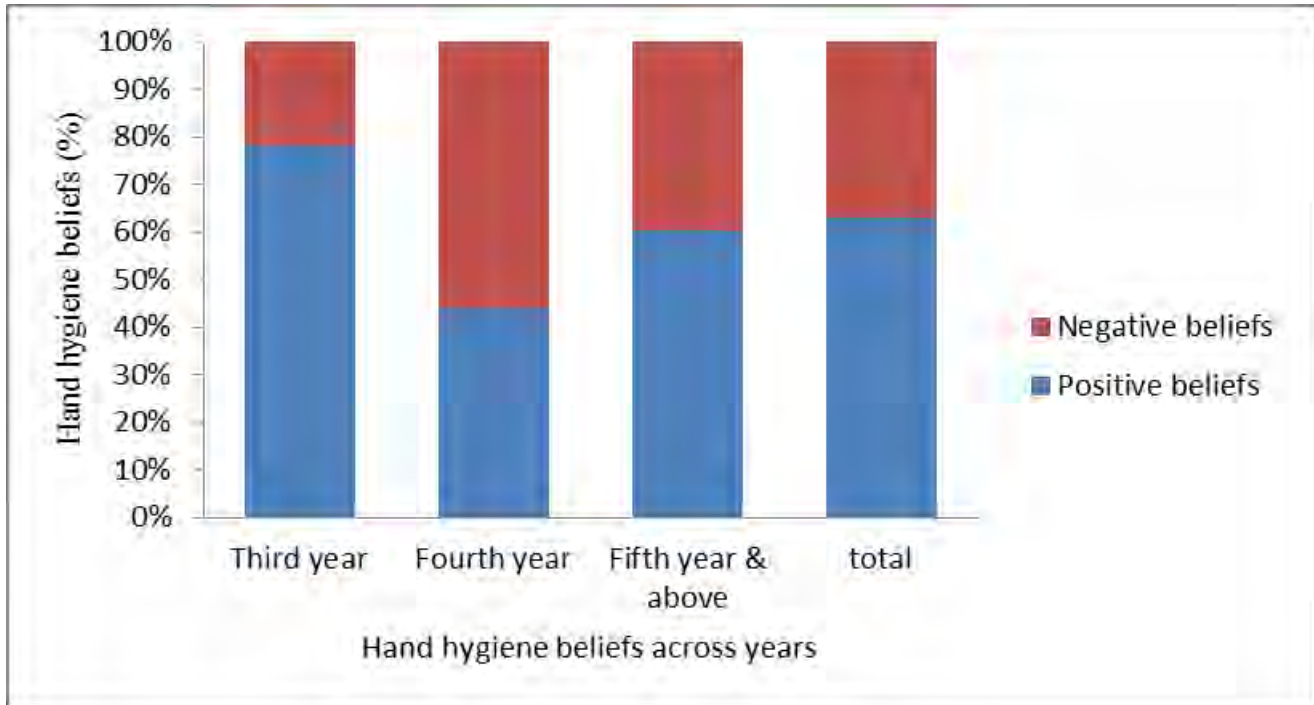


Figure 7. Percentage of overall level on beliefs of hand hygiene across medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014

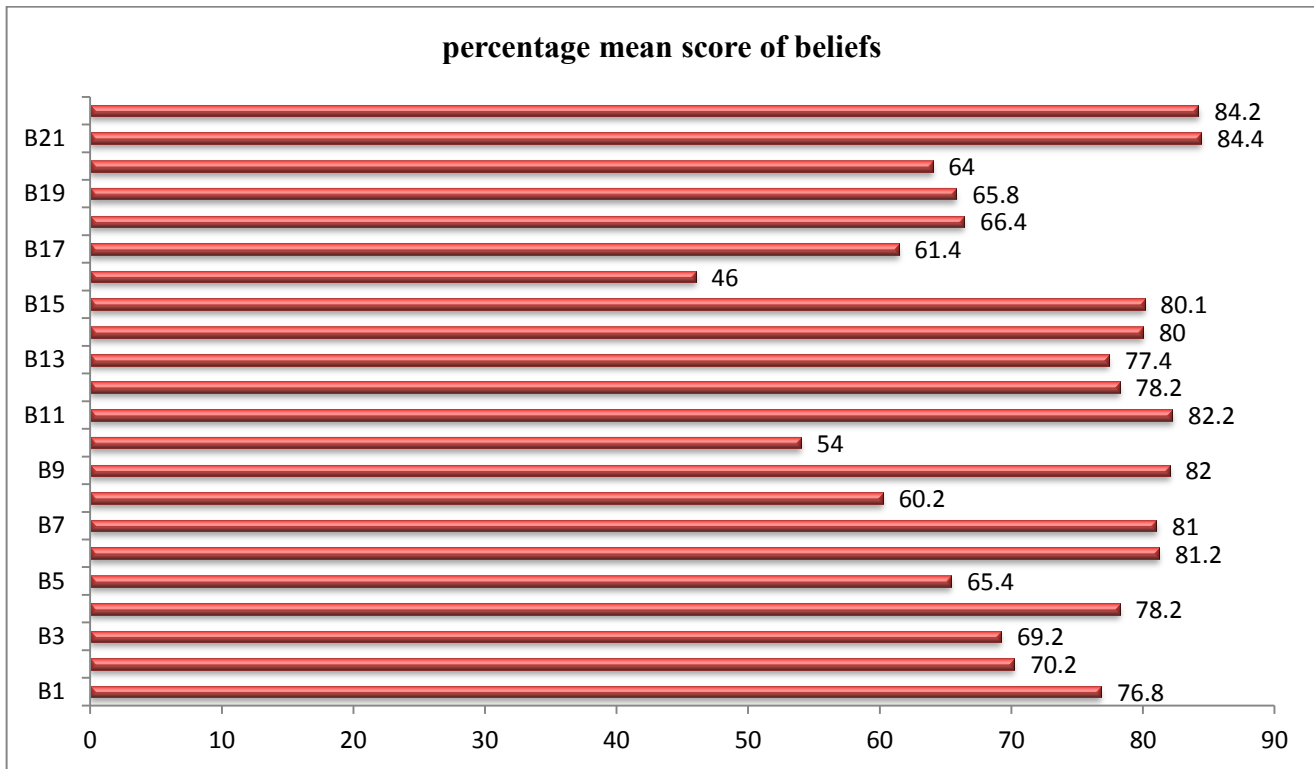


Figure 8 Percentages of mean score on beliefs of hand hygiene among medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014

Table 6: Mean scores on beliefs of hand hygiene across medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014 mean (\pm s.e.m.) (n=257)

Statement	Third year	Fourth year	Fifth year & above	Item mean	%
Hand hygiene is considered an important part of the curriculum.	4.14(0.09)	3.65(0.17)	3.64(0.11)	3.84(0.07)	76.8
The facilities in which I do clinical practicum emphasize the importance of hand hygiene.	3.87(0.09)	3.5(0.15)	3.12(0.13)	3.51(0.07)	70.2
The importance of hand hygiene is emphasized by my clinical supervisors.	3.81(0.09)	3.23(0.15)	3.25(0.12)	3.46(0.07)	69.2
I have a duty to act as a role model for other HCWs.	4.20(0.08)	3.62(0.16)	3.8(0.11)	3.91(0.06)	78.2
When busy it is more important to complete my tasks than to perform hand hygiene ^.	3.30(0.14)	3.62(0.14)	2.99(0.15)	3.27(0.08)	65.4
Performing hand hygiene in the can reduce patient mortality.	4.23(0.09)	3.88(0.15)	4.01(0.12)	4.06(0.06)	81.2
Performing hand hygiene in the can reduce medical costs associated with HAI.	4.21(0.09)	3.85(0.15)	4.04(0.12)	4.06(0.07)	81
I can't always perform hand hygiene in recommended situations because my patient's needs come first ^.	2.90(0.14)	3.42(0.14)	2.85(0.15)	3.01(0.08)	60.2
Prevention of HAI is a valuable part of a health care worker's role.	4.39(0.08)	3.62(0.16)	4.12(0.1)	4.10(0.06)	82
I follow the example of senior HCWs when deciding whether or not to perform hand hygiene ^.	2.57(0.13)	3.11(0.14)	2.55(0.14)	2.70(0.08)	54
An infectious disease in the health care setting may threaten my life or my career.	4.18(0.1)	3.86(0.15)	4.21(0.12)	4.11(0.07)	82.2
I believe I have the power to change poor practices in the workplace.	4.14(0.1)	3.59(0.14)	3.9(0.1)	3.91(0.06)	78.2
Failure to perform hand hygiene in the recommended situations can be considered negligence.	4.07(0.08)	3.8(0.13)	3.7(0.11)	3.87(0.06)	77.4
Hand hygiene is a habit for me in my personal life.	4.19(0.09)	3.8(0.13)	3.95(0.09)	4.00(0.06)	80
I am confident I can effectively apply my knowledge of hand hygiene to my clinical practice.	4.29(0.08)	3.74(0.15)	3.88(0.1)	4.00(0.06)	80.1
It is an effort to remember to perform hand hygiene in the recommended situations^.	2.21(0.1)	2.35(0.14)	2.38(0.11)	2.30(0.06)	46
I would feel uncomfortable reminding a health professional to hand wash^.	2.95(0.13)	3.2(0.16)	3.12(0.13)	3.07(0.08)	61.4
Performing hand hygiene slows down building immunity to disease^.	3.24(0.13)	3.53(0.17)	3.26(0.14)	3.32(0.08)	66.4
Dirty sinks can be a reason for not washing hands^.	3.22(0.13)	3.32(0.15)	3.37(0.14)	3.29(0.08)	65.8
Lack of an acceptable soap product can be a reason for not cleansing hands^.	3.19(0.13)	3.0(0.16)	3.34(0.13)	3.20(0.08)	64
Performing hand hygiene after caring for a wound can protect from infections.	4.46(0.07)	3.98(0.14)	4.13(0.11)	4.22(0.06)	84.4
Cleansing hands after going to the toilet can reduce transmission of infectious disease.	4.48(0.07)	4.14(0.15)	3.96(0.13)	4.21(0.07)	84.2
Overall	3.76(0.03)	3.39(0.07)	3.53(0.04)	3.59(0.03)	72
Positive beliefs (n (%))	78(78)	29(43.9)	55(60.4)	----	162(63)
Negative beliefs (n (%))	22(22)	37(56.1)	36(39.6)	----	95(37)

Scale: 1=strongly disagree to 5= strongly agree; ^ indicates the item is reverse code

Table 7: Comparison of mean scores on knowledge, beliefs and practices of hand hygiene among medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014 using One-Way between-groups ANOVA

Variable	Year	Range(mean±s.e.m)	F value(df)	P value	Eta Squared
Knowledge	Third	2-11 (7.24±0.19)	4.52(2, 254)	0.012	0.034
	Fourth	3-10 (6.27±0.22)			
	Fifth and above	2-11 (6.75±0.23)			
	Total	2-11 (6.82±0.12)			
beliefs	Third	2.91-4.64(3.76±0.03)	13.67(2, 254)	p< 0.001	0.097
	Fourth	1.27-4.73(3.39±0.07)			
	Fifth and above	2.23-4.55(3.53±0.04)			
	Total	1.27-4.73(3.59±0.03)			
practices	Third	1.57-4.64(3.76±0.06)	0.25(2, 254)	0.773	0.002
	Fourth	1.93-4.64(3.79±0.07)			
	Fifth and above	2.43-4.64(3.83±0.05)			
	Total	1.57-4.64(3.79±0.03)			

Factors associated with hand hygiene practice: Bivariate analysis

Table 8 presents the selected socio demographic variables and their relation to the hand hygiene practice. Sex, age, religion, practicum weeks and department practicing didn't show significant association with hand hygiene practice; knowledge and beliefs show significant association.

Table 9 indicates the bivariate analysis of environmental condition with respect to hand hygiene practice. Availability of soap and water in working ward, availability of sink in working ward Availability of towel/tissue paper, availability of Alcohol based hand rub in the ward, hospital promoting the importance of hand hygiene, availability of glove in the ward and knowing presence of infection prevention committees didn't show significant association with hand hygiene practice.

The crude analysis of socio demographic factors for hand hygiene practice is shown in Table 8:

The odds of hand hygiene practice were significantly higher for those who have good knowledge for hand hygiene guideline (COR [95%CI] = 2.5 [1.42, 4.38]). Medical students who have positive beliefs for hand hygiene guideline (COR [95%CI] = 3.0 [1.82, 5.21]) significantly associated with hand hygiene practice.

Medical students' sex female (COR [95%CI] = 1.63 [0.95, 2.78]), age > 23 (COR [95%CI] = 0.82 [0.49, 1.35]), religion; Orthodox (COR [95%CI] = 0.86 [0.3, 2.47]), Muslim (COR [95%CI] = 0.75 [0.22, 2.45]), Protestant (COR [95%CI] = 0.56 [0.18, 1.77]), total time spent on practicum /weeks/ 35-94 (COR [95%CI] = 0.69 [0.36, 1.29]), ≥95 (COR [95%CI] = 0.93 [0.52, 1.67]), fourth year (COR [95%CI] = 0.65 [0.34, 1.22]) fifth year & above (COR [95%CI] = 0.65 [0.34, 1.22]) didn't show significant association to the hand hygiene practice.

The crude analysis of environmental factors for hand hygiene practice is shown in Table 9:

Availability of soap and water in working ward (COR [95%CI] =1.58 [0.95, 2.62]), availability of sink in working ward (COR [95%CI] =1.6 [0.97, 2.65]), availability of towel/tissue paper (COR [95%CI] =1.12 [0.55, 2.26]), availability of Alcohol based hand rub in the ward (COR [95%CI] =1.26 [0.76, 2.08]), hospital promoting the importance of hand hygiene (COR [95%CI] =1.42 [0.81, 2.47]), availability of glove in the ward (COR [95%CI] =1.42 [0.68, 2.97]) and knowing presence of infection prevention committees (COR [95%CI] =1.01 [0.6, 1.7]) didn't show significant association

Table 8: Association of hand hygiene practice with socio - demographic factors among medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014(n=257)

Variables	Hand hygiene practice		COR(95%CI)	p-value
	Good/ ≥ 3.79 /	Poor/ < 3.79 /		
Sex				
Female	60(39.5)	30(28.6)	1.63(0.95, 2.78)	0.07
Male	92(60.5)	75(71.4)	1	
Age				
≤ 23	87(57.2)	55(52.4)	1	
> 23	65(42.8)	50(47.6)	0.82(0.49, 1.35)	0.44
Religion				
Orthodox	94(61.8)	59(56.2)	0.86(0.3, 2.47)	0.79
Muslim	22(14.5)	16(15.2)	0.75(0.22, 2.45)	0.63
Protestant	25(16.4)	24(22.9)	0.56(0.18, 1.77)	0.33
Other	11(7.2)	6(5.7)	1	
Department				
Medicine	58(38.2)	39(37.1)	1.08(0.39, 2.93)	0.87
Surgery	26(17.1)	21(20)	0.9 (0.3, 2.64)	0.84
Gynecology and obstetrics	30(19.7)	17(16.2)	1.28(0.43, 3.8)	0.65
Pediatrics	27(17.8)	20(19)	0.98(0.33, 2.88)	0.97
Other /specify/	11(7.2)	8(7.6)	1	
Total time spent on practicum /weeks/				
≤ 34	62(40.8)	38(36.2)	1	
35-94	35(23)	31(29.5)	0.69(0.36, 1.29)	0.25
≥ 95	55(36.2)	36(34.3)	0.93(0.52, 1.67)	0.82
Knowledge				
Good knowledge	122(80.3)	65(61.9)	2.5(1.42, 4.38)*	0.001
Poor knowledge	30(19.7)	40(38.1)	1	
Beliefs				
Positive	112(73.7)	50(47.6)	3.0(1.82, 5.21)**	0.000
Negative	40(26.3)	50(52.4)	1	

* Significant at $p < 0.05$

** Significant at $p < 0.001$

Table 9: Association of hand hygiene practice with environmental factors among medical students in Tikur Anbessa Specialized Hospital; Addis Ababa, Ethiopia, April 2014(n=257).

Variables	Hand hygiene practice		COR(95%CI)	p-value
	Good/ ≥ 3.79 /	Poor/ < 3.79 /		
Soap and water is available in the ward				
Yes	75(49.3)	40(38.1)	1.58(0.95, 2.62)	0.07
No	77(50.7)	65(61.9)	1	
Sink is available in the ward				
yes	86(56.6)	47(44.8)	1.6(0.97, 2.65)	0.06
No	66(43.4)	58(55.2)	1	
Towel/tissue paper is available				
yes	24(15.8)	15(14.3)	1.12(0.55, 2.26)	0.74
No	128(84.2)	90(85.7)	1	
Alcohol based hand rub is available in the ward				
yes	77(50.7)	47(44.8)	1.26(0.76, 2.08)	0.35
No	75(49.3)	58(55.2)	1	
Glove is available in the ward				
yes	135(88.8)	89(84.8)	1.42(0.68, 2.97)	0.34
No	17(11.2)	16(15.2)	1	
Knew presence of infection prevention committees				
yes	54(35.5)	37(35.2)	1.01(0.6, 1.7)	0.96
No	98(64.5)	68(64.8)	1	
Hospital promoting the importance of hand hygiene				
yes	114(75)	73(69.5)	1.42(0.81, 2.47)	0.21
No	38(25)	32(30.5)	1	

Factors associated with hand hygiene practice, Multivariate analysis

To avoid excessive number of variables that reached P-value less than 0.25 during the bivariate analysis were included in the multivariate logistic regression analysis to see the relative effect of confounding variables. The multivariate logistic analysis identified having knowledge of hand hygiene guideline (AOR [95%CI] = 2.1 [1.06, 4.14]), gender female (AOR [95%CI] = 1.88 [1.05, 3.35]) and having positive beliefs for hand hygiene guideline (AOR [95%CI] = 2.71 [1.5, 4.87]) showed significant association with hand hygiene practice. But total time spent on practicum /weeks/ 35-94, ≥ 95 ; (AOR [95%CI] = 1.04 [0.52, 2.09]); (AOR [95%CI] = 1.28 [0.67, 2.44]) respectively and Hospital promoting the importance of hand hygiene (AOR [95%CI] = 1.43 [0.78, 2.61]), availability of soap and water in working ward (AOR [95%CI] = 1.14 [0.57, 2.25]), availability of sink in working ward (AOR [95%CI] = 1.21 [0.62, 2.38]) didn't show significant association on the hand hygiene practice (Table 10).

The odds of having hand hygiene practice in medical students who have good knowledge were 2.1 times higher than who have poor knowledge (AOR [95%CI] = 2.1 [1.06, 4.14]) and The odds of hand hygiene practice among medical students who have positive beliefs were 2.7 times higher than who have negative beliefs (AOR [95%CI] = 2.71 [1.5, 4.87]).

Table 10: Summary of logistic regression analysis of Socio- demographic, knowledge, beliefs and environmental factors on hand hygiene practice among medical students in Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia, April 2014(n=257).

Variables	Hand hygiene practice		COR(95%CI)	AOR(95%CI)
	Good/ ≥ 3.79 /	Poor/ < 3.79 /		
Sex				
Female	60(39.5)	30(28.6)	1.63(0.95, 2.78)	1.88(1.05, 3.35) *
Male	92(60.5)	75(71.4)	1	
Total time spent on practicum /weeks/.				
≤ 34	62(40.8)	38(36.2)	1	
35-94	35(23)	31(29.5)	0.69(0.36, 1.29)	1.04(0.52, 2.09)
> 95	55(36.2)	36(34.3)	0.93(0.52, 1.67)	1.28(0.67, 2.44)
Hospital promoting the importance of hand hygiene.				
yes	114(75)	73(69.5)	1.42(0.81, 2.47)	1.43(0.78, 2.61)
No	38(25)	32(30.5)	1	
Soap and water is available in the ward.				
Yes	75(49.3)	40(38.1)	1.58(0.95 2.62)	1.14(0.57, 2.25)
No	77(50.7)	65(61.9)	1	
Sink is available in the ward.				
yes	86(56.6)	47(44.8)	1.6(0.97, 2.65)	1.21(0.62, 2.38)
No	66(43.4)	58(55.2)	1	
Knowledge				
Good knowledge	122(80.3)	65(61.9)	2.5(1.42, 4.38)	2.1(1.06, 4.14) *
Poor knowledge	30(19.7)	40(38.1)	1	
Beliefs				
Positive	112(73.7)	50(47.6)	3(1.82, 5.21)	2.7(1.5, 4.87) **
Negative	40(26.3)	50(52.4)	1	

* Significant at $p < 0.05$

** Significant at $p \leq 0.001$

6. Discussion

Hand hygiene remains one single and most effective means to prevent, control, and reduce healthcare-associated infections; poor hand hygiene compliance of medical students with hand hygiene, however, remains a major problem in hospitals (20). This study tried to assess hand hygiene compliance of medical students and the associated factors. Although infection is most prevalent in patients upon admission, medical students also act as potential vectors for pathogenic agents. Hospitals provide a favorable transmission pathway for the spread of nosocomial infections, owing partly to poor infection control practices of hand hygiene among medical students on one hand and overcrowding of patients in most clinical settings on the other (50). The issue of hospital-acquired infections goes beyond its impact on morbidity and mortality figures in any country, and has profound economic implications. According to Robert, acquisition of a nosocomial infection can prolong duration of hospitalization, increase the costs of health care, and place a serious economic burden on patients and their families(53). Based on clinical, experimental, and epidemiological studies, the CDC and WHO guideline strongly recommend hand washing and the use of the alcohol based solutions to minimize the burden of infection (20).

Despite the number of scientific evidence that hands are the most important vehicle for transmission of nosocomial pathogens(30), in brazil study different levels of compliance on hand hygiene between hospitals wards with the pediatric a little higher (58%) which is not consistent with this study as there was no departmental differences on practice and may be explained by methodological differences.

Knowledge to hand hygiene guideline was found to be associated with hand hygiene compliance. This was in line with other similar study done in Ghana, Italy which showed that knowledge of medical students were significantly associated with good hand hygiene compliance (29, 54). This study also gives additional evidence of knowledge on hand hygiene guideline will help to comply hand hygiene with recommended way, and knowledge will help to identify the way of HAIs transmission and how it is prevented.

The percentage of hand hygiene questions answered correctly by medical students varied between zero and 100% ($\bar{x} = 60.5\%$). Their mean hand hygiene knowledge score is comparable to the results that have been reported in Italy (63%) (29).

In this study the overall mean hand hygiene knowledge score across medical students on the hand hygiene guideline was $\bar{x} = 6.82/12 (\pm 0.12)$ or (56.8%) which is lower than from the study in Italy $\bar{x} = 7.73/12 (\pm 0.06)$ or 64.4%(29), which was a positive finding. However it is important to address

the gaps of knowledge with regard to before patient contact; implication cost of HAI, percentage of patient which develops HAI and reusing of gloves for different patient appropriate methods of hand hygiene during their training; While 52% did not know the correct indications for the use of alcohol hand rub; which is consistent with the study in Ghana(56%)(54), in England (58%)(55); not consistent with the study in Italy (44%)(29), United States (40%)(56); indicated that there was a gap on use alcohol based hand rub.

In addition, in this study 55% of students did not know that health care workers are encouraged to use hand creams to minimize skin damage and was consistent with report of CDC(45); lack of knowledge of hand hygiene guidelines and protocols is a risk factor for non-compliance by health care workers(16).

Students generally had little idea of the incidence and costs of HAIs; percentage of patients that develop hospital-acquired infections which is comparable with Italy study(29).

Students generally understood that hand hygiene must be performed before patient contact, following emptying of a drainage reservoir, and prior to and following venipuncture, and as 77% answered this question correctly. Similarly, 75% of students knew that gloves should not be re-used; although 23% did not know that hand hygiene should be performed after removing gloves. In this study found that medical students were more likely to perform hand hygiene following glove use was 42 % which is low compared to 66% in other country(57). That may be explained by lack of resources.

There was a positive significant association between hand hygiene beliefs and hand hygiene practices. This result is supported by previous studies that have demonstrated an association between beliefs and practices. (40, 56) demonstrated that positive beliefs towards hand hygiene were associated with better glove use.

As hand hygiene beliefs influenced students' hand hygiene practices, it illustrates the need to convince students that faculty and clinical facilities consider hand hygiene to be very important as an infection control measure, and this perhaps can be achieved in part by increasing the emphasis placed on hand hygiene education. Students can be socialized into particular behaviors, and they are influenced by local practice culture and role models. If senior staff/role models are modelling poor hand hygiene behavior, students will tend to follow the behavior of those role models (58).

Analysis of the results found that students felt hand hygiene was given greater importance in the curriculum than by their clinical supervisors or in the hospital in which they performing their practicum as mean score was (76%),(70%),(69%) respectively. These results suggest that it is

important to educate clinical teachers on the importance of hand hygiene and their influence on students' behavior.

Good hand hygiene compliance was noticed "after" caring for a patient; whereas poor hand hygiene compliance was reported "before" having direct contact with a patient and consistent with findings in Australia (59, 60); This difference might be explained by lack of knowledge of hand hygiene guidelines but another possible explanation is the desire on the part of medical students to protect themselves from transmissible pathogens or where they themselves feel at risk, than in situations where unclean hands put the patients at risk and also suggest that the hand hygiene behavior of medical students is largely motivated by self-protection rather than the protection of others', and that this explains why higher compliance is associated with contacts that involve a higher risk.

The average scores on the HBS(3.59 ± 0.03) and HHP(3.79 ± 0.03) were lower than those obtained by Greek study(3.94 ± 0.01), (4.58 ± 0.01) (29); indicating that they are not washing their hands at least in 'mostly' situations of hand hygiene indications.

Scholars demonstrated that self-reported hand hygiene practices improved over the duration of the course, which tends to support the findings of Snow et al(39) who noted that self-reported compliance improved with increasing duration of practicum but in this study there is no significant association and there was significant gender difference as female was good complier of hand hygiene practice than male medical student which was consistent with study done in other country(38).

Overall hand hygiene compliance of medical students in TASH was found to be 59% 95%CI (53.3, 65.0), which is comparable to; Massachusetts (61), Australia (23), Germany (62) and Switzerland (34); varied around (8 % - 52 %); lower than recent Italy study and WHO recommendation. This might be due to overestimation of their real practice; and there may be lack of knowledge about hand hygiene guideline.

In addition there was no significant difference in hand hygiene practice shown between medical students. Although fifth year and above students are clinically more experienced than fourth year than third year and consistent with study done in Pakistan (63). This might explain that clinical experience is not related with hand hygiene compliance.

Due to the dearth of published information on medical students' hand hygiene practices in Ethiopia; it was not possible to make national comparisons.

At this point, there is little insight into why medical students might overestimate compliance, but this is potentially an important area for further research and future intervention.

7. Strength and limitation of the study

7.1 Strength of the study

- It will serve as base line information for further research and important for policy makers to design strategy to prevent and control health care associated infections.
- The standard tool which developed by the World Health Organization was used.

7.2 Limitation of the study

- This study involved small sample size (n=282) and was not supported by observation.
- There is also social desirability bias.
- This study used the participants' responses to define their compliance; many participants tend to overestimate their compliance, reporting what they perceive to be ideal responses.

7. Conclusion

- Medical students' good hand hygiene compliance was indicated "after" caring for a patient; whereas poor hand hygiene compliance was reported "before" having direct contact with a patient.
- Medical students' hand hygiene practice was influenced by the beliefs and knowledge they have for hand hygiene indications as per hand hygiene guideline.
- There were no statistical significant variations on hand hygiene practice score across medical students in different clinical year.

8. Recommendations

Tikur Anbessa Specialized Hospital Medical faculty should give more emphasis on;

- Medical students should undergo regular training and retraining on hand hygiene guideline to enhance knowledge and beliefs in clinical year program.
- Efforts need to be focused to raise awareness regarding the impact of health-care associated infections and implications of hand hygiene.
- Provisions of working wards with hand hygiene facilities like sinks, towel, and alcohol based hand rub, soap and water for better hand hygiene practice.
- Lastly, a need for better study design that should involve better sample size with observation and qualitative.

Ministry of Health

- Should strengthen “Clean Care is Safer Care” initiative by collaborating with governmental and non-governmental stakeholders.

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Annex -I: English version questionnaire

This study will be conducted on the assessment of factors associated with hand hygiene practice among clinical year medical student in Addis Ababa University, 2013/2014.

1. Information sheet

Hello, I am _____ from Addis Ababa university research team. I would like to ask few questions about factors associated with hand hygiene practice to you in the previous training. Your genuine information that you are going to provide will help policy makers to design strategy/give priority for improvement of hand hygiene. Your answers will remain confidential and your name will not be taking down. Participation in this study is voluntary and you are not obligated to answer any questions that you do not want to answer and it takes 20 minutes.

Title of the study: assessment of factors associated with hand hygiene practice among undergraduate medical students in the College of Health Science in Addis Ababa University, Tikur Anbessa Specialized Hospital, Ethiopia 2013/2014 g.c.

Objective of the study: To assess the level and associated factors with hand hygiene practice among undergraduate medical students in the College of Health Science in Addis Ababa University, Tikur Anbessa Specialized Hospital, Ethiopia 2013/2014 g.c.

Rights of the participant: participating and not participating is the full right and participants can stop from participation in the study at any time. And also the participant can skip question which does not want to respond. Participants can ask any questions which is not clear for understanding.

Confidentiality: - Any information forwarded will be kept private and his/her name will not specified.

2. Informed consent

I have read all this form or it has been read to me in the language I comprehend and understood all conditions stated above. Therefore, would you willing to participate in this study

Yes. No.

Signature of participant _____

Name of researcher-----

Signature -----: Address: Tell (E-mail) 0910432040 /selamkassahun9@gmail.com

Name of witness‘ _____

Signature _____

Date _____ starting time _____ Ending time _____

Result of administration 1.Completed 2.Respondent not available 3. Refused 4. Partially completed.

If the respondent is not voluntary, please skip to the next participant.

Part I.Socio-Demographic factors-please circle a number for your response

Characteristics	Possible response	skip
Sex	Female-----1 Male-----2	
Age	-----	
Religion	Orthodox-----1 Catholic----4 Muslim-----2 Other-----5 Protestant-----3	
Educational status of the family	Mother Illiterate-----1 Illiterate-----1 Primary-----2 Primary-----2 Secondary-----3 Secondary-----3 College-----4 College-----4	

Department practicing	Medicine-----1 Gyn/obs-----3 Surgery-----2 Pediatrics-----4 Other /specify/-	
Total time spent on practicum /weeks/	-----	
Year of course	3 rd -----1 4 th -----2 5 th -----3	
Hospital promoting the importance of hand hygiene	Yes-----1 No-----0	
Availability of soap and water in working ward	Yes-----1 No-----0	
Availability of sink in working ward	Yes-----1 No-----0	
Availability of towel/tissue paper	Yes-----1 No-----0	
Availability of Alcohol based hand rub in the ward	Yes-----1 No-----0	
Availability of glove in the ward	Yes-----1 No-----0	
Knew presence of infection prevention committees	Yes-----1 No-----0	

Part II hand hygiene knowledge questionnaire-please circle a number for your response

Question	Possible response	skip
K1. Alcohol-based hand rubs should not be used when hands are visibly soiled	Yes-----1 No-----0 Don't know----0	
K2. Alcohol-based hand rubs will still be effective if applied for less than 60 seconds	Yes-----1 No-----0 Don't know----0	
K3. Hand hygiene is required following the removal of gloves after patient contact	Yes-----1 No-----0 Don't know----0	
K4. Single-use cloth towels and paper towels are acceptable for drying hands in patient care areas.	Yes-----1 No-----0 Don't know----0	
K5. Hand hygiene must be performed before patient contact, following emptying of a drainage reservoir, and prior to and following venipuncture.	Yes-----1 No-----0 Don't know----0	
K6. When using an alcohol-based hand rub to decontaminate hands they should be rubbed together until dry.	Yes-----1 No-----0 Don't know----0	
K7. Handling of paperwork is not one of the recommended situations for performing hand hygiene.	Yes-----1 No-----0 Don't know----0	
K8. Hand hygiene is required following contact with the bed linen of a patient with MRSA.	Yes-----1 No-----0 Don't know----0	
K9. Hand creams and lotions are recommended for health care workers' hands.	Yes-----1 No-----0 Don't know----0	
K10. Gloves should not be reused when caring for different patients.	Yes-----1 No-----0 Don't know----0	
K11. The average cost of a hospital-acquired infection in developed countries is approximately \$10,000*.	Yes-----1 No-----0 Don't know----0	
K12. Approximately 20% of intensive care patients develop hospital-acquired infections in developed countries.	Yes-----1 No-----0 Don't know----0	

Part III. Please circle a number to indicate your response for hand hygiene practice

I cleanse my hands: Always	Never	Some of the time	Half of the time	Mostly	
P1.After going to the toilet	1	2	3	4	5
P2.Before caring for a wound	1	2	3	4	5
P3.After caring for a wound	1	2	3	4	5
P4.After touching potentially contaminated Objects	1	2	3	4	5
P5.After contact with blood/ body fluids	1	2	3	4	5
P6.After inserting an invasive device.	1	2	3	4	5
P7. Before entering an isolation room.	1	2	3	4	5
P8. After contact with a patient's skin.	1	2	3	4	5
P9.After exiting an isolation Room.	1	2	3	4	5
P10.Before endotracheal Suctioning.	1	2	3	4	5
p11.After contact with a patient's secretions	1	2	3	4	5
P12.Before patient contact	1	2	3	4	5
P13.After removing gloves	1	2	3	4	5
P14.If they look or feel dirty.	1	2	3	4	5

Part IV. Please circle a number to indicate your response for hand hygiene beliefs

Statement	Strongly Disagree	Disagree	Not sure	Agree	Strongly agree
B1. Hand hygiene is considered an important part of the curriculum.	1	2	3	4	5
B2. The facilities in which I do clinical practicum emphasize the importance of hand hygiene.	1	2	3	4	5
B3. The importance of hand hygiene is emphasized by my clinical supervisors.	1	2	3	4	5
B4. I have a duty to act as a role model for other health Care workers.	1	2	3	4	5
B5. When busy it is more important to complete my tasks than to perform hand hygiene.	1	2	3	4	5
B6. Performing hand hygiene in the recommended Situations can reduce patient mortality.	1	2	3	4	5
B7. Performing hand hygiene in the recommended situations can reduce medical costs associated With hospital-acquired infections.	1	2	3	4	5
B8. I can't always perform hand hygiene in recommended situations because my patient's needs come first.	1	2	3	4	5
B9. Prevention of hospital-acquired infection is a valuable part of a health care worker's role.	1	2	3	4	5
B10. I follow the example of senior health care workers when deciding whether or not to perform hand hygiene.	1	2	3	4	5
B11. An infectious disease contracted in the health care setting may threaten my life or my career.	1	2	3	4	5

Statement	Strongly Disagree	Disagree	Not sure	Agree	Strongly agree
B12.I believe I have the power to change poor practices in the workplace.	1	2	3	4	5
B13.Failure to perform hand hygiene in the recommended situations can be considered negligence.	1	2	3	4	5
B14. Hand hygiene is a habit for me in my personal life	1	2	3	4	5
B15.I am confident I can effectively apply my Knowledge of hand hygiene to my clinical practice.	1	2	3	4	5
B16.It is an effort to remember to perform hand Hygiene in the recommended situations.	1	2	3	4	5
B17.I would feel uncomfortable reminding a health Professional to hand wash.	1	2	3	4	5
B18.Performing hand hygiene slows down building Immunity to disease.	1	2	3	4	5
B19. Dirty sinks can be a reason for not washing hands.	1	2	3	4	5
B20.Lack of an acceptable soap product can be a reason For not cleansing hands.	1	2	3	4	5
B21.Performing hand hygiene after caring for a wound Can protect from infections.	1	2	3	4	5
B22.Cleansing hands after going to the toilet can reduce transmission of infectious diseases.	1	2	3	4	5

Declaration

I, the undersigned, declare that this is my original work and has never been presented by another person in this or any other university and that all the source materials and references used for this thesis have been duly acknowledged.

Name: KassahunYimam (BSc)

Signature _____

Place: Addis Ababa, Ethiopia.

Date of submission: 2/10/2014

The thesis has been submitted for examination with my approval as a university advisor.

Name of advisor: Dr.Ababi Zergaw (PhD).

Signature: _____

Date: _____

