

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF NURSING AND MIDWIFERY

**KNOWLEDGE AND PRACTICE OF NURSES AND ASSOCIATED
FACTORS REGARDING PREVENTION OF SURGICAL SITE INFECTION
AMONG THOSE WHO ARE WORKING IN THE SURGICAL UNITS OF
PUBLIC HOSPITALS IN ADDIS ABABA CITY, ETHIOPIA, 2018.**

BY:

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ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, SCHOOL OF NURSING AND MIDWIFERY POSTGRADUATE PROGRAM

This research thesis entitled Knowledge and Practice of and Associated Factors Regarding Prevention of Surgical Site Infection among Those who are Working in the Surgical Units of Public Hospitals in Addis Ababa City, Ethiopia, 2018, prepared by Ayelign Mengesha Kassie is accepted in its present form by the board of examiners as satisfying thesis requirement for the degree of masters of Science in Adult Health Nursing.

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As a member of the MSc research open defense examination, I certify that I have read and evaluated the thesis prepared by Ayelign Mengesha and examined the candidate. I recommend that the thesis be accepted as fulfilling the proposal requirements for the degree of masters of Science in Adult Health Nursing.

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List of Acronyms and Abbreviations

AAU-----	Addis Ababa University
AOR -----	Adjusted Odds Ratio
BSC-----	Bachelor Science
COR -----	Crude Odds Ratio
ETB-----	Ethiopian Birr
HAI-----	Health Care Associated Infection
ICU-----	Intensive Care Unit
IP-----	Infection Prevention
LMICs-----	Low and Middle Income Countries
MRSA-----	Methicillin-Resistance Staphylococcus
OR-----	Operation Room
PI -----	Principal Investigator
S.No-----	Serial Number
SPSS-----	Software Package of Social Science
SSI -----	Surgical Site Infection
USA -----	United States America
WHO-----	World Health Organization

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ABSTRACT

Introduction: Surgical site infections are one of the commonest types of healthcare-associated infections. Up to 60% of these infections are estimated to be preventable by using evidence-based guidelines. Hence, as frontline caregivers, nurses can play a crucial role in preventing efforts.

Objective: To assess the knowledge and practice of nurses and associated factors regarding prevention of surgical site infection among those who are working in the surgical units of public hospitals in Addis Ababa city, Ethiopia.

Methods: An institution based cross-sectional study was carried out on 409 nurses. An adapted, pretested, and structured, self-administered questionnaire; containing sociodemographic, knowledge and practice related questions to measure the nurses' knowledge and practice and associated factors with hem regarding prevention of surgical site infection was utilized as a data collection tool. Stratified random sampling technique was employed. Data was entered into a computer using Epi-data 3.1 statistical package and exported to SPSS Version 23 for further analysis. Bivariate regression analysis was run to assess the association between the dependent and independent variables. To see the relative effect of independent variables on the dependent variable, multivariable regression analysis was carried out.

Result: A total of 409 nurses returned the questionnaire with a response rate of 98%. Majority, (60.4%) of them were females. The mean age was 31.16 with a median of 30 years. Most of the participants (84.1%) were BSc holders. Only 47.7% and 48.9% of the participants were found to have good knowledge and practice regarding prevention of surgical site infection respectively. Sex of participants, work experience, educational level and using available infection prevention guidelines were significantly associated with the nurse's knowledge and practice at a $p < 0.05$.

Conclusion and recommendations: More than half of the participants have inadequate knowledge and almost half of the participants were practicing poorly. Training nurses, making surgical site infection prevention guidelines easily accessible and ensuring possessed knowledge by nurses is potent enough and can be translated into desirable actions are recommended.

Key words: Nurse, Knowledge, Practice, Factors, Surgical Site Infection

CHAPTER ONE

Introduction

1.1 Background Information

Surgical site infection (SSI) refers to an infection occurring in the part of the body where the surgery took place. It is also defined as an infection that occurs in surgical patients at the incision site within 30 days after surgery if there is no implant or within 90 days if there is an implant. SSI is a potential complication associated with any type of surgical procedures [1]. Microorganisms from the patient's own skin flora or from the environment surrounding the patient are the causes for SSI. In both cases, there is a possibility for microorganisms to adhere on surgical instruments and consequently contaminate the incisional wound, particularly during contaminated surgical procedures. Most of these infections are caused by multidrug resistant microorganisms [1, 2, 3].

There are various patient-related and process related factors that affect a patient's risk of developing SSI. Some of the patient-related factors, like age and gender cannot be improved. However, the more common risk factors including; perioperative hyperglycemia, pre-existing diabetes, obesity, malnutrition, recent tobacco use, pre-existing remote body site infection, colonization with microorganisms, and the process related factors, like, perioperative hypothermia, the improper use of antibiotics and inappropriate pre and intraoperative techniques, can be managed to augment the likelihood of positive surgical outcomes [1, 3, 4].

Up to 60% of SSIs have been estimated to be preventable by using evidence-based guidelines. However, still they are the leading health care associated infections (HAIs), reported hospital-wide in low and middle income countries (LMICs). Most of these infections are attributable to the poor quality of care delivered by health workers and represent a significant burden in terms of patient morbidity, disability, mortality and additional costs to the health systems and service payers throughout the world [1, 5, 6].

It takes a multi-disciplinary approach to reduce SSIs. As frontline caregivers, nurses can help surgical patients avoid SSI through pre and intraoperative implementation of surgical safety checklists and adequate post-operative wound care and thorough discharge planning. Therefore, in order to prevent the occurrence of SSIs, all nurses must ensure the key interventions to reduce risks are carried out for every patient on every occasion, and upgrading the knowledge and level of practice of nurse's is a very essential component in preventing efforts [5, 6].

1.2 Statement of the Problem

Surgical site infections are one of the serious complications of surgical procedures and the most common type of healthcare-associated infections (HAIs). Health care-associated infections are acquired by patients when receiving care and are the most common adverse events affecting patient safety worldwide. The endemic burden of HAI is significantly (at least 2-3 times) higher in low and middle-income countries than in high-income nations, particularly in patients admitted to intensive care units, and neonates (out of 100 hospitalized patients at any given time, 7 in developed and 15 in developing countries will acquire at least one HAI) [1, 5].

Surgical site infections account for 20% of all HAIs in hospitalized patients and each SSI is associated with approximately 7–11 additional postoperative hospital-days. Patients with SSIs have a 2–11 times higher risk of death compared with operative patients without SSI, and 77% of deaths in patients with SSI are directly attributable to SSI [1, 5]. In United States America (USA), it is indicated that, the hospital-related cost of a single SSI ranges from \$12,000–\$35,000 [7].

According to 2014 WHO report, the estimated prevalence rate of SSI within the past two decades ranges to 19.6% in Europe and 20% in USA and in Africa the incidence rate was reported ranging from 12% in Algeria to 31% in Nigeria [8]. However in United States America, a recent study conducted to describe the epidemiology of complex SSIs on 29 community hospitals revealed that the overall prevalence rate of SSI was 0.7 infections per 100 procedures [9].

In Spain among hospitalized patients for secondary or tertiary peritonitis; in the intensive care unit (ICU), the SSI rate was 53.1%, which was higher compared with the rest of hospitalized patients who underwent major abdominal surgery 20.6 %. Total mortality rate was 37.9 % from which 27.9 % corresponding to ICU deaths and prolonged ICU stay was associated with SSI rate and associated higher in-hospital mortality [10]. In Saudi in orthopedic surgery, the incidence of SSI was 2.55%. Emergency operation was significantly associated with higher SSI rates and reducing the staff in the operating room to essential staff only has shown that there was no serious deep-seated infection post arthroplasty [11].

A systematic review in Iran revealed that SSIs were reported to be the third most frequent hospital-acquired infections with an estimated prevalence rate of 4.7-25% in patients undergoing elective colorectal surgery [12]. In Cameron a prevalence rate of SSI was found being 9.16% on a study conducted in three hospitals [13].

In Ethiopia, studies indicated the rate of SSIs ranging from 10.9%, in Bahirdar to 11.1%, in Harar and 19.1% in Hawassa [14, 15, 16]. In Mekelle Ethiopia, a study was done to determine the rate of Aerobic bacteria susceptibility to antibiotics in patients with SSI. 128 patients with clinical signs of post-surgical wound infection were enrolled and wound swab was taken. And the result revealed that, the prevalence rate of culture confirmed SSI was 75% and isolated bacteria's have shown multi drug resistance to the commonly used antibiotics in the hospital in 102/123(82.92%) of patients with SSI [17].

Regarding it's prevention, the surgical team can play a crucial role in the prevention of SSIs by following surgical safety checklists in terms of limiting the number of people in the operating room and in transit, minimizing conversations at the time of surgery, closing the door, improving the ventilation system, making timely decisions on type of antimicrobial prophylaxis and adequately preparing the patient's skin and hands of the surgical team, during the pre, intra and post-operative periods [1, 3, 18].

Here, since nurses are the once who spent most of their time with patients and cover most of surgical site infection prevention activities, they are the major responsible bodies and can play a central and wide-ranging role in preventing SSIs by improving the quality of care they deliver, for example; improving the improper use of prophylactic antibiotics, poor hand hygiene and skin preparation practices and proper implementation of all other surgical safety checklists [3, 19].

The knowledge and practice of nurses regarding prevention of SSIs was studied in different countries. In Pakistan and Bangladesh it was indicated that the knowledge of nurse's regarding prevention of surgical site infections was poor [20, 21]. And in Jordan the overall knowledge of nurse's regarding evidence based guidelines for the prevention of SSIs was at a low level [22]. In Ethiopia, Amhara regional state a study showed that, less than half, (40.7%) of the participants were found having adequate knowledge regarding prevention of SSI [23].

Regarding practice, the Pakistan and Bangladesh studies revealed that, the practice of staff nurses regarding preventing and managing surgical site infection was at good level [20, 21]. However, another study in Bangladesh indicated that the proportion of nurses who have good practice regarding prevention of SSI was below half, (44.5%) [24]. The Ethiopian, Nigerian, and Tanzanian studies also revealed that, majority of nurses were practicing poorly regarding prevention of SSIs [23, 25, 26].

The studies had also tried to identify the factors affecting the nurse's knowledge and practice; and age, sex of participants, service experience, taking training on infection prevention measures and number of credit hours spent in surgical training courses and income were identified as affecting the nurse's knowledge [23, 25]. Regarding practice; age, sex of participants, service year, educational level, taking training on infection prevention measures [23, 25, 26], insufficient knowledge, inadequate resources and budgets, insufficient performance monitoring systems, and lack of surveillance systems were also identified as factors affecting the level of nurse's practice regarding prevention of SSIs [24].

However, these studies have not addressed the institutional factors that affect the nurse's knowledge and practice regarding prevention of SSIs in a detailed way. Hence, the aim of this study was to assess the knowledge and practice of nurses and identify factors associated with them regarding prevention of surgical site infections.

1.3 Significance of the Study

Surgical site infection is one of the most common complications of surgical procedures and it is the most common type of healthcare-associated infections worldwide. The rate and burden of surgical site infections is significantly higher in developing nations including Ethiopia compared to the developed ones and is associated with the high prevalence of modifiable risk factors which could have been prevented with compliance to surgical site infection prevention recommendations from latest guidelines by the surgical team.

Since nurses are the ones who spent most of their time with patient's pre and postoperatively, they are the major responsible bodies in preventing surgical site infections and infection prevention is also one of the primary Ethiopian health policies. As a result, the government has given special emphasis to it, particularly to prevention of health care acquired infections which includes surgical site infection.

However, studies on nurse's knowledge and practice and associated factors regarding prevention of surgical site infections in Ethiopia are scarce. Hence, the aim of this study was to assess the knowledge and practice of nurses towards prevention of surgical site infections and identify factors associated with them and therefore findings of the study will provide important information for health professionals, administrators, program managers, policy makers, and other researchers and it will serve as an input for the planning and implementation of effective strategies to enhance the knowledge and practice of nurses regarding prevention of surgical site infections.

CHAPTER TWO

Literature Review

2.1 Review On The Theoretical perspectives of Surgical Site Infection and Evidences

Surgical site infections can be superficial, involving the skin, deep incisional involving the deep tissues or organs/space [1, 2]. Multiple risk factors influence the development of SSIs and being aware of these can help in designing effective preventive strategies.

The surgical techniques can affect the infection rate in various ways, for example in relation to skin preparation, shaving and wound closure techniques. The skin is colonized by various types of bacteria and up to 50% of these are *Staphylococcus aureus*. For this reason, preoperative skin disinfection with alcohol based products based on chlorhexidine is recommended by different sources [1, 5, 6].

It is revealed that, preoperative wash containing chlorhexidine soap solution decreases the bacterial count on skin by 80-90%, resulting in a decrease in preoperative wound contamination. It is also indicated that, shaving damages the skin and the risk of infection increases with the length of time between shaving and surgery. If a patient had been shaved before two hours of surgery the clean wound infection rate was found to be 2.3%. However, if patients had not been shaved but their body hair had been clipped the rate was 1.7%, and if they had not been shaved or clipped the rate had fallen to 0.9%. As a result, shaving is strongly discouraged all the time [1, 2, 6].

In general , different top level guidelines have set down a number of recommended best practices for preventing SSI, giving emphasis to the following areas: (1) hair removal; hair should either not be removed or, if absolutely necessary, it should be removed only with a clipper on the day of surgery, in a location outside of the operating room; (2) preoperative showering should be performed using soap, either the day before or on the day of surgery; (3) preoperative skin disinfection of patients should be performed by applying an antiseptic solution, preferably alcohol-based antiseptic solutions based on chlorhexidine [1, 2, 4]. (4) Prophylactic antibiotics, should be administered within 120 minutes before incision, while considering the half-life of the antibiotic; (5) Surgical hand preparation, should be performed by scrubbing with either a suitable antimicrobial soap and water or using a suitable alcohol-based hand rub before donning sterile gloves; (6) Proper hand hygiene practices should be performed before and after any procedure and (7) Using an aseptic, non-touch technique for changing and removing dressings [1, 4, 27, 28].

Despite the widespread international introduction of top level evidence-based guidelines for the prevention of SSIs, like that of the WHO global guideline, SSI rates have not measurably fallen, particularly in developing countries, and process related risk factors are playing significant role for this effect [1, 2, 6].

A systematic review on non-concordance of health workers with SSI prevention guidelines revealed that a mean of 1.4 antibiotic prophylaxis errors per surgery was identified. Normothermia was maintained in 79% of surgeries, and normoglycemia was kept only for 17% of diabetic patients. Hair removal technique was documented for only 14 patients by clipping and a strong correlation was identified between the degree of concordance to SSI prevention guidelines and the SSI rate ($P = 0.001$) [29].

In Brazil a research conducted on evaluation of adherence to measures regarding SSI prevention by the surgical teams showed that, in preoperative procedures, hair removal was performed on 27.7% patients inside the operating room, 80.0% with a blade and 20.0% with a clipper. Hair was removed for all patients. Regarding preoperative bathing, 83.3% of patients had a shower on the day of surgery, 73.3% had it in the hospital and 26.7% at home. Prophylactic antibiotic was administered in 77.8% patients. As of intraoperative procedures; the doors remained open in 88.9% of cases during the entire surgical procedure and it remained open in 5.6% during 90% of the surgery time [30].

In order to limit the number of individuals who enter and remain in the operating room and prevent SSI; Centers for Disease Control and Prevention guidelines recommended that, nine professionals would be the ideal number in more complex surgeries and five for less complex in the operating room considering the role played by each member. Thus, in more complex procedures it was advised that, a surgeon, three medical assistants, a scrub nurse, a circulating nurse, a preceptor anesthesiologist, a resident anesthesiologist, and an X-ray technician and for minor procedures, a surgeon, an assistant resident, a circulating nurse, a preceptor anesthesiologist, and a resident anesthesiologist to be the ideal number [31].

Hence, advancing the knowledge and practice of nurses in accordance with the latest evidence based guidelines regarding prevention of surgical site infection is strongly recommended [1, 4, 32]. Therefore, upgrading the knowledge and practice of nurses on surgical site infection prevention methods through training and other means is widely regarded as an essential measure to reduce the risk and burden of surgical site infections.

2.2 Nurse's Knowledge and Associated Factors Regarding Prevention of SSIs

Nurses can play a central role in implementing the latest surgical site infection prevention strategies and by doing so they can reduce the rate of SSI to the irreducible minimum. Many studies revealed that, the knowledge of nurses regarding prevention of surgical site infections is relatively poor. On the other hand their level of practice is reported as relatively good. In Pakistan a study revealed that the knowledge of staff nurse's regarding prevention of surgical site infections was poor [20] and in Bangladesh, majority of nurses (70%) had low knowledge regarding prevention of SSI [21].

In Jordan it was revealed that, the knowledge of nurse's regarding evidence based guidelines for the prevention of SSIs was at a low level. A statistically significant correlation $P\text{-value} < 0.01$ was found between, age, total work experience in nursing, work experience in surgical units, number of credit hours spent in surgical training courses, and monthly income and the knowledge level of nurses. A significant difference in nurses' knowledge between those who were attending special surgical related training courses and those who were not was also found. The most significant predictors of nurses' knowledge were; the number of credit hours attended by nurses for surgical-related training courses and the total years of work experience in nursing ($p = 0.001$) [22].

In Nigeria nurses demonstrated relatively high level of knowledge and poor attitude regarding prevention of SSIs. The findings showed that there was a positive and moderate correlation between knowledge and attitude regarding prevention of SSIs ($r = 0.695$, $p = 0.000 < 0.01$) [25].

In Ethiopia, Amhara regional state a study showed that, below fifty percent (40.7%) of the participants were found to be knowledgeable regarding SSI prevention. Year of service, sex and taking training on infection prevention measures were identified having significant association with the knowledge score of nurses regarding prevention of SSIs. It also indicated that male nurses were about 3 folds more likely to have good knowledge than female participants (AOR = 3.22, 95% CI). Nurses who have served for more than 5 years were about 2 folds more likely to have good knowledge than those whose service years was 5 years or less (AOR = 1.81, 95% CI) and those who had taken training on infection prevention measures were about 2 folds more likely to have good knowledge regarding SSI prevention than those who have not (AOR= 1.95, 95% CI) [23].

2.3 Practice of Nurses and Associated Factors Regarding Prevention of SSIs

In Pakistan it was revealed from the study that, the overall practice of staff nurses regarding preventing and managing surgical site infection was at good level. But a negative association was found between knowledge and practice of nurse's regarding prevention of SSIs ($r = -.562$, $P = 0.000$) [20].

A study in Bangladesh showed that, majority of nurses (98.3%) scored the practice of SSI prevention at a high level with minimum score of 80% and maximum score of 96% and a weak, negative correlation was also found between knowledge and practice of nurses regarding prevention of SSIs ($r = -.18$, $p = 0.04$) [21].

Another study in Bangladesh indicated that the proportion of nurses who always practiced SSI prevention activities was 44.5% and only 28% always practiced the preoperative shaving practices for SSI prevention. Moreover, 62.92% of the nurses did not always administer a preoperative prophylactic antibiotic timely before surgery and only 37.08% did this. Less than fifty percent of the nurses (46.42%) indicated that they always practiced preoperative skin disinfection prior to surgery, and that only 51.37% of the nurses always performed proper hand hygiene practice. This study had also identified four major factors affecting the nurse's practice. These factors were insufficient knowledge, inadequate resources and budgets, insufficient performance monitoring systems, and lack of surveillance systems related to SSI prevention [24].

In Nigeria unsatisfactory level of practice was found towards prevention of SSIs. The results further showed a relatively high practice of surgical wound prevention guidelines as only 15.1% of the respondents reported not washing their visibly soiled hands sometimes. It also showed that 71.4% reported using sterile technique to change dressing often, although 28.6% reported this practice just sometimes. It was also revealed that nearly half of the respondents (45%) reported that they sometimes change damp sterile dressing as often as possible. Again, only 22.3 and 27.3% reported using hand gloves and other protective devices very often and often respectively while 34.9% reported that they wash their hands before and after a surgical wound care every often. Generally, being safety conscious while discharging care for surgical wounds was reported to be practiced very often by only 17.6% of the respondents although 30.7% reported being safety conscious often with 6.3% reporting being indifferent. It also showed that there was positive and moderate association between knowledge and practice ($r = 0.570$, $p = 0.000 < 0.01$). High correlation was however found for attitude and practice of SSI prevention [25].

In Tanzania, a study revealed that, more than half of participants (57.7%) had poor practice on post operation wound care. Nurses with 15 to 24 years and 25 to 34 years had 14.5 and 16.38 scores respectively. Higher scores were observed in participants aged 35 to 44 years (16.65%). But significant difference was not found in practice scores between participants of different age group. Undergraduate nurses had good practice and scored higher compared to others. There was unsatisfactory post-operative wound care in nurses with diploma and poor practice in nurses with certificate level of education. There was a significant better practice between undergraduate nurses compared to diploma trained nurses ($P = 0.003$). Moreover good post-operative wound practice was observed among undergraduate nurses compared to certificate holding nurses ($P = 0.006$) [26].

In Ethiopia, a study revealed that the proportion of nurses who had good practice regarding surgical site infection prevention measures was 48.7%. Age, service year, sex of participants, taking training on infection prevention measures and educational level were identified as having significant association with practice regarding SSI prevention. But, in the multivariate analysis significant association was found only between age, sex and educational level of the participants and their level of practice. According to this study female nurses were almost 2 times more likely to have good practice compared to male nurses (AOR = 2.35, 95% CI), Those who were 30 years and above were found being about 2 times more likely to practice surgical site infection prevention actives compared to those who were less than 30 years (AOR = 1.79, 95% CI) and nurses who have diploma were also found about 2 times more likely to practice surgical site infection prevention activities compared to those who have BSc degree or higher (AOR = 2.26, 95% CI) [23].

2.4 Conceptual Framework of the Study

Regarding the conceptual framework, factors like; age, sex of participants, service experience in nursing, taking training on infection prevention measures and number of credit hours spent in surgical training courses and monthly income are associated with the nurse's knowledge regarding prevention of SSIs [23, 26]. Regarding practice; age, sex of participants, service year, educational level, taking training on infection prevention measures [23, 25, 26] and others, like, insufficient knowledge, inadequate resources and budgets, insufficient performance monitoring systems, and lack of surveillance systems are also identified as factors affecting the level of nurse's practice regarding prevention of SSIs [24].

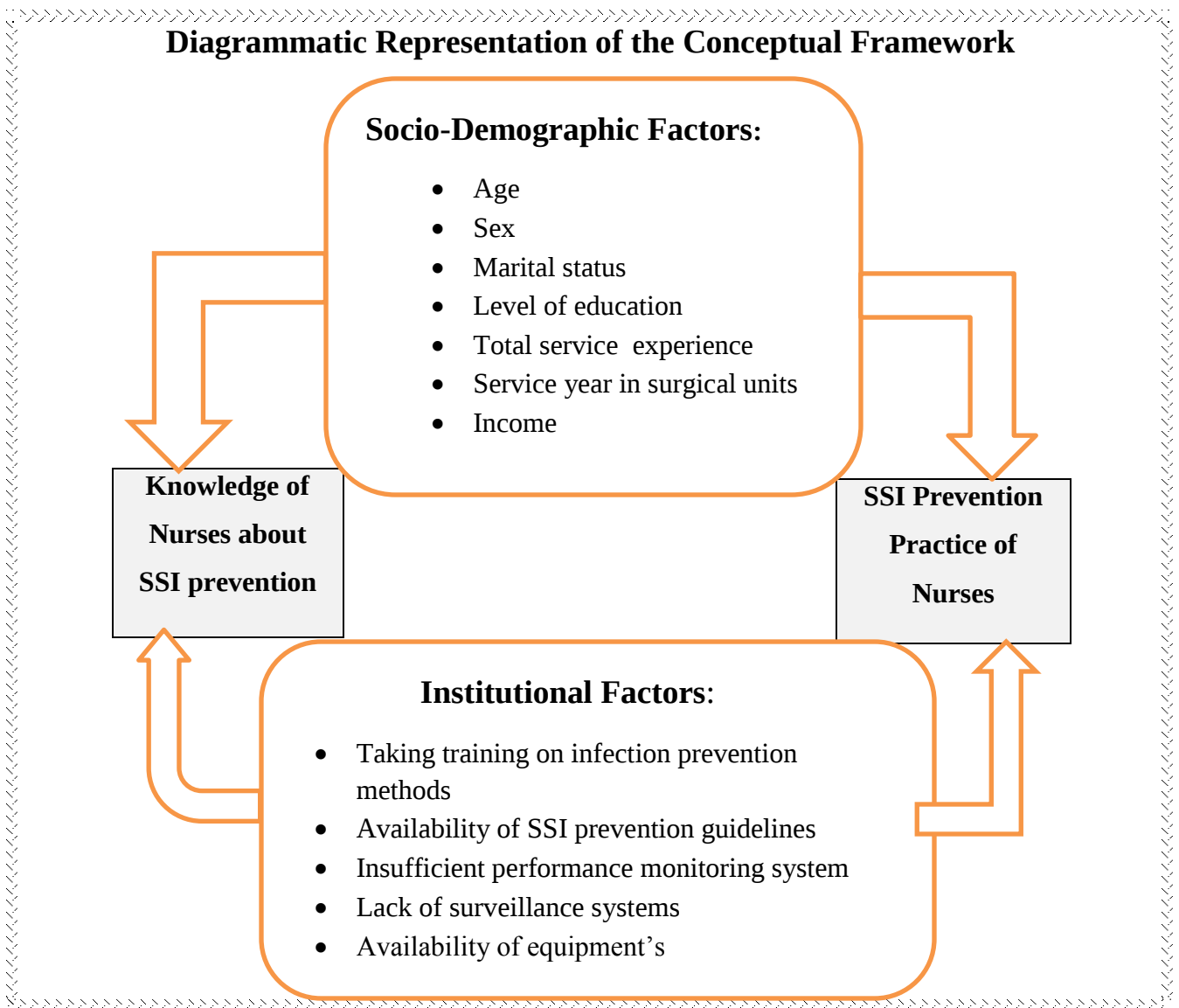


Figure-1: Conceptual framework for nurses' knowledge, practice and associated factors regarding surgical site infection prevention adapted from literatures by the principal investigator after reviewing different literatures.

2.5 Research Question

The research questions that will guide this study are:

1. What is the knowledge level of nurses regarding surgical site infection prevention?
2. What is the level of practice of nurses regarding surgical site infection prevention?
3. What are the major factors that influence the knowledge and practice of nurses regarding surgical site infection prevention?

CHAPTER THREE

Objectives of the Study

3.1 General Objective

The aim of this study was to assess the knowledge and practice nurses and associated factors regarding prevention of surgical site infection among those who are working in the surgical units of public hospitals in Addis Ababa city, Ethiopia, 2018.

3.2 Specific Objectives

The specific objectives of this study were:

1. To assess the knowledge of nurses regarding prevention of surgical site infection.
2. To examine the practice of nurses regarding prevention of surgical site infection and
3. To identify factors affecting the knowledge and practice of nurses regarding prevention of surgical site infection.

CHAPTER FOUR

Methods and Materials

3.1 Study Area

This study was carried out in Addis Ababa the capital city of Ethiopia. The city has a subtropical highland climate. According to 2017 estimation, Addis Ababa has a population of 6.6 Million people. All ethnic groups of the country are represented in this capital with the biggest groups being the Amhara, Gurage, Oromo, Tigray and Gamo. Languages spoken include; Amharic, Oromiffa, Gurage, Gamo, Tigrinya and Silt'e. The religion with the most devotees in the city is Ethiopian Orthodox having about 75% followers from the total population, followed by Muslims (18%) [33]. In this capital, there are 14 public hospitals, 34 private hospitals, 86 health centers and various NGOs and health institutions. The public hospitals found in Addis Ababa are: 1) Tikur Anbesa Specialized Teaching Hospital 2) St. Pauls Hospital 3) Zewditu Memorial Hospital 4) Alert Hospital 5) Yekatit 12 Hospital 6) Ras Desta Damtew Memorial Hospital 7) St. Peters Hospitals 8) Menilik II Hospital 9) Tirunesh Beijing Hospital 10) Armed Forces Comprehensive Specialized Hospital 11) Bella Defense Hospital 12) Federal Police Hospital 13) Amanuel Mental Health Hospital and 14) Gandhi Hospital.

3.2 Study Design and Period

An institution based cross-sectional study was carried out to assess the knowledge, practice and associated factors regarding prevention of surgical site infection among nurses working in the surgical units of public hospitals in Addis Ababa city, Ethiopia from March 01_30, 2018.

3.3 Population

3.3.1 Source Population

The source populations were all nurses working in the surgical units of public hospitals found in Addis Ababa city, Ethiopia.

3.3.2 Study Population

The study populations were nurses working in the surgical units of selected public hospitals in Addis Ababa city, Ethiopia.

3.3.3 Sample Population

The sample populations were all randomly selected nurses working in the surgical units of selected public hospitals in Addis Ababa city, Ethiopia.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion Criteria

All Ethiopian nationality nurses, who were working in the surgical units of selected public hospitals in Addis Ababa city, who have college diploma or university degree in nursing and are fulltime workers having work experience of greater than 6 months were included.

3.4.2 Exclusion Criteria

Those nurses working in the surgical units of selected public hospitals in Addis Ababa city, Ethiopia, who were on annual leave, maternity leave, study leave, sick leave and those who were part-time workers during the study period were excluded.

3.5 Sample Size Determination

The sample size was determined by using the formula for estimating single population proportion. Hence, using the formula for single population proportion, the sample size was calculated as follows:

$$n_0 = \frac{Z (\alpha/2)^2 * p (1-p)}{d^2}$$

Where,

Z = (Standard value for 95% confidence interval) = 1.96

CI = (Confidence interval) = 95%, D = (Marginal error) = 0.05

P = (Single population proportion) = 48.7 %, taken from previous similar study conducted in Amhara regional state (27).

n_0 = (The minimum required sample size). So, $n_0 = (1.96)^2 * (0.487) (0.513) / (0.05)^2 = 384$. Since, the total population size is less than ten thousand; using correction formula, the final sample size was calculated as follows. n_f = (Final sample size) = $n_0 / (1 + n_0 / N) = 384 / (1 + 384 / 745) = 253$. N is the population size, that is the total number of nurses working in the surgical units of public hospitals found in Addis Ababa city (N = 745).

Adding 10% non- response rate and multiplying by 1.5 (design effect) the total sample size required for this study appears to be **417**. Finally, the number of nurses who participate in each hospital was determined using the population proportionate sampling as follows.

$$n = \frac{n_f * N \text{ in a given hospital}}{N \text{ total}}$$

Where,

n = Proportion of nurses who participate in the study in a given (selected) public hospital. n_f = The final sample size that is obtained by using the correction formula (**417**), N = The total number of nurses who were working in the surgical units in a given public hospital and N_{Total} , is the total number of nurses who were working in the surgical units of public hospitals in Addis Ababa city, Ethiopia.

3.6 Sampling Technique

Stratified simple random sampling technique was employed to select the required number of participants from public hospitals found in Addis Ababa city. First the public hospitals found in Addis Ababa city were stratified into secondary and tertiary hospitals (because, the public hospitals found in Addis Ababa are secondary and tertiary in level). In these strata's representative hospitals, two from each (Yekatit 12 hospital medical college and Tirunesh Beijing general hospital from secondary hospitals and Tikur Anbesa specialized teaching hospital and Armed forces comprehensive specialized hospital from tertiary hospitals) were selected randomly. Then, in these selected hospitals, the number of study participants was assigned proportionally based on the nurse's number of each of those hospitals. Finally the required numbers of nurses were selected by using lottery method from each of the selected hospitals.

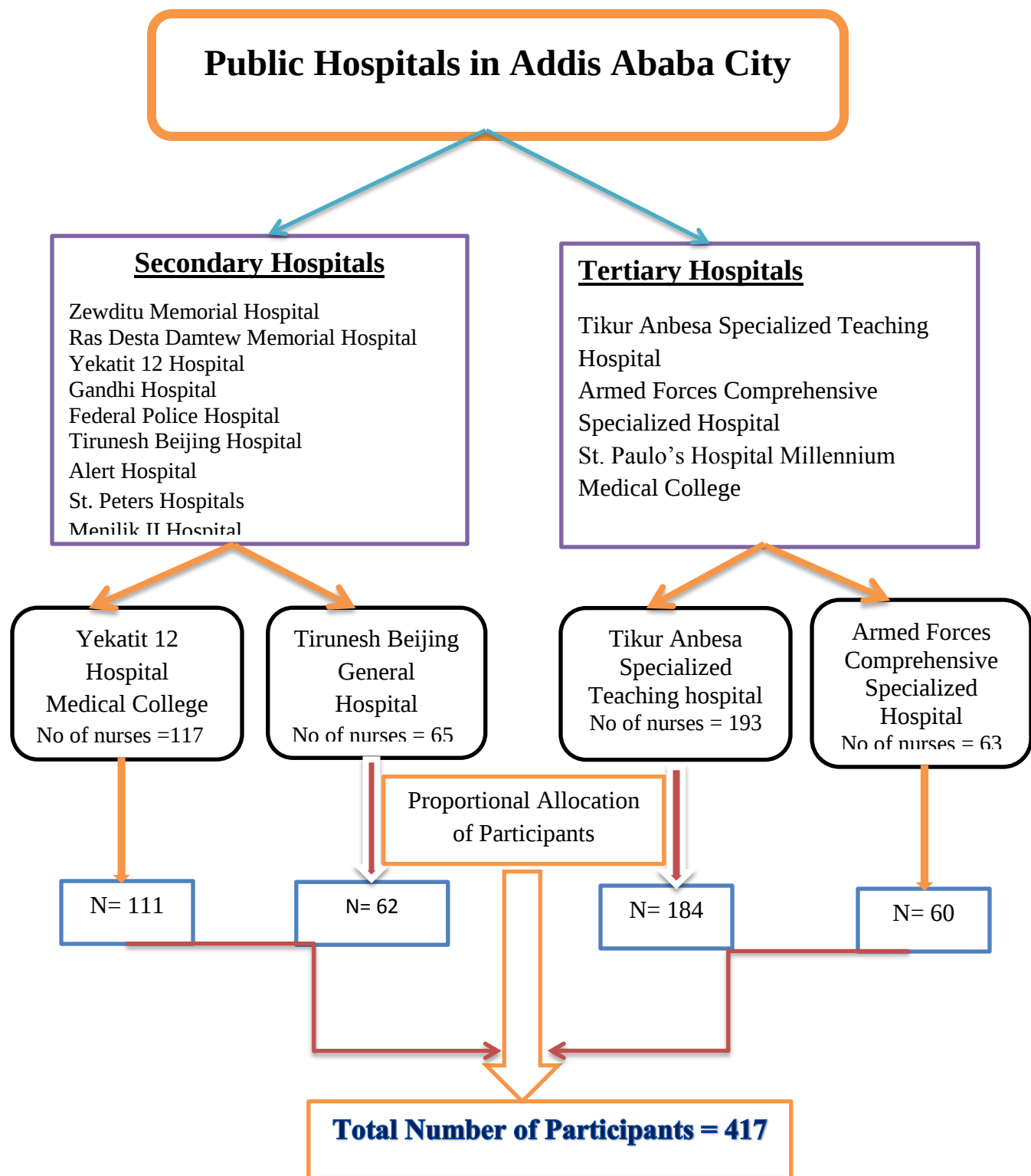


Figure-2: Schematic Representation of Sampling Procedures, February, 2018.

3.7 Study Variables

3.7.1 Dependent Variables

- ✓ Knowledge of nurses regarding prevention of surgical site infection
- ✓ Practice of nurses regarding prevention of surgical site infection

3.7.2 Independent Variables

- Age
- Sex
- Marital status
- Level of education
- Service experience
- In come
- Taking training on infection prevention measures
- Availability of SSI prevention guidelines
- Availability of equipment's
- Insufficient performance monitoring systems
- Lack of surveillance systems

3.8 Operational definitions

- **Knowledgeable:** Those participants who answer mean and above the mean, 15.23(60.92%) score of knowledge related questions regarding prevention of SSI.
- **Not knowledgeable:** Those participants who answer below the mean, 15.23(60.92%) score of knowledge related questions regarding prevention of SSI.
- **Good Practice:** Those participants who answer mean and above the mean, 58.36(77.8%) score of practice related questions regarding prevention of SSI.
- **Poor Practice:** Those participants who answer below the mean, 58.36(77.8%) score of practice related questions regarding prevention of SSI.
- **Nurse:** Those people who have college diploma or university degree and above in nursing profession.

3.9 Data Collection Technique and Tools

A structured and pretested self-administered English version questionnaire (Since English is an academic language in Ethiopia) was utilized to collect the necessary data from the study participants. The questionnaire was adapted from previous comparable studies and had three sections: The first section was about socio demographic characteristics of the participants and some institutional related issues regarding prevention of SSI.

The second section was about the knowledge of nurses regarding prevention of SSI and it consists 25 multiple choice items. Each correct response receives 1 point and the scores ranged from 0-25 and were transformed in to percentage for interpretation.

The third section consists; a Likert scale designed, to measure the nurse's practice regarding prevention of SSI. The scale consists 25 items in which responses were answered in a 4-point Likert scale (never practice, seldom practice, sometimes practice, and always practice) and the scores ranged from 0-75 and were transformed in to percentage for interpretation. The mean score was utilized as a cut of point to describe the nurse's knowledge and practice regarding prevention of SSI.

Two supervisors and four data collectors, who had BSc degree in nursing, were recruited to assist in the data collection process. Three days before the actual data collection period a one day training was given for the supervisors and data collectors on the objectives of the study, the questions and extent of explanations, the way to keep privacy and confidentiality and other ethical issues. The supervisors were coordinating the overall data collection processes.

3.10 Data Quality Assurance

To ensure the quality of data, the questionnaire was pretested on 5% (21) of the sample size, among nurses working in the surgical units of Zewditu memorial hospital 2 weeks before the actual data collection period. The pretest study was conducted at Zewditu memorial hospital which is not included in the study settings and was selected by lottery method among the hospitals not included in the study settings. The study subjects who fulfill the inclusion criteria were selected by simple random sampling technique. The result of the pretest was discussed and all the necessary amendments were made on, the instructions, contents, order and grammatical issues based on the pretest results.

During the study period, all data's were checked for completeness, accuracy, clarity and consistency by the supervisors and the principal investigator immediately after the data were collected. The principal investigator and the supervisors were closely monitoring the data collection process. Double data entry and validation was performed to assure the quality of data and the data were intensively cleaned before analysis.

3.11 Data Processing and Analysis

After data collection, the data were coded and entered into a computer using Epi-data 3.1 Statistical program and were exported to SPSS Version 23 for further analysis. Then, mean, median, standard deviation and proportion were calculated. Bivariate logistic regression analysis was run to assess the association between the independent and dependent variables. Multivariate logistic regression analysis was carried out to see the relative effects of independent variables on the outcome variables. Odds ratio was calculated to determine strength of association between independent and dependent variables and 95% confidence interval was utilized to guide interpretation of results. P-value of less than 0.05 was taken as a cutoff point to declare statistically significant association between independent and dependent variables. And finally the result is presented by using texts, tables and graphs.

3.12 Ethical Consideration

Ethical clearance was first obtained from Addis Ababa University institutional review board and letters were written to the selected public hospitals and concerned others to obtain permission and cooperation during the data collection process. Then, the letters were taken to Addis Ababa city health bureau to obtain ethical clearance to conduct the study in the selected public hospitals. Ethical clearance & support letter was obtained from Addis Ababa city health bureau ethical review committee. Then, the ethical clearance & support letter was taken to the selected hospitals to obtain permission and cooperation during the data collection process. Informed oral consent was obtained from each study subject prior to the data collection process after the purpose of study has been explained and they become briefed about the confidentiality of their responses and the importance of providing the right information to help the study achieve its objective. All participants were asked for their willingness to participate in the study and were told that it will not have any risk on them. Confidentiality of the information was assured and privacy of the respondent was maintained.

3.13 Dissemination of Findings

The result of the study will be submitted to Addis Ababa University, college of health sciences, school of nursing and midwifery. Then, it will be disseminated to the selected public hospitals in Addis Ababa city, Ethiopia/ the study area, and to all other concerned bodies who may utilize the findings in one way or another as deemed necessary. Again it will be presented at Addis Ababa University and other research symposiums. Finally it will also be sent for publication to Ethiopian or other Journals accordingly after being reviewed.

CHAPTER FIVE

Results

5.1 Sociodemographic Characteristics of Respondents

A total of four hundred nine nurses (409) 238 (58.2%) from tertiary hospitals (Tikur Anbesa specialized teaching hospital and Armed forces comprehensive specialized hospital) and 171(41.8%) from secondary hospitals (Yekatit 12 hospital medical college and Tirunesh Beijing general hospital) completed and returned the questionnaire making the response rate 98%. Two hundred seventy four (60.4%) of them were females. The mean age score was 31.16 and the median was 30 years. Among the study participants 221 (54%) were married, 179 (43.8%) single and the remaining 9 (2.2%) were widowed. Most of the study participants (84.1%) were BSc holders followed by (10%) masters and (5.9%) diploma nurses. The average monthly income of participants was 5258.94 Ethiopian birr. Only 224 (54.8%) of the study participants claim they have taken training regarding infection control methods (Table 1).

Table 1: Sociodemographic characteristics of nurses and related institutional issues, in the public hospitals in Addis Ababa city, Ethiopia, 2018 ($n = 409$).

Characteristics		Frequency	Percentage
Age	< 30years	238	58.2%
	$\geq$ 30years	171	41.8%
Sex	Male	162	39.6%
	Female	247	60.4%
Marital status	Single	179	43.8%
	Married	221	54%
	Divorced	9	2.2%
Educational status	Diploma	24	5.9%
	BSc degree	344	84.1%
	Master's degree	41	10%
Monthly income	<5258.94 ETB	223	54.5%
	$\geq$ 5258.94 ETB	186	45.5%
Total work experience	Five years or less	223	54.5%
	More than 5 years	186	45.5%
Experience in surgical units	Three years or less	301	73.6%
	More three years	108	26.4%
Duty ward	Surgical	152	37.2%
	Orthopedics	94	23%
	Recovery	50	12.2%
	Gyn. and labor	79	19.3%
	Others	34	8.3%

Ever took IP training	Yes	224	54.8%
	No	185	45.2%
Number of IP trainings attended	Only once	170	75.9%
	More than once	54	24.1%
Availability of IP guidelines	Yes	225	55%
	No	184	45%
Usage of IP guidelines	Yes	209	51.1%
	No	200	48.9%

5.2 Knowledge of Nurses Regarding Prevention of Surgical Site Infections

The mean knowledge score of the study participants was 15.23(60.92%) $\pm$ 3.29 with minimum score of 5 and a maximum score of 23 out of 25 items. In this study, less than half, i.e. 195 (47.7%) of the respondents had good knowledge regarding surgical site infection and its prevention (Figure 3).

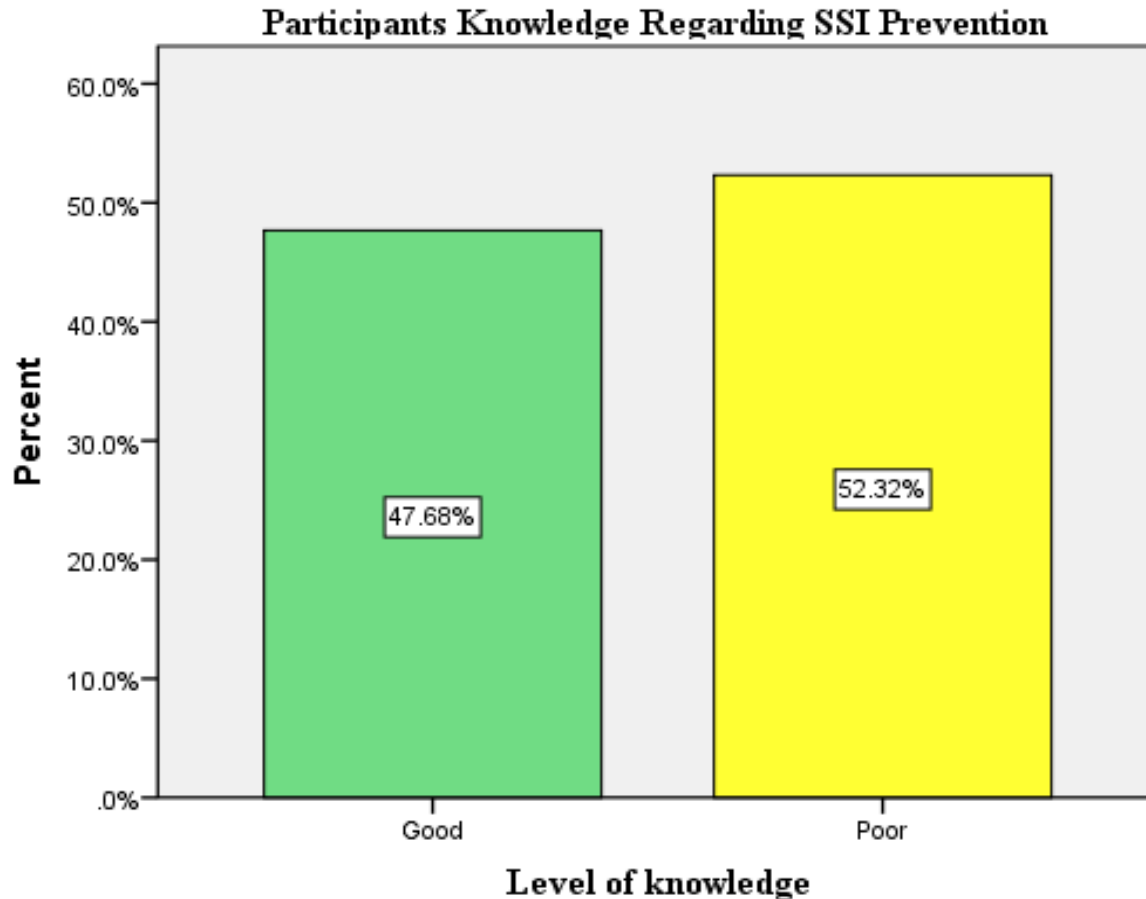


Figure 3: Knowledge of nurse's regarding SSI and its prevention, in the public hospital in Addis Ababa city, Ethiopia, 2018 ($n = 409$).

Concerning with items; of the participants, only 80 (19%) correctly responded to best methods for pre-operative shaving, while less than half i.e. 185(45.2%) replied correctly for a question when to change surgical dressing (Table 2).

Table 2: Responses of nurses on each item of the knowledge section about SSI and its prevention, in the public hospital in Addis Ababa city, Ethiopia, 2018 (n = 409).

Questions	Frequency of Correct Answers	Percentage of Correct Answers
Best method for preoperative shaving	80	19.6%
Best time for preoperative hair removal	126	30.8%
Correct time to administer prophylactic antibiotics	82	20%
Correct about prophylactic antibiotics	340	83.1%
Primary purpose of preoperative showering	326	79.7%
Best agent for preoperative showering to prevent SSIs	320	78.2%
Purpose of preoperative skin preparation	358	87.5%
Best agent for pre-operative skin preparation	240	58.7%
Method of disinfecting surgical sites before surgery	202	49.4%
Best antiseptic to disinfect surface of dressing trolley	184	45%
The correct purpose of surgical hand washing	358	87.5%
The correct step of hand washing	297	72.6%
The kind of diets to be given for postoperative patients	285	69.7%
Maintaining good nutritional status for surgical patients	348	85.1%
Correct for surgical pts. with compromised immunity	274	67%
Prevent infection in pts. with immunodeficiency disorder	172	42.1%
Laboratories to assess patient's nutritional status	309	75.6%
Level of blood sugar that'd be maintained to prevent SSI	261	63.8%
Correct for the malnourished surgical patients	326	79.7%
Time to change the surgical wound dressing	185	45.2%
Select dressing solutions for surgical wound	303	74.1%
Correct for the benefit of wound dressing	250	61.1%
Correct for the diagnosis of surgical site infection	88	21.5%
A good sign of no surgical site infection	309	75.6%
Laboratory to ensure surgical site infection	206	50.4%

5.3 Factors Associated With Knowledge of Nurses Regarding Prevention of SSIs

Bivariate logistic regression analysis was made for different variables. Participants age, income, level of hospitals nurses are working in, total work experience, work experience in surgical units, taking training on infection prevention methods and using available infection prevention guidelines were significantly associated with the knowledge of nurses regarding surgical site infection and its prevention methods. All variables with *P* values less than 0.25 were fitted into the backward stepwise multivariate logistic regression model. But, on multivariate analysis, only sex of the participants, work experience, educational level and using available infection prevention guidelines were significantly associated with the knowledge of nurses regarding prevention of surgical site infections.

The odds of male nurses to have good knowledge regarding prevention of surgical site infections was around 2 times higher than females (AOR = 1.81, 1.15 - 2.85). The odds of nurses with work experience of more than 5 years was about 3 times higher to have good knowledge regarding prevention of surgical site infection than those who have 5 years or less experience (AOR = 2.89, 1.60 - 5.21).

The odds of BSc degree holder nurses was about 3 times higher to have good knowledge regarding prevention of surgical site infection than diploma nurses (AOR = 3.11, 1.16 - 8.30) and nurses with master's degree had odds of about 5 times higher to have good knowledge regarding prevention of surgical site infection than diploma nurses (AOR = 5.19, 1.55 - 17.39) and the odds of those who uses available infection prevention guidelines in their routine practice was about 4 times higher to have good knowledge regarding prevention of surgical site infection than those who did not (AOR = 3.73, 2.37 - 5.87) (Table 3).

Table 3: Logistic regression analysis of factors associated with the knowledge of nurses regarding prevention of SSI, in the public hospitals, in Addis Ababa city, Ethiopia, 2018 (n = 409).

List of independent Variables	Knowledge of nurses		Bivariate logistic regression COR (95%CI)	Multivariate logistic regression AOR (95%CI)
	Good	Poor		
Sex				
Male	92(56.8%)	70(43.2%)	1.84(1.23-2.74)	1.81(1.15-2.85)**
Female	103(41.7)	144(58.3%)		
Age				
≥ 30	96(56.1%)	75(43.9%)	11.78(1.21 -2.67)	0.583(0.32-1.067)*
< 30	99(41.6%)	139(58.4%)		
Educational status				
Diploma	12(50.0%)	12(50.0%)		
Degree	153(44.5%)	191(55.5%)	0.801(0.35-1.83)	3.11(1.16-8.30)**
Masters	30(73.2%)	11(26.8%)	2.73(0.95-7.85)	5.19(1.55-17.39)**
Level of hospital				
Secondary	70(40.9%)	101(59.1%)		
Tertiary	125(52.5%)	113(47.5%)	1.50(0.99-2.28)	1.26(0.796-1.994)*
Monthly income				
≥ 5258.94ETB	101(54.3%)	85(45.7%)	1.63(1.10-2.41)	0.62(0.33-1.16)*
< 5258.94ETB	94(42.2%)	129(57.8%)		
Work experience				
More than five years	110(59.1%)	76(40.9%)	2.35(1.58-3.49)	2.89(1.60-5.21)**
Five years or less	85(38.1%)	138(61.9%)		
Experience in surgical unit				
More than three years	69 (63.9%)	39(36.1%)	2.46(1.56-3.87)	1.64(0.91-2.97)*
Three years or less	126(41.9%)	175(58.1%)		
Ever took IP training				
Yes	133(59.4%)	91(40.6%)		
No	62(33.5%)	123(66.5%)	1.84(1.24-2.72)	1.97(0.18-3.27)*
No of trainings attended				
More than once	32(59.3%)	22(40.7%)	0.98(0.53-1.81)	0.98(0.48-1.99)*
Only once	101(59.4%)	69(40.6%)		
Usage of IP guidelines				
Yes	129(61.7%)	66(33%)	3.86(2.55-5.85)	3.73(2.37-5.87)**
No	80(38.3%)	134(67.0%)		

*Not significant

** Significant at p<0.05.

5.4 Nurses Practice Regarding Prevention of Surgical Site Infections

The mean practice score of the study participants was found being 58.36 (77.8%) and SD of 7.36 with a minimum score of 27 and a maximum score of 75 out of a 25 Likert items (the score ranging from 0 to 75) that were employed to measure the level of practice of nurse's regarding prevention of surgical site infections. In this study, around half, 200 (48.9%) of the participants were found having good practice regarding prevention of surgical site infection (Figure 4).

Participants Level of Practice Regarding SSI Prevention

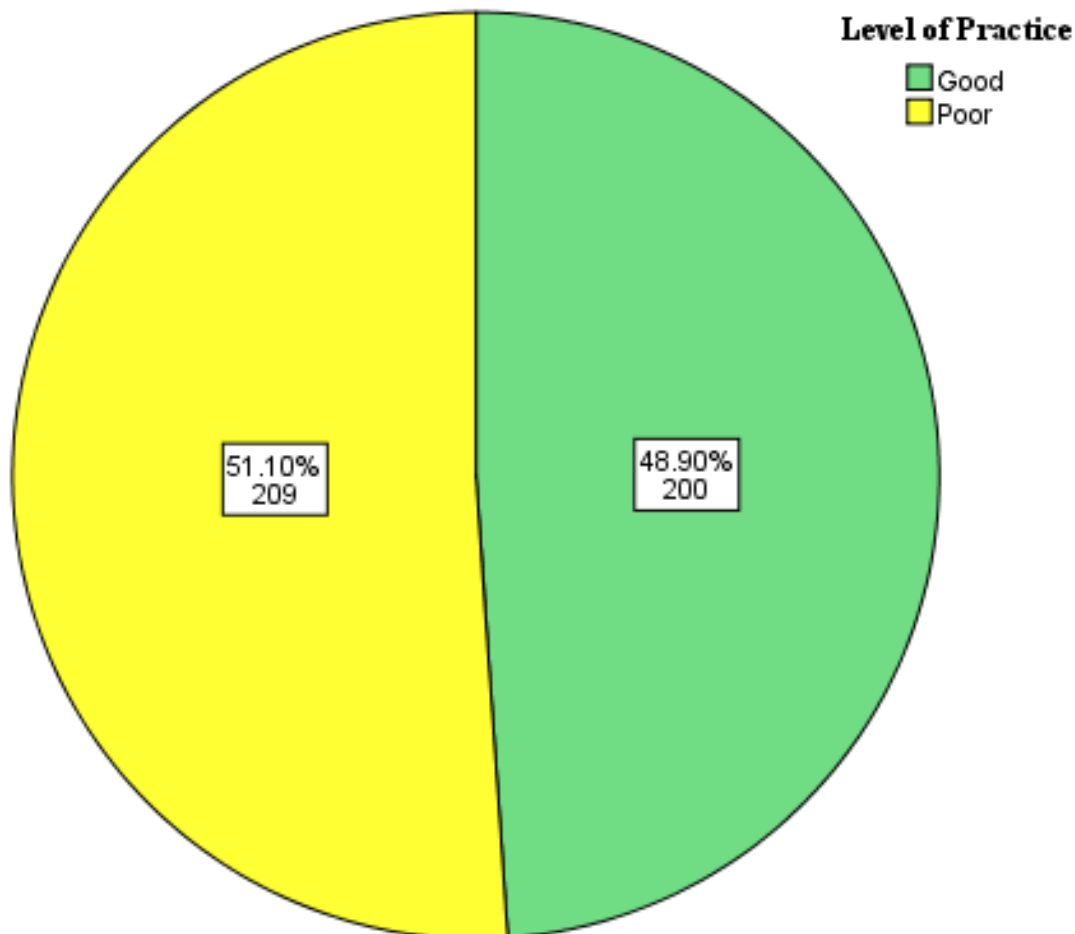


Figure 4: Nurse's level of practice regarding SSI and its prevention, in the public hospital in Addis Ababa city, Ethiopia, 2018 ($n = 409$).

Table 4: Responses given by nurses on each item of the practice section, in the public hospitals, in Addis Ababa city, Ethiopia, 2018 (n = 409).

SSI prevention practice items	Frequency and percentage			
	Never	Seldom	Sometimes	Always
Use alcohol and chlorhexidine gluconate	2(0.5%)	6 (1.5%)	142(34.7%)	259(63.3%)
Wash hands before and after changing wound dressings.	2(0.5%)	21(5.1%)	118(28.9%)	268(65.5%)
Wash hands before wearing surgical gloves.	2(5.6%)	61(14.9%)	194(47.4%)	131(32%)
Perform preoperative shaving on the day before surgery.	213(52.1%)	74(18.1%)	76(18.6%)	46(11.2%)
Learn shaving methods from others	124(30.3%)	93(22.7%)	129(31.5%)	63(15.4%)
Administer preoperative prophylactic antibiotics within 120 minutes before surgery	37(9%)	39(9.5%)	113(27.6%)	220(53.8%)
Advise patients to take pre-operative showering within 6-12 hours before surgery	43(10.5%)	56(13.7%)	179(43.8 %)	131(32 %)
Advise patients to take pre-operative showering with antimicrobial agent.	43(10.5%)	57(13.9%)	186(45.5%)	123(30.1%)
Perform prescribed glucose test before and after surgery in a diabetic patient.	6(1.5%)	16(3.9 %)	67(16.4 %)	320(78. %)
Assess pt.'s body mass index before and after surgery	88(21.5 %)	116(28.2 %)	146(35.7 %)	59(14.4 %)
Administer injection insulin/oral medication as ordered in diabetic pt.	8(2%)	4(1%)	76(18.6%)	321(78.5%)
Advise obese patients to reduce the amount of carbohydrate they take.	31(7.6%)	54(13.2%)	196(47.9%)	128(31.3%)
Advise a malnourished patient to take nutritious diet.	1(0.2%)	17(4.2%)	133(32.5%)	258(63.1%)
Advise immuno-compromised patients to avoid contact with people having infections	6(1.5%)	32(7.8%)	151(36.9%)	220(53.8%)
Advise a malnourished patient to take vegetables and fruits before & after surgery.	10(2.4%)	22(5.4%)	120(29.3%)	257(62.8%)
Use sterile forceps and other sterile dressing materials for cleaning surgical wound.	2(0.5%)	9(2.2%)	76(18.6%)	322(78.7%)
Advice patients with immunodeficiency disorder to maintain their personal hygiene.	2(0.5%)	7(1.7%)	71(17.4%)	329(80.4%)
Follow aseptic technique to obtain swab culture	2(0.5%)	22(5.4%)	62(15.2%)	323(79%)
Follow aseptic technique during dressing	1(0.2%)	6(1.5%)	89(21.8%)	313(76.5%)
Use povidone-iodine and normal saline for cleansing surgical wound dressing.	2(0.5%)	7(1.7%)	146(35.7%)	254(62.1%)
Asses and monitor surgical site conditions	3(0.7%)	6(1.5%)	99(24.2%)	301(73.6%)
Separate infected dressing from non-infected	0(0%)	19(4.6%)	138(33.7%)	252(61.6%)
Wear face mask during surgical wound care	2(0.5 %)	65(15.9%)	273(66.7%)	69(16.9%)
Clean and disinfect surface of the dressing trolley with anti-septic solutions.	0(0 %)	9(2.2%)	186(45%)	214(52.3 %)
Discard the soiled materials in the proper place after performing wound dressing?	0(0%)	2(0.5%)	48(11.7%)	359(87.8%)

5.5 Factors Associated with Nurses practice regarding Prevention of SSIs

In the bivariate regression analysis; participants age, income, total work experience, work experience in surgical units, taking training on infection prevention methods and using available infection prevention guidelines were significantly associated with the practice of nurses regarding surgical site infection and its prevention methods. However on multivariate analysis, only educational status, work experience and using available infection prevention guidelines were significantly associated with the practice of nurses regarding prevention of surgical site infections. Training had a weak association with practice at a p value of 0.05.

The odds of nurses with BSc degree was about 4 times higher to have good practice regarding prevention of surgical site infection than diploma nurses (AOR = 4.35, 1.73 - 10.95) and the odds of those who use available infection prevention guidelines in their routine practice was about 3 times higher to have good practice regarding prevention of surgical site infection than those who did not (AOR = 2.72, 1.73 - 4.28). The odds of nurses with work experience of more than 5 years was about 2 times higher to have good practice regarding prevention of surgical site infection than those who have 5 years or less experience (AOR = 2.89, 1.60 - 5.21) (Table 6).

Nurses were asked to rate their level of practice and 56 (13.7%) of them rated their level of practice as unsatisfactory. And then, they were asked to mention the possible factors affecting their level of practice and they put their responses as follows: I have no sufficient knowledge about SSIs, 19 (4.6%), inadequate resources to implement surgical safety checklists, 154 (37.7%), insufficient performance monitoring systems, 101 (24.7%), lack of surgical site infection assessment and preventive measure feedback systems, 60 (14.7%). And other reasons, 372 (91%) like; excessive workload, staff inadequacy, lack of training to upgrade their level of practice, small chance to learn and develop knowledge and skills through formal education, lack of encouraging programs, insufficient orientation programs during unit rotation, unsuitable hospital environment and negligency and lack of interest as a result of the harassing hospital environment were mentioned as factors affecting their level of practice (Table 5).

Table 5: Nurse's personal rating of their level of current practice and the respective reasons regarding prevention of SSI, in the public hospitals, in Addis Ababa city, Ethiopia, 2018 ($n = 409$).

Questions	Responses	Frequency	Percentage
How do you rate the overall level of your current practice regarding prevention of SSI?	Very unsatisfactory	1	0.2%
	Unsatisfactory	55	13.4%
	Satisfactory	341	83.4%
	Very satisfactory	12	2.9%
If you are not very satisfied with your current level of practice, what are the reasons/factors?	I have no sufficient knowledge about SSIs	19	4.6%
	Inadequate resources to implement surgical safety checklists	154	37.7%
	Insufficient performance monitoring systems	101	24.7%
	Lack of surgical site infection assessment and preventive measure feedback systems	60	14.7%
	Others	372	91%

Table 6: Logistic regression analysis of factors associated with the practice of nurses regarding prevention of SSI, in the public hospitals, in Addis Ababa city, Ethiopia, 2018 (n = 409).

List of independent Variables	Practice of nurse's		Bivariate logistic regression COR (95%CI)	Multivariate logistic regression AOR (95%CI)
	Good	Poor		
Sex				
Male	84(51.9%)	78(48.1%)		
Female	116(47.0%)	131(53.0%)	1.22(0.82-1.81)	1.22(0.78-1.92)*
Age				
≥ 30 years	94(55.0%)	77(45.0%)	1.52(1.02-2.26)	0.84(0.46-1.51)*
< 30 years	106(44.5%)	132(55.5%)		
Educational status				
Diploma	8(33.3%)	16(66.7%)		
Degree	171(49.7%)	173(50.3%)	1.98(0.82-4.74)	4.35(1.73-10.95)**
Masters	21(51.2%)	20(48.8%)	2.1(0.74-5.98)	2.20(0.75-6.46)**
Level of hospital				
Secondary	78(45.6%)	93(54.4%)		
Tertiary	112(51.3%)	116(48.7%)	1.03(0.68-1.55)	1.09(0.70-1.71)*
Monthly income				
≥ 5258.94 ETB	105(56.5%)	81(43.5%)	1.75(1.18-2.59)	1.01(0.56-1.84)*
< 5258.94 ETB	95(42.6%)	128(57.4%)		
Total work experience				
More than five years	105(56.5%)	81(43.5%)	1.75 (1.18-2.59)	1.71(1.10-2.64)**
Five years or less	95(42.6%)	128(57.4%)		
Experience in surgical unit				
More than three years	64(59.3%)	44(40.7%)	1.77(1.13-2.76)	1.33(0.74-2.40)*
Three years or less	136(45.2%)	165(54.8%)		
Ever took IP training				
Yes	132(58.9%)	92(41.1%)	2.01(1.35-2.99)	1.90(0.16-3.11)*
No	68(36.8%)	117(63.2%)		
No of IP trainings attended				
More than once	35(64.8%)	19(35.2%)	1.29(0.69-2.41)	1.21(0.59-2.47)*
Only once	97(57.1%)	73(42.9%)		
Usage of IP guidelines				
Yes	125(59.8%)	84(40.2%)	2.63(1.76-3.94)	2.72 (1.73-4.28)**
No	75(37.5%)	125(62.5%)		

*Not significant

** Significant at p<0.05.

CHAPTER SIX

Discussion

Surgical site infections are one of the serious complications of surgical procedures and the most common type of healthcare-associated infections (HAIs) [1]. Up to 60% of SSIs have been estimated to be preventable by using evidence-based guidelines. However, still they are the leading HAIs reported hospital-wide in low and middle income countries (LMICs) and represent a significant burden in terms of patient morbidity, disability, mortality and additional costs to the health systems and service payers throughout the world. Patients with a SSI have a 2–11 times higher risk of death compared with operative patients without SSI and seventy-seven percent (77%) of deaths in patients with SSI are directly attributable to SSI which could be prevented by health care workers by acting in accordance with the latest guidelines with the latest recommendations regarding prevention of SSIs [1, 5, 6].

It takes a multi-disciplinary approach to reduce SSIs. However, as frontline caregivers, nurses can help surgical patients avoid SSI through pre and intraoperative implementation of surgical safety checklists and adequate post-operative wound care and thorough discharge planning [2, 5, 6]. Hence, upgrading the nurse's knowledge and practice regarding SSI and the preventive measures in accordance with the latest recommendations in the newly developed global and national surgical site infection prevention guidelines, like that of the WHO global guideline is an essential component in SSI prevention efforts. Therefore, the aim of this study was to assess the knowledge and practice of nurses and identify factors associated with them regarding prevention of surgical site infections and examine the type of relationship they have.

Regarding knowledge, only 195 (47.7%) of nurses were found having good knowledge regarding surgical site infection and its prevention with the mean score being 60.92%. This reveals that more than half of the nurses have inadequate knowledge about SSI and its preventive measures. This finding is consistent with across literatures; in Pakistan a study revealed that the knowledge of staff nurse's regarding prevention of surgical site infections was poor [20] and in Bangladesh, majority of nurses (70%) had low knowledge regarding prevention of SSI [21]. It was also revealed that Jordanian nurse's knowledge regarding evidence based guidelines for the prevention of SSIs was low [22].

It is also in line with a study conducted in Ethiopia, Amhara regional state in which only 40.7% of the participants were found having good knowledge about SSI prevention [23]. These studies suggested that the knowledge of nurses about surgical site infection was low because of different reasons giving example, the nurse's lack of training on SSI prevention methods and failure of the hospitals to make latest SSI prevention guidelines easily accessible to the staff nurses.

However, it is in contrast with a Nigerian study in that nurses demonstrated relatively high level of knowledge regarding prevention of SSI [25]. This difference might emerge from differences in trainings and use of SSI prevention guidelines. It may also be due to the assessment tool between the two studies and the convenience sampling technique the study employed. Because, those who participate conveniently are always different from others in certain characteristics may result in possibly biased study outcomes.

The study also revealed that participant's sex was significantly associated with knowledge regarding prevention of surgical site infection. The odd of male nurse's was almost 2 times higher to have good knowledge than females regarding prevention of surgical site infections. The possible reasons for this finding might be due to the fact that in this study the proportion of males who claim they have taken training on infection prevention methods and use available infection prevention guidelines in their routine practice was higher compared to females. Therefore, the difference in knowledge level could be due to differences in training and the practice of using available surgical site infection prevention guidelines. This finding is in line with study's conducted in Jordan and in Ethiopia, Amhara regional state [22, 23].

Work experience was another factor which was significantly associated with nurse's knowledge. The odds of those nurses with work experience of more than 5 years was about 3 times higher to have good knowledge regarding prevention of surgical site infection than those who have 5 years or less. This finding is in line with findings across studies in which year of experience was positively associated with knowledge regarding SSI prevention [22, 23]. This could be due to the fact that as the number of years of practice increases, nurses are repeatedly exposed to various types of procedures and gain knowledge through working with experienced medical staffs.

Educational level was the other important factor which was significantly associated with knowledge of nurses. The odds of BSc degree holder nurses was about 3 folds higher to have good knowledge regarding prevention of surgical site infection than diploma nurses and for nurses with master's degree, it was about 5 folds higher to have good knowledge than diploma nurses. This finding is consistent with a study in Jordan [22]. This could be due to differences in the number of credit hours learnt and duration of college or university stay. As the level of education increases, the number of credit hours learnt and the duration of college or university stay also increases resulting in possible better knowledge.

Using available infection prevention guidelines in routine nursing practice was also significantly associated with knowledge of nurses regarding prevention of site infection. The odds of those nurses, who use available infection prevention guidelines in their routine practice was about 4 folds higher to have good knowledge regarding prevention of surgical site infection than those who did not. The possible explanation is that as nurses read infection prevention guidelines they are more likely to gain knowledge about SSI prevention.

Nurses were asked the question that what is the best method for pre-operative shaving and only 80 (19.6%) of the participants responded correctly and again asked, when do you change the surgical wound dressing after a patient undergoing operation and less than half, i.e. 185(45.2%) replied the correct answer (majority of them said when surgeon orders, but the recommendation is within 24 hours of post operation from the given alternatives depending on the wounds condition and the result is in line with other studies [20, 21].

The suggestion of these studies was that nurses are heading towards being task oriented rather than implementing nursing activities based on their knowledge (Table 2). This might be due to insufficient involvement of nurses in designing strategies in the hospital administration activities, excessive workload, unsuitable working environment, and, or due to deeply held misperception by nurses that nursing is performing when ordered by physicians.

At the same time, this study had also tried to examine the level of nurse's practice regarding prevention of SSI and less than half, 200 (48.9%) of the nurses were found having good practice regarding prevention of SSI with the mean practice score being 77.8%. This means that in the reverse more than half of the nurses were practicing improperly regarding prevention of SSI. This finding is in agreement with studies conducted in Ethiopia (Amhara regional state), Bangladesh, Nigeria and Tanzania in which the level of nurse's practice towards prevention of SSIs was at a low level [23, 24, 25, 26]. The implication of these studies is that, the practice of nurses regarding prevention of SSI was affected by multiple factors giving lack of training on SSI prevention methods in accordance with the latest global and national guidelines with the latest recommendations as an example.

But the result is in contrast with studies in Pakistan and another study in Bangladesh in that the overall practice of staff nurses regarding preventing and managing surgical site infection was at good level [20, 21]. This difference might be due to differences in sample size, attitude, training and workload of nurses regarding prevention of SSI. It might be also due to differences in the development level of the countries and the resulting shortage of resources as nurses reported that, lack of resources to implement SSI prevention activities is one of the major factors affecting their practice regarding prevention of SSIs.

The odds of nurses with BSc degree was about 4 folds higher to have good practice regarding prevention of surgical site infection than diploma nurses and for those who use available infection prevention guidelines in their routine practice was about 3 folds higher to have good practice regarding prevention of surgical site infection than those who did not. The possible reasons for these findings might be due to the fact that majority of participants were BSc holders and diploma nurses were very small in number and again those who claim they are using available infection prevention guidelines in their routine practice were larger in number than diploma nurses.

The other reason might be the number of credit hours learnt and the duration of college and university stay which is different between them. This finding is consistent with a study in Tanzania in which undergraduate nurses demonstrated and scored higher in their practice compared to diploma and certificate nurses ($P = 0.003$) [26]. However it is in contrast with a study in Ethiopia, Amhara regional state in which diploma nurses scored better in practice compared to BSc nurses (23).

This difference might be due to differences in, workload, trainings and attitude of nurses regarding prevention of SSIs. It may be also due to the assessment tool which is vulnerable to central tendency, acquiescence and social desirability biases [21, 34].

The odds of nurses with work experience of more than 5 years was about 2 folds higher to have good practice regarding prevention of surgical site infection than those who have 5 years or less experience. The finding is in line with other studies in which work experience was significantly associated with the nurse's level of practice [23, 26]) The possible explanation is as the nurses service year increases, they are more likely to be exposed to work with experienced staffs and acquire knowledge and necessary skills through the process.

Nurses were asked to rate their level of practice and 56 (13.7%) of them rated their level of practice as unsatisfactory and the number is highly significant. Then, they were asked to mention the possible factors affecting their level of practice. And the result revealed that insufficient knowledge about SSIs, inadequate resources to implement surgical safety checklists, insufficient performance monitoring systems, lack of surgical site infection assessment and preventive measure feedback systems, and others, like; excessive workload, staff inadequacy, lack of training to upgrade their level of practice, insufficient orientation programs during unit rotation, unsuitable and harassing hospital environment, negligency and lack of interest due to the harassing hospital environment were the identified factors affecting the nurses practice.

These factors may result in feelings of frustration among nurses and may end up with professional non-achievement for nurses and low quality care to the health system. The finding is consistent with a Bangladesh study in which, insufficient knowledge, inadequate resources and budgets, insufficient performance monitoring systems, and lack of surveillance systems were identified as a major factors affecting the nurses level of practice in SSI prevention efforts [24].

CHAPTER SEVEN

Strength and Limitations of the Study

7.1 Strength

1. The study involved the two levels of public hospitals found in Addis Ababa city and tried to make the result representative.
2. The study had also tried to explore the factors affecting the nurse's knowledge and practice in-depth.

7.2 Limitations

1. Since this study had used a self-administered Likert scale to measure the nurse's practice regarding prevention of surgical site infections, the following limitations were inherent: avoidance of using extreme response categories by participants - central tendency bias, agreeing with statements as presented - acquiescence bias and participants attempt to portray themselves or their organization in a more favorable way - social desirability bias [21, 34]. Therefore, the result may not reflect the actual nursing practice regarding prevention of SSIs.
2. The study design was cross sectional and therefore it cannot establish cause and effect relationships.
3. The other limitation was that this study was limited to public hospitals in Addis Ababa city only due to constraints of time and fund. It would have been possible to assess differences in nurse's knowledge and practice regarding prevention of SSI, among those who are working in private and public hospitals in Addis Ababa city.
4. Finally, since the study involved only those who are working in the surgical units its generalizability is also limited to those who are working in surgical related units.

CHAPTER EIGHT

Conclusions and Recommendations

8.1 Conclusion

An institution based cross-sectional study was carried out to assess the knowledge, practice and associated factors regarding prevention of surgical site infection among nurses working in the surgical units of public hospitals in Addis Ababa city, Ethiopia from March 01_30, 2018. An adapted English version questionnaire was utilized as a data collection tool. The result of this study revealed that more than half of the participants have inadequate knowledge regarding prevention of surgical site infections. In addition, almost half of participants were practicing poorly.

Sex of the participants, work experience, educational level and using available infection prevention guidelines were factors that were significantly associated with the knowledge of nurses regarding prevention of surgical site infections. On the other hand, only educational status, work experience and using available infection prevention guidelines were significantly associated with the practice of nurses regarding prevention of surgical site infections.

In sufficient knowledge, inadequate resources to implement surgical safety checklists, insufficient performance monitoring systems, lack of surgical site infection assessment and preventive measure feedback systems, and others, like; excessive workload, staff inadequacy, lack of training, insufficient orientation programs during unit rotation, lack of interest due to the harassing hospital environment were also identified as factors affecting the nurse's practice regarding prevention of SSIs.

The results on some items also suggested that nurses are practicing based on trends and are not following the latest recommendations on prevention of SSI. Furthermore, it also indicated that nurses are waiting doctor's order or they are heading towards being task oriented to intervene rather than intervening based on their knowledge and this may result in professional non- achievement for nurses and low quality care for patients and the health systems as a whole.

Therefore, attention should be given on updating nurse's knowledge, making the training programs fair, making resources available and establishing infection prevention committee. Furthermore, hospital administrators should emphasis on involving nurses in designing strategies; so that nurses can be encouraged and work effectively.

8.2 Recommendations

- ❖ For Federal Ministry of Health: Developing national surgical site infection prevention guidelines based on evidence based global guidelines with the latest recommendations and designing in-service and off-service training programs for nurses working in hospitals regarding prevention of surgical site infections, in collaboration with other stake holders is strongly recommended.
- ❖ For the departments of nursing in higher educational institutions in Ethiopia: Revising the curriculum and incorporating surgical site infections prevention methods in a more detail way in closer courses, probably in operation theatre technique course is very essential; so that new graduates' level of understanding about it can be strengthen.
- ❖ For hospital administrators: Preparing and providing, in-service training programs for nurses on methods of surgical site infection prevention, based on latest evidence based global and national guidelines is strongly recommended. It is also very important, if surgical site infection prevention guidelines are made accessible to staff nurses; Example, putting them in the nearby areas like in nurse's duty rooms through coordinators.
- ❖ For nurses: there are many latest recommendations regarding prevention of surgical site infections, that are different from the older ones and it is very important to update once knowledge through reading, training, etc. Therefore reading the latest SSI prevention guidelines is strongly recommended. It is also very important to ensure self-possessed knowledge is translated into desirable actions. Working based on self-possessed knowledge not only benefits patients but also, it upgrades the nurse's professional achievement and give personal satisfaction.
- ❖ For researchers: Conducting further study using triangulated study design and addressing the unreached problems in this study in a detail way including, the nurses attitude regarding prevention of surgical site infections is very strongly recommended.

CHAPTER NINE

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CHAPTER TEN

Annexes

Annex I: Information sheet and consent form

Addis Ababa University College of Health Sciences, School of Nursing and Midwifery

Consent form to certify the participants agreement on the questionnaire!

Introduction

This is a self-administered questionnaire prepared to collect data on the knowledge, practice, and associated factors regarding prevention of surgical site infection among nurses working in the surgical units of public hospitals in Addis Ababa city, Ethiopia, 2018.

Today I am here to collect data on the knowledge, practice and associated factors regarding surgical site infection prevention. The objective of this study is to assess the knowledge, practice and associated factors regarding surgical site infection prevention among nurses working in the surgical units of public hospitals in Addis Ababa city. Your correct and genuine answer to the questions can make the study achieve its goals. Based on such result and commitments from the researcher the findings will be disseminated to different stakeholders and the problem will be solved accordingly. I kindly request you to answer the questions honestly and anonymously. Since this self-administered questionnaire is based on willingness you have the right not to participate, to participate partially and wholly. I would like to promise you that it will not have any risk on you and confidentiality of the information you rendered will be kept. For that reason you don't need of writing your name. It will take approximately 1 hour to complete the questionnaire.

Are you willing to participate in the study?

Yes

☐

No

☐

Thank you for your cooperation!!!

Annex II: Structured English Version Questionnaire

Section One: Questions on Socio Demographic Characteristics of Participants and Related Institutional Issues.

Please read and encircle the number that belongs to you and write your answer on the blank spaces for the questions asking you to write your answer.

S. No	Questions	Responses
101	Age	_____years
102	Sex	1. Male 2. Female
103	Marital status	1. Single 2. Married 3. Divorced 4. Widowed 5. Separated
104	Educational status	1. Diploma 2. Degree 3. Masters
105	Total monthly income	_____Ethiopian birr
106	Total work experience	1. 0-5 years 2. 6-10 years 3. 11-15 years 4. 16-20 years 5. Above 20 years
107	Work experience in the surgical units	_____ years
108	Name of duty ward	1. Surgical 2. Orthopedics 3. Recovery 4. Gyn. and labor 5. Others (specify)_____
109	Level of the hospital you are working in?	1.Primary hospital 2. Secondary hospital 3. Tertiary hospital
110	Have you ever taken training regarding infection control? If no, go to question number 112.	1. Yes 2. No
111	If yes for the above question, mention the number of infection control trainings you attend.	_____Times
112	Is there a surgical site infection prevention guideline in your hospital? If no, go to section two.	1. Yes 2. No
113	If yes for question number 112; Are you using it?	1. Yes 2. No

Section Two: Questions That Are Used To Assess Nurses Knowledge About Surgical Site Infection

Multiple Choice Questions: Read the questions and encircle the best answer based on your understanding.

No	Questions	Responses
201	What is the best method for preoperative shaving if indicated?	1. Razor shaving method 2. Applying shaving cream method 3. Clipping shaving method
202	When is the best time for preoperative hair removal?	1. On night preoperatively outside the OR 2. On the day of surgery inside the OR 3. On the day of surgery outside the OR
203	When should you administer antibiotic prophylaxis?	1. Within 120 minutes before operation 2. Within 60 minutes before operation 3. Within 30 minutes before operation
204	Which one is correct answer for prophylaxis antibiotics?	1. Prophylaxis antibiotic is important to prevent surgical site infection 2. Prophylaxis antibiotic is less important to prevent surgical site infection 3. Prophylaxis antibiotic is not important to prevent surgical site infection
205	What is the primary purpose of preoperative showering?	1. To reduce the skins microbial load 2. To make the patient feel comfortable 3. To prevent spread of infection from the patient to the health workers
206	What is the best agent for preoperative showering to prevent surgical site infection?	1. Tap water 2. Anti-bacterial soap 3. Herbal soap
207	What is the purpose of preoperative skin preparation?	1. To prevent or inhibit bacterial growth 2. To prevent or inhibit viral growth only 3. To prevent or inhibit fungal growth only
208	Which one is the best agent for pre-operative skin preparation?	1. Alcohol based products based on with chlorhexidine 2. Savalon solution products 3. Hydrogen peroxide solution products
209	How would you disinfect surgical site before surgery?	1. Applying broad spectrum antiseptics 2. Applying soap solution 3. Applying Savlon solution
2010	What is the best antiseptic solution to disinfect the surface of dressing trolley?	1. Savalon solution 2. 0.5 % chlorhexidine solution 3. 70%Ethylalcohol with 0.5 chlorhexidine
211	Which one is the correct purpose of surgical hand washing?	1. Reduce the risk of dryness of the hand 2. Increase the risk of surgical site infection 3. Reduce the risk of surgical site infection
212	Which one is the correct step of hand washing?	1. Wet your hands, rinse, apply antiseptic agent and dry 2. Wet your hands, apply antiseptic agent, rinse and dry 3. Wet your hands, apply antiseptic agent, dry and rinse

213	What kinds of diet should be provided for the postoperative patients?	1. Protein rich diet and vitamin C containing foods 2. Carbohydrate rich diet& vitamin C containing foods 3. Fat rich diet & vitamin C containing foods
214	What is the purpose of maintenance of normal nutritional status for surgical patients?	1. Preventing post-operative complication 2. Reduce immune function 3. Reduce healing process
215	Which one is correct answer for surgical patients with compromised immune system?	1. More vulnerable to surgical site infection 2. Have normal immune function 3. Less vulnerable to surgical site infection
216	How do you prevent infection of patients with immunodeficiency disorder?	1. Eat fresh fruits and fresh vegetables 2. Eat well-cooked food 3. Drink tap water
217	What are laboratories in assessing patient's nutritional status?	1. Serum albumin and complete blood count 2. Serum albumin and urine analysis 3. Serum albumin and stool examination
218	What is correct level of blood sugar which enhances function of white blood cell adequate to prevent surgical site infection?	1. Lower than or equal to 110 mg/dl 2. Lower than or equal to 200 mg/dl 3. Higher than 200 mg/dl
219	Which one is correct for the malnourished surgical patients?	1. Have more immune response to prevent infection 2. Have less immune response to prevent infection 3. Have normal immune response to prevent infection
220	When do you change the surgical wound dressing?	1. Within 24 hours after surgery 2. When a dressing material present with a lot of exudates 3. When a surgeon orders
221	How do you select dressing solutions for surgical wound?	1. Based on wound characteristics 2. Based on size of the wound 3. Based on the depth of the wound
222	Which one is the correct answer for the benefit of wound dressing?	1. Dressing decreases wound pain 2. Dressing absorbs exudates 3. Dressing doesn't absorb exudates
223	Which statement is correct for diagnosis of surgical site infection?	1. Surgical site infection occurs within 30 days after operation 2. Incision culture is negative 3. Patient has fever within the first 3 days after operation
224	Which answer is a good sign of no surgical site infection?	1. No discharge, no fever 2. No discharge, edema of the skin around the wound 3. No discharge, open suture line
225	Which laboratory is used to ensure surgical site infection?	1. Swab culture investigation 2. Blood culture investigation 3. Urine culture investigation

Section Three: Questions That Are Used To Assess Nurses level of Practice Regarding Prevention of Surgical Site Infection and Related Institutional Issues.

Please answer the following questions by giving the mark (X) on the column that best fit to your current level of practice honestly.

Sr.No.	Questions	Never	Seldom	Sometimes	Always
301	How often do you use alcohol and chlorhexidine gluconate as an antimicrobial in your ward?				
302	How often do you wash your hands before and after changing wound dressings and touching surgical sites?				
303	How often do you wash your hands before wearing surgical gloves?				
304	How often do you perform preoperative shaving on the day before surgery?				
305	How often do you administer preoperative prophylactic antibiotics within 120 minutes before surgery?				
306	How often do you learn shaving methods from others?				
307	How often do you advise patients to take pre-operative showering within 6-12 hours before surgery?				
308	How often do you advise patients to take pre-operative showering with antimicrobial agent?				
309	How often do you perform prescribed glucose test before and after surgery in a diabetic patient?				
310	How often do you assess the patient's body mass index (BMI) before and after surgery?				
311	How often do you administer injection insulin or give oral medication as ordered in diabetic patient?				
312	How often do you advise obese patients to reduce the amount of carbohydrate they take?				
313	How often do you advise a malnourished patient to take nutritious diet (especially protein diet)?				
314	How often do you advise a patient with a compromised immune system to avoid contact with people who have infections?				
315	How often do you advise a malnourished patient to take vegetables and fruits before & after surgery?				
316	How often do you use sterile forceps and sterilized dressing materials for cleaning surgical wound dressing?				
317	How often do you advice patients with immunodeficiency disorder to maintain their personal hygiene?				
318	How often do you follow an aseptic technique during obtaining swab culture?				

319	How often do you follow an aseptic technique during surgical wound dressing?				
320	How often do you use povidone-iodine and normal saline for cleansing surgical wound dressing?				
321	How often do you asses and monitor surgical site conditions?				
322	How often do you separate infected dressing from non-infected dressing?				
323	How often do you wear face mask during cleaning surgical wound and change dressings?				
324	How often do you perform cleaning and disinfect surface of the dressing trolley with anti-septic solutions?				
325	How often do you discard the soiled materials in the proper place after performing wound dressing?				
326	How do you rate the overall level of your current practice regarding prevention of surgical site infection? Encircle your choice. 1. Very unsatisfactory 2. Unsatisfactory 3. Satisfactory 4. Very satisfactory				
327	If you are not very satisfied with your practice, what are the reasons? Note: More than one answer is possible. Encircle your choice. 1. I have no sufficient knowledge about surgical site infection prevention 2. Inadequate resources to implement surgical safety checklists in the hospital 3. Insufficient performance monitoring systems related to surgical site infection prevention 4. Lack of surgical site infection assessment and preventive measure feedback systems 1. Others: _____ _____				

Annex III: Declaration Sheet

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every effort has been made to avoid plagiarism in the preparation of this thesis.

This thesis is submitted in partial fulfillment of the requirement for a graduate degree from the Addis Ababa University at College of Health Sciences, School of Nursing and Midwifery. The thesis is deposited in the Addis Ababa University Digital Library and is made available to local, national and international scientific community. I solemnly declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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