ECRONICON OPEN ACCESS

EC NURSING AND HEALTHCARE
Research Article

Prevalence of Surgical Site Infection and Associated Factors among Patients Undergone Surgery, North West Ethiopia: Facility Based Cross Sectional Study

Achashman Tafere[1], Saleamlak Adbaru Yalew[2], Getnet Tesfaw Admassu[3]*, Kassaw Wubneh Zerihun[4], Gashew Mekete[4], Bayileyegni Mulat[4] and Yalew Ebabu Necho[4]

[1]GT Health Science, Businesses and Technology College, Gondar, Ethiopia

[2]Department of Health Informatics, Debre-Tabor Health Science College, Debre-Tabor, Ethiopia

[3]Department of Environmental Health, Debre-Tabor Health Science College, Debre-Tabor, Ethiopia

[4]Department of Nursing, Debre-Tabor Health Science College, Debre-Tabor, Ethiopia

***Corresponding Author:** Getnet Tesfaw Admassu, Department of Environmental Health, Debre-Tabor Health Science College, Debre-Tabor, Ethiopia.

Received: October 19, 2022; **Published:** October 24, 2022

Abstract

Introduction: Surgical Site Infection (SSI) is directly related to surgical procedures and is now one of the most important health care problems among the healthcare-associated infections.

Objective: The aim of this study was to assess the prevalence of surgical site infection and associated factors among patients under taken surgery at Koladiba Primary Hospital, Northwest Ethiopia.

Methods: Institutional-based cross-sectional study was conducted from May 17, 2022 to June 29, 2022. Data was collected from 197 recruited who was follow at surgical referral clinic through chart review and face to face interview using structured questionnaire. Study participants were selected by systematic sampling method. Data was entered using EPi Info and analysed by SPSS version 20. Bivariate and multivariate regression analysis was done to identify factors associated with Surgical Site Infection.

Result: The prevalence of surgical site infection was 9.6% (95%CI: 6.9 - 12.5). According to the current finding the mean (SD) duration of surgery was 2.4081 ± 1.89813 hours and Also patients who have history of history of TB were 1.2 times higher risk than those who have history of TB [AOR: 1.2 (0.56 - 8.5)]. But patients who have wound care practice reduce the risk of surgical site of infection by 60% compared with patients whose wound do not get adequate care [AOR: 0.4 (0.1 - 0.9)] were positively and negatively associated with prevalence of surgical sister infection.

Conclusion: The current study finding 9.3% revealed that lower compared to similar studies from Ethiopia and Africa but higher compared with the study findings from developed world. So, awareness by disseminating accurate and detailed information about surgical sit infection is crucial.

Keyword: *Infection; Operation; Surgical Site; Koladiba Primary Hospital*

Abbreviations

HAIs: Healthcare-Associated Infections; SSI: Surgical Site Infection; NNISS: National Nosocomial Infection Surveillance System; ASA: American Society of Anesthesiologists; NHSN: National Healthcare Safety Network; DM: Diabetes Mellitus; HIV: Human Immunodeficiency Virus; TB: Tuberculosis; PPH: Postpartum Hemorrhage; WHO: World Health Organization; USA: United States of America

Background

Healthcare-Associated Infections (HAIs) is a subject of great concern of the healthcare services. Among the features of the HAIs, Surgical Site Infection (SSI) is directly related to surgical procedures and is now one of the most significant among the HAIs [1-3].

SSI leads to serious consequences, including increased costs due to its treatment [7] and increased length of hospital stay [7,8]. The risk of death in patients with SSI is increased when compared to those who did not develop an infection [8].

Several risk factors are known in the literature as predisposing to SSI and make up the surgical infection risk index of the National Nosocomial Infection Surveillance System (NNIS) [9], such as the American Society of Anesthesiologists (ASA) index, which classifies patients according to their clinical condition [9]; the Wound class, which represents the classification of the surgical wound by the surgical team in terms of the potential presence of microorganisms [9] and the Duration of Surgery [10].

Surgical site infection (SSI) refers to infections that take place within 30 days of an operative procedure and may extend to more than 30 days according to the surgical procedure [14]. One of the common problems in a hospital setting, reports from the World Health Organization in 2009, 23% of surgical patients worldwide developed SSIs [15].

In a study of the National Healthcare Safety Network (NHSN) involving information of 850,000 general surgeries performed in the United States, it was found an overall incidence of SSI equal to 1.9% [2]. In Brazil, data on the incidence of SSI in general and specific surgeries vary from 1.4% to 38.8 [13,19]. It is important to note that, of these studies, only two refer to data from general surgeries [11,19].

Although high incidence of SSI is suspected in Ethiopia, the magnitude of the problem is not known, especially for obstetrics. However, the overall SSI rate was reported to be 21% in general surgical wards of teaching hospitals [20].

Different studies have shown that the most common causes of SSIs relate to inadequate supplies of personal protective equipment, a lack of training on infection control measures, an absence of hospital policy on infection control, and inadequate hand washing practices [8,21]. Infections might also be related to direct contact between a patient and an inanimate object without proper hand washing or using appropriate antisepsis. Excessive nursing workload is an additional factor of SSIs [8,21].

According to a 2014 WHO report, the estimated prevalence rate of SSIs within the past two decades ranges to 19.6% in Europe and 20% in the United States of America (USA). Similarly, in Africa, the incidence rate of SSIs is reported ranging from 12% in Algeria to 31% in Nigeria [23]. The rate of SSIs is declining in developed countries. In the USA, a more 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 [24].

The prevalence rate of SSI also significantly varies from region to region and country to country [24]. A systematic review in Iran has reported that SSIs were the third most frequent hospital-acquired infections with an estimated prevalence rate of 4.7 - 25% in patients undergoing elective colorectal surgeries in various countries [25].

A study in Cameron has revealed that the prevalence rate of SSI was around 9.2% on a study conducted in three hospitals in the country in patients who undergo different types of surgeries in these settings [26].

Ethiopia shares the burden of SSIs and the infection rate is reported ranging from 10.9%, in Bahir Dar to 19.1% in Hawassa respectively [27,28]. Another study among patients with clinical signs of post-surgical wound infection in Ethiopia has revealed that the prevalence rate of culture-confirmed SSI was 75% and isolated bacteria's have shown multi-drug resistance to the antibiotics in the hospital in 82.9% of the patients with SSI [29]. Another study conducted in Bahir Dar private and public hospitals report the prevalence of SSI 9.9% (6.5%in private and 13.4%in public hospital) [30].

The importance of SSIs prevention policy has been recognized in Ethiopia. Various primary studies in Ethiopia show the extent of SSIs as a health issue in the region. However, incidence rates are inconclusive.

Aim of the Study

This study aims to determine the prevalence of SSI and the associated factors in the study.

Methods

Study design and setting

Facility based cross-sectional study design was employed to assess the prevalence of surgical site infection and associated factors among patients underweight surgery at Koladiba Primary Hospital, Northwest Ethiopia. The study was conducted from May 17, 2022 to June 29, 2022.

Koladiba primary hospital designed to serve more than 860000 people of Dembya and the surrounding worda. The hospital has 2 general wards, 6 OPDs, and other service areas.

All post-operative patients' follow-ups at Koladiba primary Hospital were considered as source population for the study and all post-operative patients' who undergone surgery at Koladiba primary Hospital from May 17 to June 2, 2022 were considered a study population.

Sample size and sampling procedure

The sample size was determined using the single population proportion formula. It was computed by considering the previous study has demonstrate that, so simply take 13.4% (30) and 95% confidence level, and 5% margin of error. The largest sample size was considered (n = 197). And each study participant was selected by systematic random sampling method from post-operative patients' who undergone surgery at Koladiba primary Hospital during the study period.

Operational definitions

- **Clean wound**: Defined as an uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital or uninfected urinary tracts are not entered.
- **Surgical site infection:** Is classified as superficial, deep and organ/space infection which occurs within 30 days after the operation.
- **Superficial SSI:** Is infection which involves only skin and subcutaneous tissue of the incision and at least one of: Purulent drainage with or without laboratory confirmation, Organism isolated from superficial incision, Presence of sign and symptoms of infection at the site, Diagnosis of SSI by physician/surgeon.
- **Deep incisional SSI:** is infection involving deep soft tissues (e.g. fascial and muscle layers) of the incision.

Study variables

The dependent variable is prevalence of surgical site infection.

And the independent variables are:

- Sociodemographic variables like age, sex, ethnicity, religion, etc.
- Surgical related factors like the previous surgical history, duration of surgery, types of surgery, etc.
- Medication related factors like the type of anesthesia, duration of anesthesia time and Antibiotic prophylaxis.
- Clinical related factors like history of DM, HIV, TB, etc.

Data collection

Data was collected using structured questionnaire. Two experienced data collectors and one supervisor were assigned during filed survey. Training was given to both data collectors and the supervisor. Data was obtained on surgical site infection status, socio-demographic characteristics, surgical related, medication related, and clinical factors by interview and patient medical records and surgeon operation and anesthesia notes chart review as appropriate.

Study instruments

The data collection tool was first prepared in English and translated to the local language, Amharic and back translated to English by language expert to cheek for consistency. Pre-test was done on 5% of the respondents prior to the actual data collection period at another health center, which was not selected for the study. Revision was done on questions. Training was given for both data collectors and supervisor on the data collections tools and procedures. Daily supervision was done by the supervisor and principal investigator. The study was permitted by GT Health Science, Business and Technology College ethical review board.

Data was cleaned for completeness and consistencies, coded and entered in Epi info version 3.5.3 and transported to SPSS version 20 for analysis. The results were organized and summarized using appropriate descriptive measures such as text, tables, graphs, frequencies and percentage. Associations between the outcome and independent variables were assessed by using odds ratio with 95% confidence interval. Bivariate logistic regression was used to screen variables that had significant association with the outcome variable and variables with P-value < = 0.2 was considered significant. Variables considered significant were entered in to multivariate logistic regression to assess the independent predictor of long-acting family planning methods. P-value less than or equal to 0.05 was considered as there was significant association between the independent and outcome variables.

Results

Sociodemographic characteristics of the study participants

From the current study 197 patients were enrolled and all questionnaires were returned with 100% of response rate. The mean (SD) age and duration of smoking were 30.2437 ± 18.89934 years 30.2437 ± 18.89934 years respectively. Among the overall study participants more than half (50.8%) and 53.8% (106) were females and aged < 30 years respectively.

Also 55.3% (109) and 66% (130) of the study participants live in rural areas and orthodox by their religion. Whereas majority of the study participants (79.7%) and more than two third (60.4%) Amhara by their ethnicity and having primary school educational status.

Majority of the study participants (69%) and about 20.3% (40) engaged with marital status and governmental employee by their occupational stratus respectively. Of the total study participants 4.1% (8) had have a habits of smoking cigarettes with 3% (6) and 1% (2) with duration of smoking cigarettes (in years) < 10 and >=10 years respectively.

Concerning alcohol drinking 45.2% (89) drinking alcohol typically Tella (17.8%) Areki (14.2%), advanced alcohol (Birr, woyin/wuski) (10.7%) and others (2.5%) respectively.

Variables	Frequency	Percent (%)
Sex		
Male	97	49.2
Female	100	50.8
Age (in years)		
< 30	106	53.8
>=30	91	46.2
Address		
Urban	88	44.7
Rural	109	55.3
Religion		
Orthodox	130	66.0
Muslim	45	22.8
Protestant	14	7.1
Catholic	8	4.1
Ethnicity		
Amhara	157	79.7
Oromo	2	1.0
Tigray	12	6.1
Other	26	13.2
Educational status		
No education	13	6.6
Primary	119	60.4
Secondary	36	18.3
Above collage	29	14.7
Marital status		
Single	28	14.2
Married	136	69.0
Separated	20	10.2
Widowed	6	3.0
Divorced	7	3.6
Occupation		
Unemployment	26	13.2
Daily laborer	9	4.6
Governmental	40	20.3
Private employed	40	20.3
Self employed	11	5.6
Farmer	33	16.8
Commercial sex worker	5	2.5
Merchant	23	11.7
Housewife	10	5.1

Table 1: *Sociodemographic characteristics of the respondents among patients undergone surgery at Koladiba Primary Hospital, 2022 (n = 197).*

Prevalence and surgical related factors of the respondents

Among the study participants undergoing surgery about 9.6% (95%CI: 6.9 - 12.5) of surgical patients in Koladiba Primary Hospital was presented with surgical site infection. According to the current finding the mean (SD) duration of surgery was and the mean (SD) amounts of blood loss (in ml) was 2.4081 ± 1.89813 hours and 2.0211 ± 1.10109 ml respectively.

Among the involved study participants 28.9% (57) of patients have previous surgical history and less than one third of the patient (26.9%) and 20.8% of patients have, 3hrs duration of surgery and have < 2 liters of blood loss (in ml) respectively.

Among patients having surgery 17.3% (34) and 11.7% (23) of patients under went electives and emergency surgery from abdomen (16.2%), thoracic (1%), extremity (1.5%) and C/S (10.2%) respectively.

Variables	Frequency	Percent (%)
Do you have previous surgical history		
Yes	57	28.9
No	140	71.1
Duration of surgery (in Hrs)		
< 3	53	26.9
>=3	4	2.0
Amounts of blood loss (in Liters)		
< 2	41	20.8
>=2	16	8.2
Type of surgery		
Electives	34	17.3
Emergency	23	11.7
Type of surgical procedure		
Abdominal	32	16.2
Thoracic	2	1.0
Extremity	3	1.5
Cesarean section	20	10.2

Table 2: *Prevalence and surgical related factors of respondents among patients undergone surgery at Koladiba Primary Hospital, 2022 (n = 197).*

Medication related factors of the respondents.

Among 57 patients undergone surgery 17.3% (34), 1.5% (3) and 10.2% were having spinal, local and general anesthesia respectively. Regarding duration of anesthesia the mean duration of anesthesia was 2.0211 ± 1.10109 hours and 18.8% (37) and 10.2% (20) lasts < 4 and >= 4 hours for anesthesia respectively.

Whereas 21.3% (42) and 7.6% (15) of surgical patent took antibiotic prophylaxis for prevention of infection (Table 3).

Variables	Frequency	Percent (%)
Type of anesthesia		
Spinal	34	17.3
Local	3	1.5
General	20	10.2
Duration of anesthesia time		
<4	37	18.8
>=4	20	10.2
Antibiotic prophylaxis is given		
Yes	42	21.3
No	15	7.6

Table 3: *Medication related factors among patients undergone surgery at Koladiba primary hospital, 2022 (n = 197).*

Clinical related factors of the respondents

Concerning clinical factors which facilitate and promote the spread of surgical site of infection less than one tenth (9.1%) of the study participants have history of DM followed by have history of HIV (12.2%). Few of the study participants (1%) and 3.6% (9) also have history of TB and malignancy respectively.

Among patients having surgery 20.3% (40) of wound care is performed with frequency of daily (10.7%), two times daily (3.6%) and 6.1% (12) every other day respectively. Similarly, 9.6% (19) and 19.3% (38) of patients also belongs to clean and contaminated type of wound respectively.

Variables	Frequency	Percent (%)
Do you have history of Malignancy		
Yes	2	1.0
No	195	99.0
Wound care is performed		
Yes	40	20.3
No	157	79.7
How frequently		
Daily	21	10.7
Two times daily	7	3.6
Every other day	12	6.1
Type of wound		
Clean	19	9.6
Contaminated	38	19.3

Table 4*: Clinical related factors among patients undergone surgery at Koladiba primary hospital, 2022 (n = 197).*

Factors associated with prevalence of surgical site infection

Factors associated with prevalence of malnutrition was identified and the variables with p-value of 0.20 and less would fit to logistic model for multivariable analysis to determine relative prediction level of independent variables to the outcome variable.

P-value less than 0.05 with 95% confidence interval had been considered as statistically significant and Model goodness-of-fit would be checked by Hosmer Lemeshow test, shows the model fitness was 78.2% at multivariable analysis, it indicates the model fitness was good.

After analysis by enter method those candidate/eligible variables were analyze by forward conditional method. Variables such as sex of the child study participants who live in rural areas, history of drinking alcohol history of DM and history of malignancy eliminated by the final stage of multivariable analysis.

Variables that had p-value less than 0.2 such as age of the study participants < 30 years [AOR: 3.2 (1.6 - 20.8)], history of smoking [AOR: 2.6 (1.6 - 11.8)], history of history of TB [AOR: 1.2 (0.56 - 8.5)] and wound care practice [AOR: 0.4 (0.1 - 0.9)] were positively and negatively associated with prevalence of surgical sister infection.

Age of the study participants < 30 years were 3.2 times exposed for surgical site infection than study participants whose age >= 30 [AOR: 3.2 (1.6 - 20.8)]. Similarly study participants who have history of smoking was also 2.6 times risk for the prevalence of surgical site infection [AOR: 2.6 (1.6 - 11.8)]. Also, patients who have history of history of TB were 1.2 times higher risk than those who have history of TB [AOR: 1.2 (0.56 - 8.5)]. But patients who have wound care practice reduce the risk of surgical site of infection by 60% compared with patients whose wound do not get adequate care [AOR: 0.4 (0.1 - 0.9)] were positively and negatively associated with prevalence of surgical sister infection.

Variables	Surgical site infection		COR (95% CI)	AOR (95% CI)
	Yes	No		
Age (in years)				
<30	12	94	5.1 (1.02 - 22.4)	3.2 (1.6 - 20.8)**
>=30	6	85	1.00	1.00
Sex of the child				
Male	7	90	2.8 (1.7 - 5.88)	2.2 (0.8 - 9.66)
Female	12	88	1.00	1.00
Address				
Urban	8	80	0.76 (0.22 - 0.86)	1.5 (0.93 - 13.4)
Rural	11	98	1.00	1.00
Smoking cigarettes				
Yes	5	3	3.6 (1.6 - 9.72)	2.6 (1.6 - 11.8)**
No	14	175	1.00	1.00
Drinking alcohol				
Yes	9	80	1.65 (1.9 - 16.00)	1.4 (0.9 - 12.6)
No	10	98	1.00	1.00
History of DM				
Yes	2	16	1.55 (1.1 - 12.89)	1.3 (0.87 - 13)
No	17	162	1.00	1.00
History of TB				
Yes	3	6	1.3 (1.2 - 12.0)	1.2 (0.56 - 8.5)
No	16	172	1.00	1.00
Wound care is performed				
Yes	12	28	0.5 (0.2 - 0.5)	0.4 (0.1 - 0.9)**
No	7	150	1.00	1.00
History of Malignancy				
Yes	1	1	1.2 (1.5 - 16.0)	1.1 (0.5 - 13.0)
No	18	177	1.00	1.00

Table 5: *Factors associated with prevalence surgical site infection among patients undergone surgery at Koladiba primary hospital, 2022 (n = 197).*

Discussion

This institutional based cross-sectional study was attempted to assess the prevalence of surgical site infection and associated factors among patients underweight surgery at Koladiba primary hospital, Northwest Ethiopia.

The study showed that the prevalence of surgical site infection was 9.6% (95%CI: 6.9 - 12.5). It was in line from similar study conducted in Bahir Dar private hospital but lower than public hospitals report the prevalence of 9.9 in private [30]. But lower compared with similar study finding in Ethiopia with infection rate reported ranging from 10.9%, in Bahirdar to 19.1% in Hawassa respectively [27,28].

However the prevalence of SSI from the current study was extremely lower compared another study conducted among post-surgical wound at (75%) and isolated bacteria's have shown multi-drug resistance to the antibiotics in the hospital in 82.9% of the patients with SSI [29].

The study finding also in line with the range of similar study finding obtained with a systematic review in Iran has reported that SSIs were the third most frequent hospital-acquired infections with an estimated prevalence rate of 4.7 - 25% in patients undergoing elective colorectal surgeries in various countries [25].

Despite similarities between the study conducted the current study and the study between Cameroon, however in line with according to a 2014 WHO report, the estimated prevalence rate of SSIs within the past two decades ranges to 19.6% in Europe and 20% in the United States of America (USA) and higher compared with the study conducted in Africa, the incidence rate of SSIs is reported ranging from 12% in Algeria but lower Nigeria (31%) [23].

All the lower and higher prevalence durance between the studies could be due to differences in study period, sampling technique, availability of infection prevention practice and the knowledge and skill of the surgeon determines the difference in prevalence of surgical site infection.

Though the current study lower and inline compared with similar studies in Ethiopia and Africa. But it was extremely lower compared with the study conducted middle-income countries at up to 60% of SSIs have been estimated to be preventable by using evidence-based guidelines [4].

Like developing countries still in developed countries such as the study conducted in Brazil, at prevalence of surgical site infection (22%) was higher compared with the current study [4]. And also the finding of the current study lower than the report finding on surgical site infection from the World Health Organization in 2009 at 23% [2].

Higher infection rates recorded among patients from the current study may be due to underdeveloped immune system in the children and weakened immune system coupled with presence of other comorbid conditions in the elderly and also the abundant of resistant surgical site isolates observed in this study maybe as a result of indiscriminate use of antibiotics in the hospital.

Concerning clinical factors which facilitate and promote the spread of surgical site of infection less than one tenth (9.1%) of the study participants have history of DM followed by have history of HIV (12.2%). Few of the study participants (1%) and 3.6% also have history of TB and malignancy respectively. Among patients having surgery 20.3% of wound care is performed with frequency of daily (10.7%), two times daily (3.6%) and 6.1% [12] every other day respectively. Similarly, 9.6% and 19.3% of patients also belongs to clean and contaminated type of wound respectively.

Regarding factorials analysis variables such as age of the study participants < 30 years, history of smoking, history of history of TB and wound care practice [AOR: 0.4 (0.1 - 0.9)] were positively and negatively associated with prevalence of surgical sister infection. The study finding was supported by the study finding from Ethiopia, Africa and developed word [26,30,39].

Significance of the Study

Despite improvements in operating room practices, instrument sterilization methods, better surgical technique, and the best efforts of infection prevention strategies, surgical site infections remain a major cause of hospital acquired infections. In addition, Postpartum hemorrhage (PPH) is the leading cause of maternal mortality. All women who carry a pregnancy beyond 20 weeks' gestation are at risk for PPH and its sequelae. Although maternal mortality rates have declined greatly in the developed world, PPH remains a leading cause of maternal mortality elsewhere.

The importance of SSIs prevention policy has been recognized in Ethiopia. International and Ethiopian studies show the extent of SSIs as a health issue in the region. However, incidence rates are inconclusive. Therefore, this study aims to determine the prevalence of SSI and its associated factors.

Limitation of the Study

Anaerobic bacteria profile and fungal cultures were not done on the wound swabs obtained from surgical sit infections.

The study conducted based on cross sectional study design which has chickened egg dilemma that becomes difficult to determine be the true causal relationship.

Conclusion

The current study finding at 9.3% revealed that lower compared similar finding from Ethiopia and Africa but higher compared with the study findings from developed world such as Brazil. As a result, to establish the most suitable empirical treatment for each patient, it is very important to know the microbial epidemiology of each institution. The information obtained from this study allows a better understanding of the microbial etiology of SSIs in hospital which may have epidemiological and therapeutic implications.

The study also showed that factors such as smoking cigarette, history of DM, history of TB and history of malignancy were the major contributing factors for the occurrence of surgical site infection.

Moreover, administration of surgical antimicrobial prophylaxis for more than 24 hours was not protective for SSIs. Examining and identifying high risk patients and accordingly taking all appropriate care should be done to decrease the risk of SSIs. Prolonged administration of surgical antimicrobial prophylaxis should be avoided because antimicrobial resistance is one of global threat, which results partly due to unnecessary prolonged administration. In addition, periodic surveillance on incidence rate and predictors of SSI will further decrease the incidence rate and also further researches with long study period and with large sample size should be done to get overall predictors of SSI.

Competing Interests

The authors have declared that no competing of interests exists.

Ethics Approval and Consent to Participate

Ethical clearance and approval were obtained from institutional review board of GT Health Science, Business and Technology College. Official permission letter was obtained from Koladiba Primary Hospital which is the data collection institution.

Informed verbal consent was obtained from each study participant after they were informed about the aim of the research. Individual participant records were coded on each respective questionnaire and accessed only by research team members. Confidentiality was maintained at all levels of the study.

Consent for Publication

No applicable.

Availability of Data and Material

The data are available at hand.

Funding Support

There is no funding.

Authors' Contributions

Achasman Tafere is designed the study, participated in the data collection, performed analysis and interpretation of data and drafted the paper and prepared the manuscript. Saleamlak Adibaru, Getnet Tesfaw, and Kassaw Wubneh assisted with the design, approved the proposal, revised drafts of the paper, prepared and revised the manuscript.

All authors read and approved the manuscript and agreed on which journal to submit the publication.

Acknowledgments

We are highly indebted to GT Health Science, Businesses and Technology College Department of Nursing, for sponsoring this research project. We would like to extend our thanks to Koladiba Primary Hospital for permitting to conduct the study and providing the necessary preliminary information while conducting this study.

We would also like to extend our appreciation to the study participants, supervisors and data collectors.

Bibliography

1. Who Global Guidelines for The Prevention of Surgical Site Infection: A New Step to Improve Patients 'safety Before, During and After Surgery (2017).
2. Shiferaw WS., *et al*. "Surgical site infection and its associated factors in Ethiopia: a systematic review and meta-analysis". *BMC Surgery* 20.1 (2020): 1-15.
3. Altemeier W. "Sepsis in surgery: Presidential address". *Archives of Surgery* 117.2 (1982): 107-112.
4. Ercole FF., *et al*. "Risk of surgical site infection in patients undergoing orthopedic surgery". *Revista Latino-Americana De Enfermagem* 19 (2011): 1362-1368.
5. Korol E., *et al*. "A systematic review of risk factors associated with surgical site infections among surgical patients". *PloS One* 8.12 (2013): e83743.

6. Anderson DJ., *et al*. "Strategies to prevent surgical site infections in acute care hospitals: 2014 update". *Infection Control and Hospital Epidemiology* 35.6 (2014): 605-627.

7. Danzmann L., *et al*. "Health care workers causing large nosocomial outbreaks: a systematic review". *BMC Infectious Diseases* 13.1 (2013): 1-8.

8. Ott E., *et al*. "The prevalence of nosocomial and community acquired infections in a university hospital: an observational study". *Deutsches Ärzteblatt International* 110.31-32 (2013): 533.

9. Organization WH. Global guidelines for the prevention of surgical site infection: World Health Organization (2016).

10. NWOSE PC. "A prospective study of the incidence of surgical wound infection at the Nnamdi Azikiwe University Teaching Hospital, NNEWI". Faculty of Surgery (2006).

11. Nobandegani Zinat M., *et al*. "Surgical site infection incidence after a clean-contaminated surgery in Yasuj Shahid Beheshti hospital, Iran". *Investigación y Educación en Enfermería* 29.3 (2011): 435-441.

12. Lubega A., *et al*. "Incidence and etiology of surgical site infections among emergency postoperative patients in mbarara regional referral hospital, South Western Uganda". *Surgery Research and Practice* (2017).

13. Mulu W., *et al*. "Associated risk factors for postoperative nosocomial infections among patients admitted at Felege Hiwot Referral Hospital, Bahir Dar, Northwest Ethiopia". *Clinical Medicine and Research* 2.6 (2013): 140-147.

14. Fisha K., *et al*. "The prevalence and root causes of surgical site infections in public versus private hospitals in Ethiopia:a retrospective observational cohort study". *Patient Safety in Surgery* 13.1 (2019): 1-9.

15. Weldu MG., *et al*. "Magnitude and determinant factors of surgical site infection in Suhul hospital Tigrai, northern Ethiopia: a cross-sectional study". *Surgical Infections* 19.7 (2018): 684-690.

16. Mawalla B., *et al*. "Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern Tanzania". *BMC Surgery* 11.1 (2011): 1-7.

17. Legesse Laloto T., *et al*. "Incidence and predictors of surgical site infection in Ethiopia: prospective cohort". *BMC Infectious Diseases* 17.1 (2017): 1-9.

18. Yaouba D., *et al*. "Incidence and risk factors for surgical site infections in N'Gaoundéré regional hospital, Cameroon". *American Journal of Infection Control* 44.10 (2016): 1195-1196.

19. Kefale B., *et al*. "Surgical site infections and prophylaxis antibiotic use in the surgical ward of public hospital in Western Ethiopia: A hospital-based retrospective cross-sectional study". *Infection and Drug Resistance* 13 (2020): 3627.

20. Kitembo S and Chugulu S. "Incidence of surgical site infections and microbial pattern at kilimanjaro christian medical centre*". Annals of African Surgery* 10.1 (2013).

21. Korol E., *et al*. "A systematic review of risk factors associated with surgical site infections among surgical patients". *PloS One* 8.122 (2013): e83743.

22. Anderson DJ., *et al*. "Strategies to prevent surgical site infections in acute care hospitals: 2014 update". *Infection Control and Hospital Epidemiology* 35.6 (2014): 605-627.

23. Danzmann L., *et al*. "Health care workers causing large nosocomial outbreaks: a systematic review". *BMC Infectious Diseases* 13.1 (2013): 1-8.

24. Ott E., *et al*. "The prevalence of nosocomial and community acquired infections in a university hospital: an observational study". *Deutsches Ärzteblatt International* 110.31-32 (2013): 533.

25. Organization WH. Global guidelines for the prevention of surgical site infection: World Health Organization (2016).

26. NWOSE PC. "A prospective study of the incidence of surgical wound infection at the Nnamdi Azikiwe University Teaching Hospital, NNEWI". *Faculty of SURGERY* (2006).

27. Nobandegani Zinat M., *et al*. "Surgical site infection incidence after a clean-contaminated surgery in Yasuj Shahid Beheshti hospital, Iran". *Investigación y Educación en Enfermería* 29.3 (2011): 435-441.

28. Lubega A., *et al*. "Incidence and etiology of surgical site infections among emergency postoperative patients in mbarara regional referral hospital, South Western Uganda". *Surgery Research and Practice* (2017).

29. Mulu W., *et al*. "Associated risk factors for postoperative nosocomial infections among patients admitted at Felege Hiwot Referral Hospital, Bahir Dar, Northwest Ethiopia". *Clinical Medicine and Research* 2.6 (2013): 140-147.

30. Fisha K., *et al*. "The prevalence and root causes of surgical site infections in public versus private hospitals in Ethiopia: a retrospective observational cohort study". *Patient Safety in Surgery* 13.1 (2019): 1-9.

Volume 4 Issue 12 December 2022