THE RATE OF SURGICAL SITE INFECTION AND ASSOCIATED FACTORS AMONG SURGICAL PATIENTS ADMITTED TO POST-OPERATIVE WARD OF ATTAT HOSPITAL, SOUTH ETHIOPIA, FROM JANUARY 1 TO AUGUST 30, 2018.

BY MARKOS BITANA (BSc)

A RESEARCH THESIS TO BE SUBMITTED TO JIMMA UNIVERSITY INSTITUTE OF HEALTH, RESEARCH AND POST-GRADUATE COORDINATING OFFICE, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN INTEGRATED EMERGENCY OBSTETRICS AND GYNECOLOGY AND GENERAL SURGERY.

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Abstract

Back ground: surgical site infection is the first leading infection among common nosocomial infection bearing significant burden among hospitalized patients. Despite it imposes significant burden on clinical care through increasing morbidity and mortality of patients. Moreover found to have significant economic burden in health care settings via prolonged hospitalization secondary to surgical site infection. Though multiple studies identified various factors such as type of operation , antimicrobial prophylaxis ,patients related factors as predictors ,nothing have been observed to be done particularly in developing setups to pave its burden . Thus we found so curious to conduct this study to determine rate of surgical site infection and associated factors among postoperative patients in our setup.

Objective: This study aimed at determining rate of surgical site infection and associated factors among postoperative patients at Attat Hospital, southwest Ethiopia from February1 to August 30, 2018 .

Method & Result: A cross sectional observational study was conducted recruiting consecutively among 121 postoperative patients admitted during study period at Attat Hospital ,southwest Ethiopia . Female respondents account for three quarter of the enrolments and the mean age of respondents were 29.59 ± 10.1(SD) in age range of [18-60]in years. Emergency cases , accounts for 79.3% while the rest were elective. Major surgery, accounting for about 81% of total. It was also revealed that about 16.5% were found to have predisposing factor for infection. Cesarean section reported in 56.2%.rate of SSI was revealed to be 35%, over half (56%) of respondents whom found to develop surgical site infections and organ space reported in about 20% of cases diagnosed with surgical site infection. Though multiple patients related and procedure related variable found as risk factors in our study about five variable was observed as a predictor for surgical site infection. Preoperative hospital stay longer than 24hoursAOR 14.110(1.264;157.42), Laparotomy procedure AOR 30.774(2.057;460.286). Presence of infection predisposing factor AOR38.932(4.015;377.481), not following protocol for standard care bundle for surgical site infection prevention on antibiotics AOR 4.542(1.330;15.514),not following protocol for standard care bundle for surgical site infection prevention on antiseptics AOR3.402(1.036;11.172).

Conclusion: surgical site infection was revealed to be prevalent among our sample accounting for 35%. Preoperative hospital stay longer than 24 hour, Laparotomy procedure, Presence of infection predisposing factor, not following protocol for standard care bundle for surgical site infection prevention on antibiotics, not following protocol for standard care bundle for surgical site infection prevention on antiseptics were identified in our study as significant predictors for surgical site infection. It was found wrathful if we stick to per protocol meeting minimum standards and considering patients perspective in basing surgical care decision to be comprehensive via which reducing morbidity and mortality imposed by surgical site infection.

Key-Words:- **Surgical Site Infection, Incidence Rate, Risk Factors, Wound type.**

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Tables and figures

Acronyms &Abbreviations

ASA: American Society of Anesthesiologist

ASC: Active Surveillance Culture

AST: Active Surveillance Testing

CBE: Capacity Building &Education office

CDC: Communicable Disease Control Authority

HAI: Hospital Acquired Infections

OR: Odds Ratio

WHO: World Health Organization.

NNIS: National Nosocomial Infection Surveillance

NPO: Nothing per-OS

Chapter one

1. Introduction

1.1. Background

Surgical site infections (SSIs) represent the second major cause of increased hospital stay and mortality (1) .They are potential complications associated with any type of surgical procedure.

Although there are global variations around the definition of SSI ,SSIs are defined and reported according to Centers for Disease Control and Prevention (CDC) criteria(2). SSIs are classified as either incisional (superficial or deep) &/or organ/space. Incisional SSIs are further divided into superficial incisional SSI (skin or subcutaneous tissue) and deep incisional SSI (deeper soft tissues of the incision). Organ/ space SSIs involve any anatomic site other than the incised areas (eg, meningitis after brain tumor removal). An infection is considered as an SSI if any of the above criteria is met and the infection occurs within 30 days of the operation. If a prosthetic is implanted during the operation, the timeline extends out to 1 year(2).

According to CDC standardized definition of SSIs requires the presence of purulent drainage; spontaneous drainage of fluid from the wound regardless of whether it is culture positive for bacteria; OR localized signs of infection for superficial sites or radiological evidence of infection for deep sites; OR an abscess or other type of infection on direct surgical exploration; or a diagnosis of an infection by a surgeon. SSIs are categorized based on tissue layer they affect into superficial, deep, and organ/space infections. Superficial infections involve the skin or subcutaneous(3).

The National Research Council, USA developed a system for categorizing incisions based on the degree of contamination of the incision. The original classification was based on 4 categories: clean, clean-contaminated, contaminated, and dirty; but the contaminated and dirty were later amalgamated(4).

Globally, SSIs rates have been reported to range from 2.5% to 41.9% with higher rates in developing countries. Besides, the surgical mortality in developing nations is 10 times higher

than developed countries and deaths attributed to anesthesia are 1000-fold higher(5). In a recent meta-analysis report of 220 international studies investigating SSIs rates in developing countries, the cumulative incidence ranged from 0.4 to 30.9 per 100 patients and from 1.2 to 23.6 per 100 surgical procedures, while the pooled cumulative incidence was 11.8 per 100 patients(6).

Surgical safety in low- and middle-income countries (LMICs) is a major, but poorly recognized public health issue with postoperative infections responsible for a large burden of morbidity and death(6). Surgical site infections (SSIs) are the most common contributor of hospital-acquired infections (HAIs) in sub-Saharan Africa, with affected patients having a two-fold increase in death and a five-fold increase in readmission after discharge(7).

Although SSIs are among the most preventable HAI (Hospital Acquired Infections), they still represent a significant burden in terms of patient morbidity and mortality and additional costs to health systems and service payers worldwide. SSI is both the most frequently studied and the leading HAI reported hospital-wide in LMICs (low& middle income countries) (8).For these reasons, the prevention of SSI has received considerable attention from surgeons and infection control professionals, health care authorities, the media and the public. In particular, there is a perception among the public that an SSIs may reflect a poor quality of care. Thus the aim of this study will be to assess rate of surgical site infection and associated factor among patients admitted to post-operative ward at Attat Hospital south Ethiopia.

1.2. Statement of the problem

Surgical site infections are now the most common and costly of all hospital-acquired infections, accounting for 20% of all hospital-acquired infections. They were associated with increased length of stay and a 2- to 11-fold increase in the risk of mortality(4).

Numerous risk factors such as intrinsic (patient) factors that are modifiable or non- modifiable, as well as extrinsic (e.g. procedure, facility, preoperative, and operative) factors have been identified for the development of SSIs after surgery. Potentially modifiable patient risk factors include glycemic control and diabetic status, dyspnea, alcohol and smoking status, preoperative albumin, obesity, and immunosuppression. Non-modifiable patient factors include increasing age, recent radiotherapy, and chronic use of steroids and history of skin or soft tissue infection(8).

On top of above risk factors many literatures identified other factors shown to have direct/indirectly related to SSI, such as Procedure-related factors include emergency and more complex surgery and wound classification. Facility risk factors include inadequate ventilation, increased operating room (OR) traffic, and an inappropriate sterilization of equipment. Preoperative risk factors include presence of a pre-existing infection; inadequate skin preparation; hair removal; and antibiotic choice, administration, and duration. Intraoperative risk factors include duration of surgery, blood transfusion, maintenance of asepsis, poor-quality surgical hand scrubbing and gloving, hypothermia, and poor glycemic control(8–10).

The objective of this study will be to obtain the incidence of SSI and determine various risks factors influencing the SSI rate. A better understanding of the risk factors associated with SSI could help reduce their occurrence by promoting effective strategies for infection prevention. So there is a great need of the studies for better understanding of the incidence and risk factors of SSI in sub-Saharan country including our country Ethiopia. Baseline information regarding SSI with feedback of appropriate data to surgeons has shown to be an important component of strategies to reduce SSI risk.

1.3. Significance of the study

Increased morbidity and mortality are associated with SSI, ranging from wound discharge associated with superficial skin infection to life-threatening conditions such as severe sepsis .The development of an SSI causes a substantial increase in the clinical and economic burden of surgery. Patients who develop an SSI constitute a financial burden approximately double that of patients who do not develop an SSI. The length of hospitalization was more than twice as long for patients with an SSI relative to uninfected patients. SSIs may therefore represent an opportunity cost to hospitals by displacing hospital resources that would otherwise be spent elsewhere, as well as delaying subsequent patients' surgery. SSIs negatively impact on patient physical and mental health. Increased patient morbidity, mortality, and loss of earnings during recovery are some of the indirect costs associated with infection. Intangible costs may also be incurred by the patient, such as pain and anxiety. In addition, patients may experience delayed wound healing and be more susceptible to secondary complications, such as bacteremia (12,13).Distress may also be caused to the patient and family members if the patient is absent from home and work for a prolonged period. Accordingly, prolonged hospitalization and increased morbidity as a result of developing an SSI have been shown to negatively impact on patient health-related quality of life.

Despite a variety of different prevention measures, as many as 5% of all patients undergoing surgery continuously develop SSI, which lead to additional morbidity and mortality. Hospitals are under pressure to reduce costs, and efforts to decrease the rate of SSI. As SSIs continue to pose challenges in healthcare management, detailed and specific identification of the factors that may place individual patients at greater risk of infection, and identification of the gaps in currently-available prevention options could help to minimize morbidity, mortality and healthcare costs associated with SSI. Thus our study finding will help to reduce overall post procedure outcome from patient perspectives through enabling health care professionals to identify those risk factors early and simplify tasks imposed to nurses as well as surgeons.

Chapter two

2. Literature review

A prospective active surveillance study done in Greece at the University Hospital of Ioannina involving 207 patients undergoing general surgery, showed that being females, an ASA score >2, increased duration (>24 hrs.) of chemoprophylaxis, and an NNIS score >1 were associated with an increased risk for SSIs(14)

A prospective bedside surveillance study conducted in china done in the Dong Guan Hospital of Traditional Chinese Medicine, recruiting about 287 orthopedic surgery cases showed that surgical site infection was reported in 2.8% of enrollments and wound contamination class, wound drains and blood transfusion were identified as a risk factor for reported incidence(15) .

Another prospective study done in china recruiting 2,809 consecutive patients undergoing elective colorectal resection via laparotomy had revealed that, The overall SSI, incisional SSI, and organ/space SSI with and without clinical anastomotic leakage rates were 4.7%, 3%, 2%, and 0.8%, respectively. ASA score 2 or 3, male gender, surgeons, types of operation, creation of ostomy, contaminated wound , use of drainage, and intra- or postoperative blood trans- fusion were identified as risk factors for SSI . However, only blood transfusion was found to be consistently associated with a risk of SSI at any specific site (16).

A non-concurrent cohort study conducted in Brazil at a large general hospital in Belo Horizonte including 16,882 information of patients undergoing general surgery showed that surgical site infection were reported in among 3.4% .in this study it was also revealed that length of preoperative hospital stay more than 24 hours; duration of surgery in hours; wound class clean-contaminated, contaminated and dirty/infected; and ASA index classified into ASA II, III and IV/V as independent predictors for surgical site infection (17).

A hospital based observational study done in India at Swami Raman and Teerth Rural Govt. Medical College, Ambajogai enrolling 30 patients scheduled for elective anterior abdominal surgical procedures for duration of 2 months showed that surgical site infection was reported in about 16.67% of respondents. In this study, patients underwent either of procedure during study period hernia and appendectomy each accounts to 66.66% & 33.33%, respectively. BMI was found to have significant association with Surgical Site Infection (18).

Another prospective observational study done in India at Punjab general surgery hospital enrolling 111 surgical patients revealed that the overall Surgical Site Infection rate was found 12.6%. In emergency surgeries, infection rate was more when compared with elective surgeries. Surgical operating procedure time, the wound class, pre-existing medical illness are predisposing factors in surgical site infection rate (19).

Another prospective longitudinal study done in Ahmadabad city at a tertiary care center enrolling 480 patients operated for general surgical procedures revealed that about 9.4% developed the SSI. Age, diabetes, type of anesthesia, type of surgery, duration of surgery, and type of wound, pre-operative hospital stay and presence of drain were found as the risk factor for development of SSI(20) .

A prospective descriptive study conducted in Kavre, Nepal in Kathmandu University Hospital involving 638 patients undergoing elective and emergency surgery on departments of General surgery, Gynecology and Obstetrics, Orthopedics and Trauma and Otorhinolaryngology and Head & Neck Surgery showed that Overall SSI rate was 2.6% while The SSI rate was 0.0% for clean wounds, 2.9%, 15.3% and 18.7% for clean-contaminated, contaminated and dirty wounds respectively. Increases in surgical wound class, National Nosocomial Infections Surveillance System risk index, American Society of Anesthesiologist score >2 and emergency surgeries were associated with increased SSI rate (21)

A prospective cross sectional study done in Karnataka at teaching hospital recruiting 418 surgeries showed that the overall infection rate was 20.09%. The SSI rate was 11.53% in clean surgeries, 23.33% in clean contaminated ones, 38.10% in contaminated ones and 57.14% in dirty surgeries. It also revealed that SSI rate increased with increasing age and it also increased significantly with the increasing duration of pre-operative hospitalization. The SSI rate was too observed to be with higher odds in emergency surgeries as compared to the elective surgeries. The infection rate was significantly higher as the order and the duration of the surgery increased(22) .

A retrospective cross-sectional study was conducted in Malaysia recruiting 400 women undergoing CS at Hospital Pulau Pinang for about 18 months showed that prevalence of surgical site infection accounts for about 18.8% of respondents higher BMI, blood loss during operation, prolonged labor, spinal anesthesia, breach baby presentation and intrathecal analgesia were revealed as independent predictors for surgical site infection (23).

A prospective cohort study done in Nigeria at operating theatres of University of Abuja Teaching Hospital (UATH), Gwagwalada recruiting 127 surgical patients , revealed that rate of surgical site infection was reported among 27.56% of enrolments. The superficial incisional site (22; 62.9%) was the most frequently infected surgical site, followed by deep incisional sites (9; 25.7%) and organ/space (4; 11.4%). Prolonged post-operative hospital stays was revealed as independent predictor for surgical site infection (24).

A prospective hospital based study conducted in Uganda enrolling 114 emergency postoperative patients at the Mbarara Regional Referral Hospital revealed that among Overall sample SSI incidence was reported in about 16.4%: 5.9% superficial and 47.1% deep and organ space SSIs each. Wound class, anemia, low serum albumin and property of suture material used were revealed as an independent predictors for surgical site infection among the sample (25).

A Hospital based prospective cross sectional study done in north Ethiopia at Ayder Teaching and Referral Hospital recruiting 128 patients who had undergone surgery in general surgery and orthopedics ward showed that surgical site wound infection was as high as 75% and multi drug resistance was seen in 82.92% of the isolates leaving clinicians with few choices of drugs for the treatment of post-surgical wound infected patients. Wound type, longer preoperative stay, type of operation, wound class and ward type, showed statistically significant association with postoperative wound infection(26).

A hospital based cross-sectional study conducted in Ethiopia in at Lemlem Karl hospital retrospectively reviewing patient's data that underwent cesarean section for about three years including about 384 patient profile for three years revealed that surgical site infection was reported in about 6.8% of the sample . Duration of labor, membrane rapture and mid abdominal incision was revealed as an independent predictor for surgical site infection among included cases (27).

A cross sectional study was done on patients admitted to surgical and gynecological ward in Ethiopia at Jimma University Specialized Hospital, Jimma enrolling 500 which were admitted to Surgical (n=350) and Gynecological (n=150) wards showed that surgical site infection was reported in about 40% of total sample .moreover ,it was revealed that of total 35% were found to be culture positive of which surgical site infection accounts for about 47.1% of them which is the leading cause of all hospital acquired infections .In this study Intestinal obstruction15.2%, Goiter 12.5%, Laparotomy 11.25% and Cholecystectomy 10.5% were reported general surgical

procedures during study period . Likewise cesarean section 24.4%, Myoma 22.4% and ovarian tumor 16.3% were reported from whom underwent gynecologic procedure. The median length of hospital stay for admitted patients with clinical sign was 11 days (ranges from 3 to 45 days)(28).

A prospective study involving 105 patients that undergone major surgical procedure at Hawassa University Referral Hospital revealed that about 19.1%of them had develop SSIs. Age greater than 40 years, preoperative hospital stay more than 7 days, duration of operation more than an hour and administering antimicrobial prophylaxis before an hour of operation were found to be the independent predictors for surgical site infections(29) ..

A hospital based cross-sectional multi-center study done in Ethiopia (St. Paul's Hospital Millennium Medical College and Yekatit 12 Hospital Medical College enrolling 1088 operations observed that surgical site infection rate was 9.8%(30).

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2.1. Conceptual framework

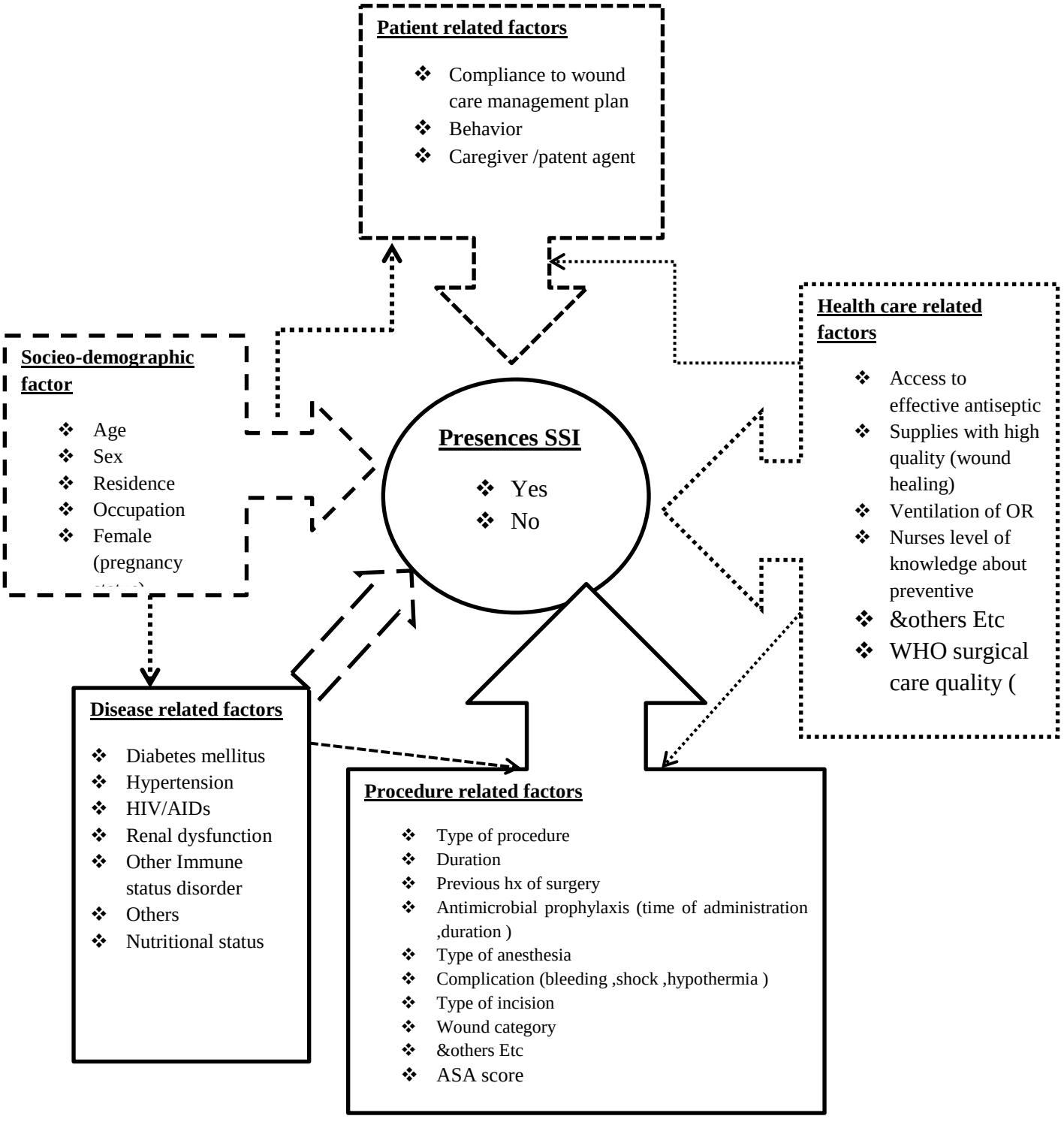

Figure 1: Conception frame work

Chapter three

3. Objective

3.1. General objective

- To assess rate of surgical site infection and associated risk factors among surgical patients admitted to post-operative ward of Attat Hospital from January 1 to August 30, 2018.

3.2. Specific objective

- To determine the rate of surgical site infection among surgical patients admitted to post-operative ward of Attat Hospital from January 1 to August 30, 2018.
- Characterize wound category according to CDC criteria and risks among surgical patients admitted to post-operative ward of Attat Hospital from January 1 to August 30, 2018.
- To identify risk factors associated to surgical site infection among surgical patients admitted to post-operative ward of Attat Hospital from January 1 to August 30, 2018.

Chapter four

4. Method and material

4.1. Study Area

The study has been conducted from January 1 to August 30, 2018 in Attat hospital which is found in Cheha district, Gurage zone in SNNPR, Ethiopia. It was located 168km to the south west of Addis Ababa & 254km far from regional city of Hawassa. It gives service for 800,000 populations of Gurage zone, some parts of south west showa, Silte and Hadiya zone. Currently it has 100 beds, staffed with 64 health professionals of different categories such as:- Gynecologist, General Surgeon, IESO, General practionar, Health officers ,nurses, midwifes and 68 administrative workers. The hospital provides outpatient, in patient services, major and minor operation, NICU, psychiatric, MCH, HIV/TB control, laboratory, x-ray, US, Pharmacy, eye & dental clinic services.

4.2. Study Design

- Facility based Cross sectional study has been employed in Attat Hospital from January 1 to August 30,2018.

4.3. Population

4.3.1 Source population

- All adult patients undergone surgical procedure at Attat Hospital during study period.

4.3.2 Study population

- Selected adult patients who undergone surgical procedure and admitted in surgical ward of Attat Hospital from January1 to August 30,2018.

4.4 Inclusion and Exclusion Criteria

4.4.1 Inclusion criteria

- ❖ All adult post-operative patients who admitted to Attat Hospital with in the study period.

4.4.2 Exclusion Criteria

- ❖ Patients whom have diagnosis of infection prior to surgery
- ❖ Patients with dry/wet gangrene
- ❖ Localized stab wound.
- ❖ Cellulitis (redness/warmth/swelling) due to injection site.
- ❖ Age<15yrs

4.5. Sample Size Determination and Sampling Techniques

4.5.1 Sample Size Determination

Sample size is determined using sample size determination formula for single population proportion and rate of SSI reported in previous studies, which was conducted in a relatively similar setting.

Calculated sample:- $n = \frac{z^2_{\alpha/2} * p(1-p)}{d^2}$

Where:-*n* represents calculated sample size

Z 1-α/2=Critical value associated with significance level of 0.05, taken as 1.96 for a 95% Confidence interval.

p= proportion of SSIs reported from previous literature

d= the margin of error tolerable (0.05)

Table1 :sample size determination based on prevalence reported from literature.

List of literatures	Variables of interest P (proportion of SSI reported) (%) Assumption of Ninety five percent CI, 5% margin of error and a 10% of non-response rate were also considered to determine the sample size (Z=1.96)		ni	Nf(10%contingency)
St paulose millennium medical college and specialized hospital	Overall Incidence rate	9.8%	136	**150**

4.6 Study Variables

4.6.1 Dependent variables

Surgical site infection

4.6.2 Independent variables

Socieo-demographic factor

- Age
- Sex
- Residence
- Occupation
- Female (pregnancy status)

Patient related factors

- Compliance to wound care management plan
- Behavior
- Caregiver /patent agent

Health care related factors

- Access to effective antiseptic
- Supplies for wound dressing(availability)
- Ventilation of OR
- Nurses level of knowledge about preventive activities
- Ward cleanness(neatness)
- Professional levels of surgeon.

Disease related factors

- Diabetes mellitus
- Hypertension
- HIV/AIDs
- Renal dysfunction
- Other Immune status disorder
- Nutritional status

Procedure related factors

- Type of procedure
- Duration
- Previous hx of surgery
- Antimicrobial prophylaxis (time of administration ,duration)
- Type of anesthesia
- Complication (bleeding ,shock ,hypothermia)
- Type of incision
- Wound category
- ASA score

4.7 Data Collection Tools and procedures

4.7.1. Data Collection instruments

Check-list, pencil,

4.7.2 Data Collection Techniques

The data was collected using interviewer administered check lists by face-to-face interview, observation of wound site and patient document review.

Data was included sex, age, presence of any coexisting diseases, history of previous procedure, weight loss, preoperative albumin and hemoglobin values, preoperative stay (days), operating surgeon, timing of operation, type of operation, additional surgical procedures, use of surgical drains, surgical wound class, duration of operation, patient preparation (decontamination, enema), administration of perioperative antibiotics, and type and amount of perioperative blood transfusion. Outcome variables included incisional SSI (superficial or deep), space/organ SSI (intra-abdominal/pelvic abscess, peritonitis), anastomotic insufficiency, postoperative fever, and length of postoperative stay. The attending surgeon and/or one of four surgical nurses inspected and evaluated the wounds daily during the hospital stay.

4.8 Data Quality Assurance

To keep the quality of data detail trainings was given for data collectors, day to day activities during data collection; supervised and evaluated errors corrected by the investigator before the following day activity. And to have quality health professionals involved in data collection. Furthermore principal investigator and supervisors give feedback and correction on daily basis at the end of every data completed to data Completeness, accuracy, and clarity of the collected data checked carefully. Any errors, ambiguity, incompleteness encountered addressed on the following day before starting next day activities.

4.9 Data Processing and Analysis

The collected data of each questionnaire was checked for completeness and coded before data entry. Data entered, cleaned and analyzed using SPSS version22.

Different frequency tables, graphs, charts and descriptive summaries were used to describe the study variables. Binary logistic regression was performed to identify the associations and predictors of the outcome variable. The 95% confidence interval set to determine the level of significance P – Value of < 0.05 was considered to be statistically significant.

4.10 Ethical Considerations

Letter of ethical clearance was obtained from Research Ethics Committee of Jimma University. Letter of permission was obtained from Attat General hospital administration. Permission was asked from the surgical department head. All information obtained from the patients' and cards was anonymous. Furthermore, name of the patients were excluded and confidentiality ensured for any response obtained from the patients and records .

4.11 Dissemination Plan

The finding from this study will be submitted to CBE office (Capacity Building &Education), Health library and research and post graduate program coordinator office of Jimma University. Similarly it will be submitted to Attat hospital director office, surgical ward case team office and Gurage zone health department. Also there was an attempt to publish the result in reputable journals.

4.12 Limitation of the study

The study is limited by the single center, lack of uniform protocol to follow for infection prevention and treatment.

4.13. Operational definition

Surgical site infection:

- **Superficial Incisional SSI:**
  - ✓ Infection occurs within 30 days after any NHSN operative procedure (where day 1 = the procedure date) **AND** involves only skin and subcutaneous tissue of the incision **AND** patient has at least one of the following:
    - A. purulent drainage from the superficial incision
    - B. Organisms identified from an aseptically-obtained specimen from the superficial incision or subcutaneous tissue by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment
    - C. Superficial incision that is deliberately opened by a surgeon, attending physician other designee and culture or non-culture based testing is not performed. AND patient has at least one of the following signs or symptoms: pain or tenderness; localized swelling; erythema; or heat.
    - D. Diagnosis of a superficial incisional SSI by the surgeon or attending physician** or other designee.
- **Deep Incisional SSI:**
  - ✓ Infection occurs within 30 or 90 days after the NHSN operative procedure (where day 1 = the procedure date) **AND** involves deep soft tissues of the incision (e.g., fascial and muscle layers) **AND** patient has at least one of the following:
    - **A.** Purulent drainage from the deep incision.
    - **B.** A deep incision that spontaneously dehisces, or is deliberately opened or aspirated by a surgeon, attending physician** culture or non-culture based microbiologic testing method is not performed AND patient has at least one of the following signs or symptoms: fever (>38°C); localized pain or tenderness. A culture or non-culture based test that has a negative finding does not meet this criterion.
    - **C.** An abscess or other evidence of infection involving the deep incision that is detected on gross anatomical or histopathology exam, or imaging test.

❖ **Organ/Space SSI:**

- ✓ Infection occurs within 30 or 90 days after the NHSN operative procedure (where day 1 = the procedure date) **and** infection involves any part of the body deeper than the fascial/muscle layers, that is opened or manipulated during the operative procedure **AND** patient has at least one of the following:
  - A. purulent drainage from a drain that is placed into the organ/space (e.g., closed suction drainage system, open drain, T-tube drain, CT guided drainage)

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  - **B.** an abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging test evidence suggestive of infection **.**

The wound class system used in NHSN is an adaptation of the American College of Surgeons wound classification schema:

Clean: An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or un infected urinary tracts are not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow non-penetrating (blunt) trauma should be included in this category if they meet the criteria.

Note: The clean wound classification level will not be available for denominator data entry for the following NHSN operative procedure categories: APPY, COLO and REC.

Clean-Contaminated: Operative wounds in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.

Contaminated: Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered including necrotic tissue without evidence of purulent drainage (e.g., dry gangrene) are included in this category.

Dirty or Infected: Includes old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation

Rate of Surgical site infection:

- Rates are obtained by dividing a numerator (number of infections or infected patients observed) by a denominator (population at risk, or number of patient-days of risk).

$$rateSSI = \frac{number\ of\ identified\ cases\ with\ SSIs}{total\ patients\ obseved\ during\ the\ period} * 100$$

- Attack rates can be estimated by the calculation of simplified infection ratio using an estimate of the denominator for the same period of time (i.e. number of admissions or discharges, number of surgical procedures).

$$attack\ rate\ of\ SSIs = \frac{Number\ of\ new\ infections\ acquired\ in\ a\ period}{Number\ of\ patients\ exposed\ in\ the\ same\ period} * 100$$

Nutritional status: in this study it will be determined using number of days that the patients were put on NPO (nothing per oral) hence to determine short term or acute nutritional problems and standard measurements were difficult to employ.

- **Poor nutritional status** >two days of NPO with subjective patients compliant to normal diet schedule
- **Moderate nutritional status**: less than two days but more than 12hrs of NPO with subjective patients compliant to normal diet schedule.
- **Good nutritional status**: less than 12 hour of NPO without subjective patients compliant to normal diet schedule.

Chapter five

5. Result

5.1, Socio-demographic characteristics of the patients

In this study of total 121 , patients whom undergone operation in Attat Hospital female respondents account for three quarter of the enrolments and the mean age of respondents were 29.59 ± 10.1(SD) in age range of [18-60]in years,. Majority of enrolments found to have recent antibiotic use history and among about 12 of them revealed to undergone surgical procedure before current hospitalization. In this study of total majority of them found to underwent surgical procedure within 24 hours of admission while rest stay longer, which accounts each for 90.9%(110) &11(9.1%) ,respectively. It was also revealed that large number of enrolment were from gynecology and obstetrics ward while about a third of them were admitted for general surgical care .in addition to this about one sixth of respondents revealed to have in one or other way found to have predisposing condition for infection.

Table 1:- Socio-demographic characteristics of the patients

Characteristics	Category	Frequency	Percentage
Age	15-35 yrs	87	71.9
	36-54 yrs	31	25.6
	>= 55 yrs	3	2.5
Gender	Male	29	24.0
	Female	92	76.0
Period of NPO	< 24 hr	110	90.9
	>= 24 hr	11	9.1
Case category	Obs & Gyn case	71	58.7
	General surgery cases	50	41.3
Duration of Antibiotics administration during perioperative period	1-2 days	85	70.2
	> 2 days	36	29.8

5.2, Clinical characteristics of patients whom were admitted to post -operative ward of Attat primary hospital for surgical care during study period 2017/18.

Out of enrolled patents admitted for surgical care, majority of surgical cases was reported as emergency cases which accounts for 79.3% while the rest were elective. Similarly, most of them reported to underwent major surgery, accounting for about 81% of total. It was also revealed that about 16.5% were found to have predisposing factor for infection. Among surgical procedure underwent, cesarean section reported in over half respondents accounting for 56.2%, while laparotomy and appendectomy were the second and third frequently reported next to cesarean section accounts in among 11.6% & 9.9%, respectively. Moreover, resection and anastomosis of large and small bowl was revealed to accounts for 9.1% and fourth prevalent procedures among respondents. Cephalo- pelvic disproportion, cord prolapse and fetal distress were the three leading obstetric condition responsible for cesarean section listed in decreasing order of frequency, each accounts for 21.5% ,9.9% & 8.3% respectively . Appendicitis and hernia were the leading surgical care conditions responsible for general surgical procedure, 12.4% & 8.3% each respectively. Among all surgical incision related wounds, over half of operation were found to be clean operation while in similar proportion clean contaminated and dirty wound were the next prevalent operation wounds ,which accounts for 60.3% ,15.7% &15.7% each respectively . Surgical site infection was reported in about 35% of total enrollments .over half (56%) of respondents whom found to develop surgical site infections found to be superficial surgical site infection while organ space reported in about 20% of cases diagnosed with surgical site infection. In this study, ampicillin ,ceftriaxone and metronidazole were the three commonest antibiotics employed either for prophylaxis and empiric management of surgical wound infection among majority of enrolments each accounts for 57.9% ,35.5% & 32.2% in decreasing order of frequency . Alcohol and hypertonic saline were revealed as the two frequently employed antiseptic in perioperative period among our samples each accounting for 36.4% & 38.8% respectively.

Table 2:- clinical and procedure related characteristics of the patients

Characteristics	Category	Frequency	Percentage
Type of surgical case	Elective surgery	25	20.7
	Emergency surgery	96	79.3
Category of surgical procedure	Minor surgery	23	19.0
	Major surgery	98	81.0
Infection predisposing factors	No	101	83.5
	Yes	20	16.5

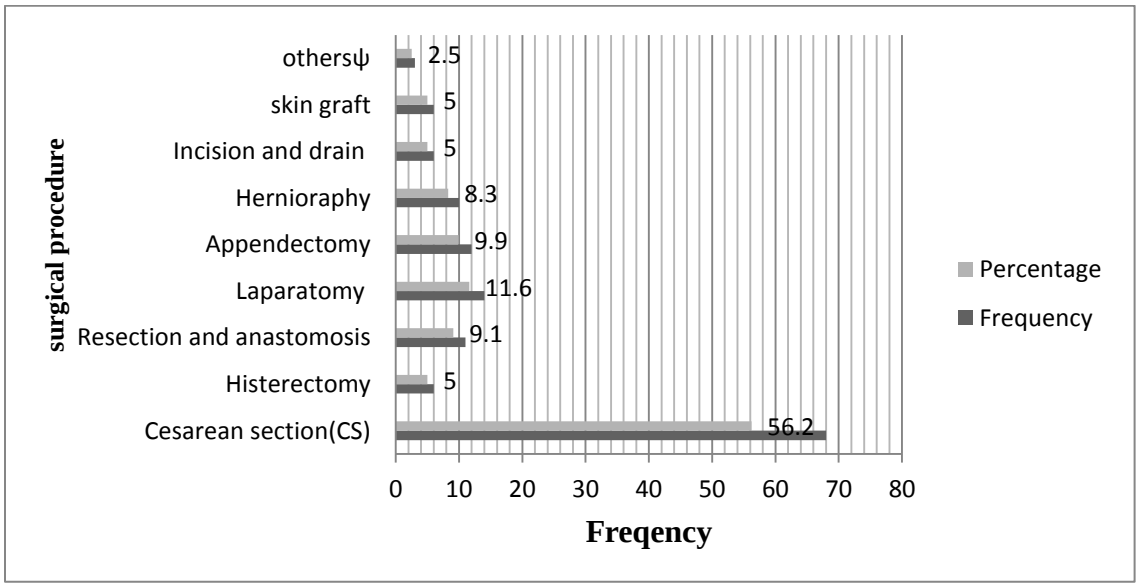

Figure 1: - Distribution of operation procedure undergone among respondents during study period.

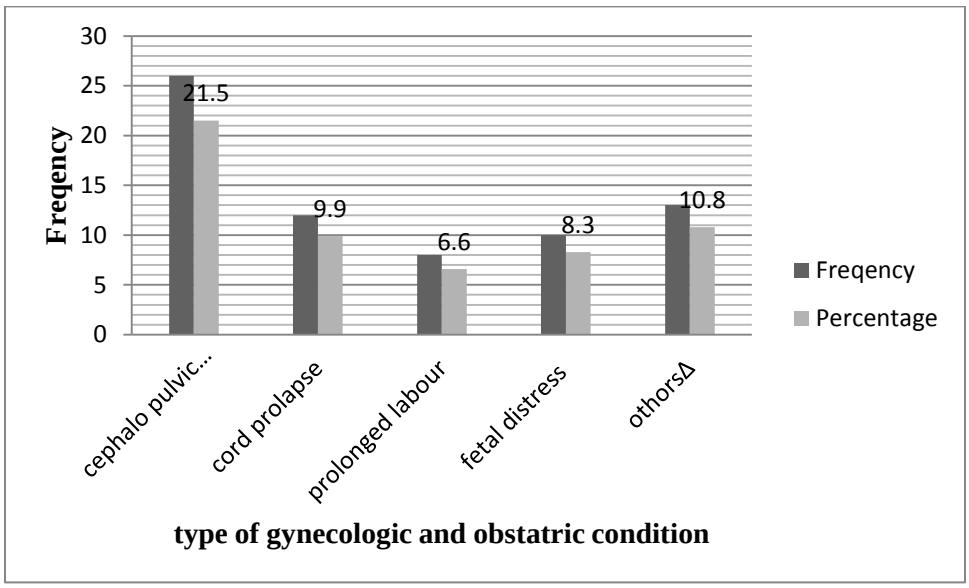

Figure 2:- gynecologic and obstetric condition needs surgical care among sample during study period

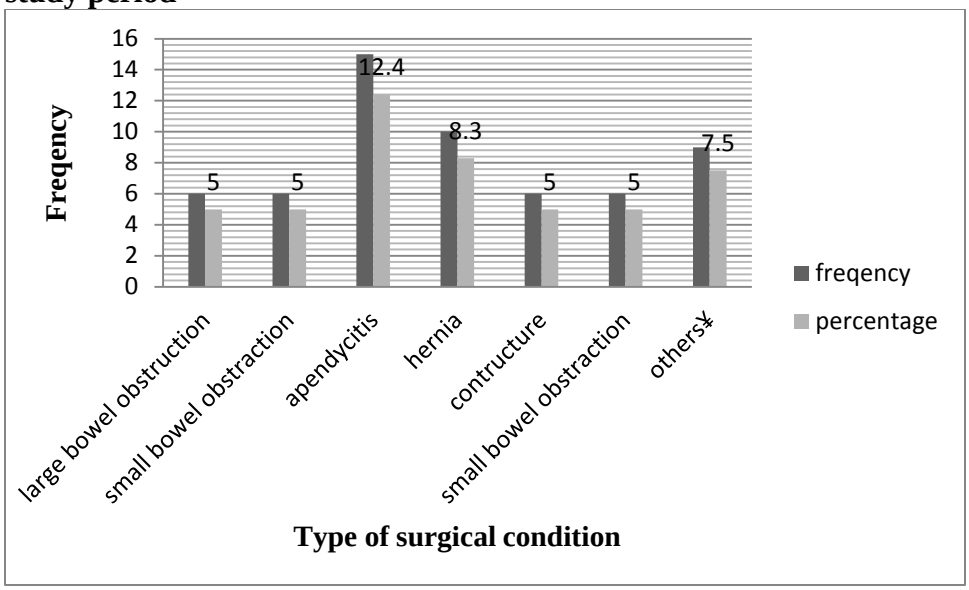

Figure 3:- Distribution of general surgical condition needs surgical care among our sample during study period

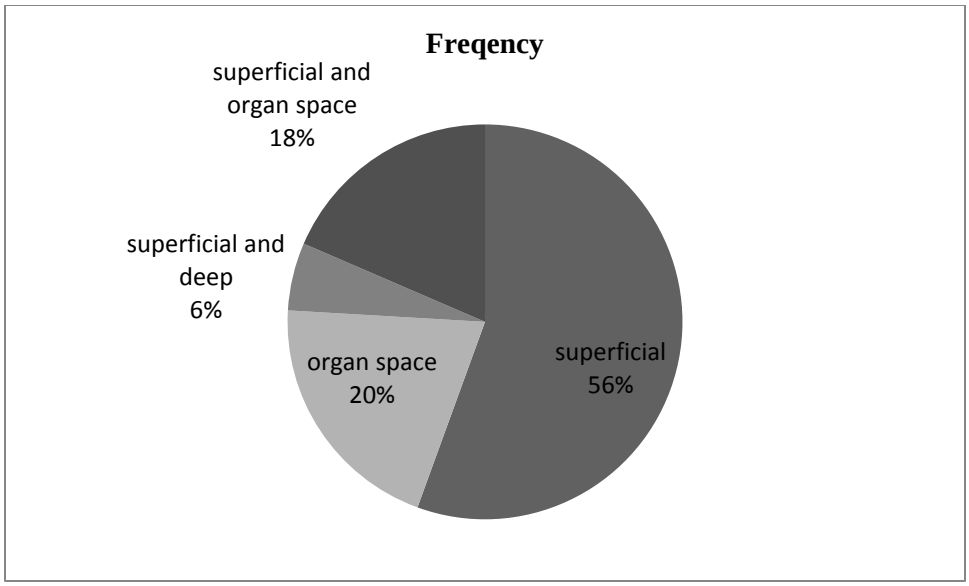

Figure 4:- Type of surgical site infection reported among our sample during study period

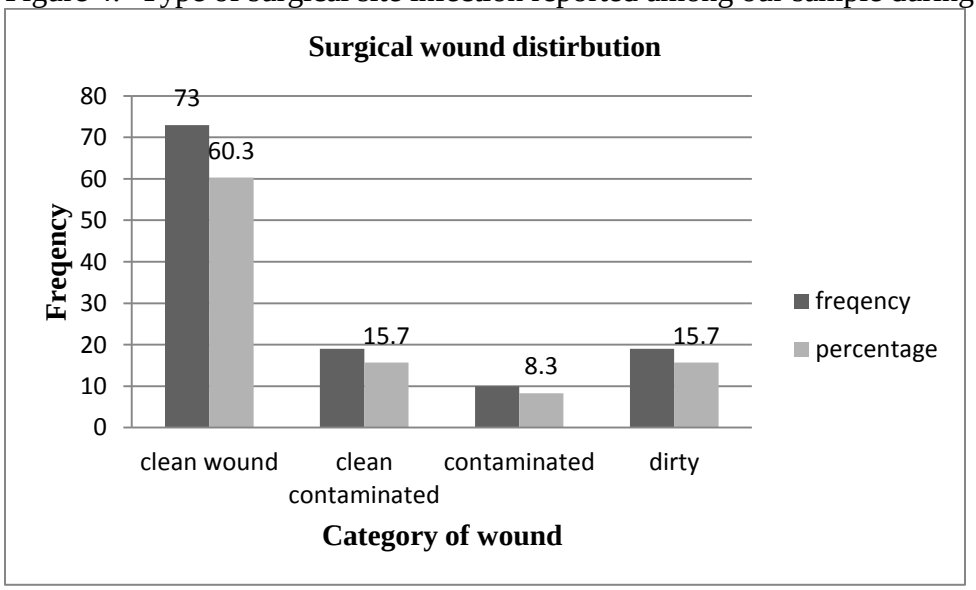

Figure 5:- WHO surgical wound distribution among our sample during study period

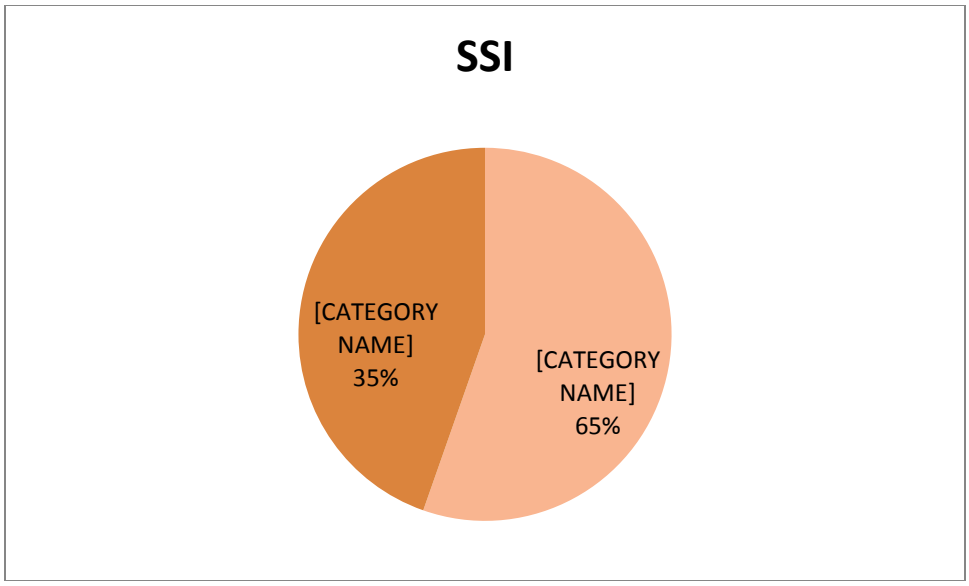

Figure 6:- Rate of surgical site infection among our sample during study period

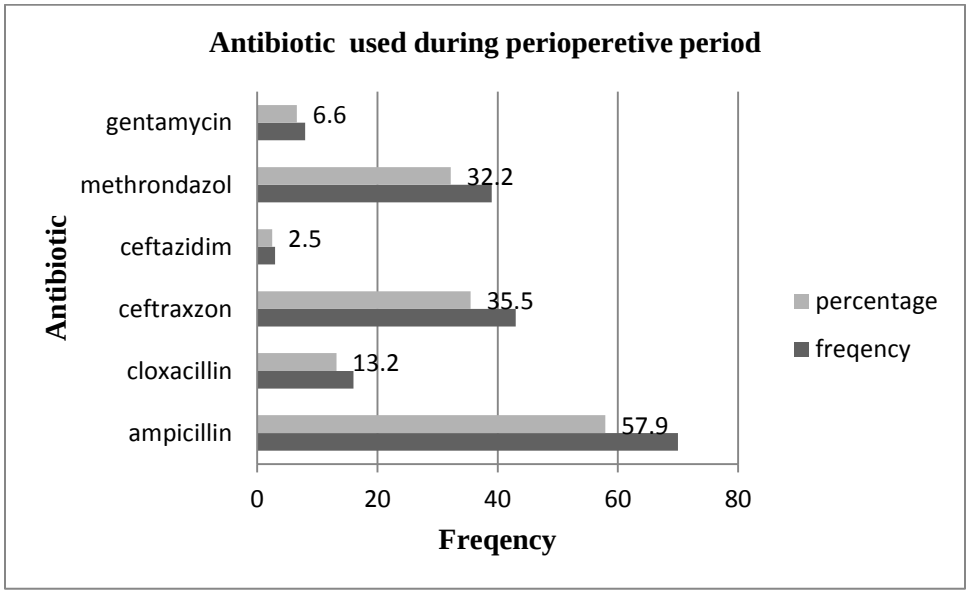

Figure 7:- Antibiotics employed among our sample during study period

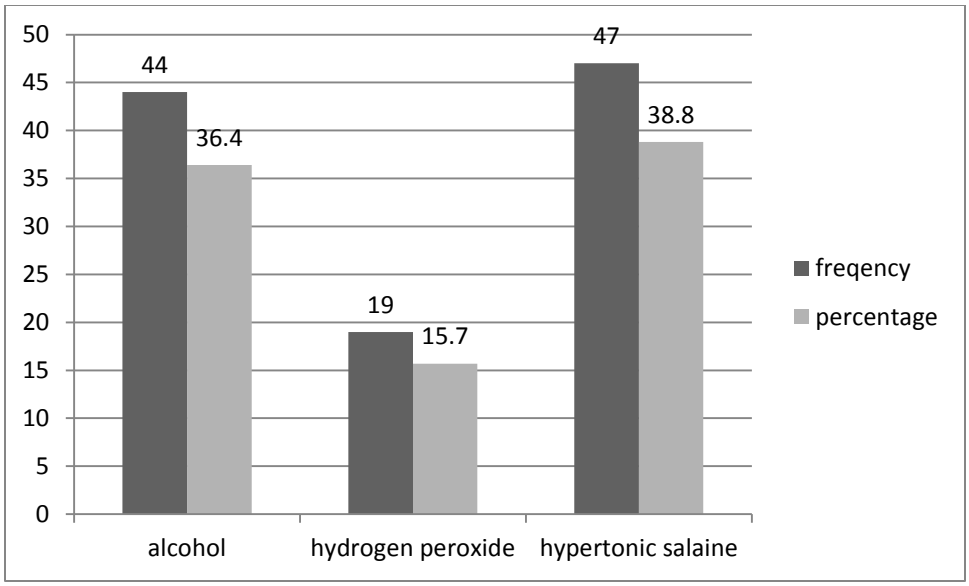

Figure 8:- The antiseptic found commonly employed among our sample during study period.

5.3, Result on binary logistic regression analysis among post -operative patients included in our study.

From this cross sectional prospective study ,multiple socio-demographic ,clinical and procedure related factors was revealed to be risk factors among included sample that increase probability of operation related surgical site infection .

Out of all factors revealed from binary regression analysis male gender, type of surgical condition, duration of operation ,length of preoperative hospital stay ,duration that patients put on netting per oral ,other than cesarean section procedure ,laparotomy ,resection and anastomosis ,appendectomy ,presence of infection predisposing factor ,standard care bundle criteria for antibiotics and antiseptics were observed as risk factors for surgical site infection among our sample .

Being male gender was revealed that about three times more likely to develop operation related surgical site infection when compared to their counter parts with COR 3.094(1.291;7.414) .

Being admitted for general surgical condition identified to have nearly five and half times higher chance of being diagnosed with surgical site infection than other surgical conditions with COR 5.419(2.465;11.912).

Cases which takes longer than an hour was revealed to have eleven times higher chance of surgical site infection than those operations which takes short with COR 11.200(1.321;94.949) .

Those patients whom stay longer pre operatively after admission was found to have fifteen times higher likely hood to develop surgical site infection than those whom stays less than a 24 hour with COR 15.000(1.854;121.361) .

Patients whom reported to have greater than 24 hour put on NPO revealed to have over four and half times higher chance to develop surgical site infection compared to those not with COR 4.693(1.872;11.765) .

Those whom underwent cesarean section procedure were revealed to have nearly six times more likely to develop surgical site infection than those underwent other procedure with COR 5.882(2.672;12.951) .

For those whom Laparotomy procedure was employed have over twenty times more likely to develop surgical site infection than those not underwent it with COR 20.927(2.638;166.000).

For those whom resection and anastomoses was underwent they have fifteen times more likely to be diagnosed with surgical site infection than their counter parts with COR 15.000(1.854;121.361).

For those whom found to underwent appendectomy procedure, they were revealed to have over seven times higher chance to develop surgical site infection than others with COR 7.386(1.543;35.350).

Those whom revealed to have infection predisposing condition perioperative period was found to have over thirty five times higher likely to be diagnosed with surgical site infection than those not with COR 35.829(4.602;278.931).

Among our sample, those of whom standard care bundle criteria for antibiotics administration peri-operatively was not followed were revealed to have over four & half times more likely to develop surgical site infection than those whom meet criteria with COR 4.542 (1.330;15.514).

Those of whom standard care bundle criteria for antiseptics was not followed were revealed to have over three & half times more likely to be diagnosed with surgical site infection than those operation found to be followed with COR 3.402(1.036;11.172).

Table 3:- Bivariate regression analysis result

Variable	Category	Surgical site infection		Bivariate analysis	
		No	Yes	p-value	COR95%CI
Gender	Female	57	35	1.000	1.000
	Male	10	19	0.011	3.094(1.291;7.414)
Type of surgical condition	Gynecology and Obstetric	51	20	1.000	1.000
	General Surgical	16	34	<0.001	5.419(2.465;11.912)
Duration of operation	<=45 minutes	56	35	1.000	1.000
	45-60 minutes	10	12	0.174	1.920(.750;4.913)
	>60 minutes	1	7	0.027	11.200(1.321;94.949)
Length of stay before operation	< 24 hr.	66	44	1.000	1.000
	>= 24 hr.	1	10	0.011	15.000(1.854;121.361)
NPO	no	59	33	1.000	1.000
	yes	8	21	0.001	4.693(1.872;11.765)
Cesarean section	no	17	36	<0.001	5.882(2.672;12.951)
	yes	50	18	1.000	1.000
Laparotomy	no	66	41	1.000	1.000
	yes	1	13	0.004	20.927(2.638;166.000)
Resection and anastomosis	no	66	44	1.000	1.000
	yes	1	10	0.011	15.000(1.854;121.361)
Appendectomy	no	65	44	1.000	1.000
	yes	2	10	0.012	7.386(1.543;35.350)
Infection predisposing factor	no	66	35	1.000	1.000
	yes	1	19	0.001	35.829(4.602;278.931)
Standard care bundle meet for antibiotics	poor	10	19	0.011	3.094(1.291;7.414)
	good	57	35	1.000	1.000
Standard care bundle meet for antiseptic	poor	11	27	<0.001	5.091(2.202;11.770)
	good	56	27	1.000	1.000

5.4, Result on multivariate logistic regression analysis among sample patients admitted for surgical care during study period.

Though multiple factors were observed as risk factors for surgical site infection, only about five factors was observed after multivariate logistic regression analysis revealed to be independent predictor for development of surgical site infection. Those factors observed were listed in table below.

Preoperative hospital stay longer than 24 hour, observed to have over fourteen times higher chance to have surgical site infection than their counter parts with AOR 14.110(1.264;157.49.

Laparotomy procedure was observed to have over thirty times much likely to be diagnosed with surgical site infection than other procedure underwent among our sample with AOR 30.774(2.057;460.286)

Presence of infection predisposing factor during perioperative period was revealed to increase nearly forty times higher chance to be diagnosed with surgical site infection than those whom found not to have it with AOR38.932(4.015;377.481).

During perioperative period not following protocol for standard care bundle for surgical site infection prevention on antibiotics found to have about four and half times higher chance of surgical site infection than their counter parts with AOR 4.542(1.330;15.514).

During perioperative period not following protocol for standard care bundle for surgical site infection prevention on antiseptics found to have about three times higher chance of surgical site infection than their counter parts with AOR3.402(1.036;11.172).

Those of whom found stay longer than 24 hour at surgical ward, identified as an independent predictor to be diagnosed with surgical site infection than their counter parts.

Infection predisposing conditions during perioperative period was revealed to be one of surgical site infection predictors among our sample.

Laparotomy procedure was observed as an independent predictor for surgical site infection among enrolled surgical patients

Not following standard care bundle protocol during perioperative period for antibiotics administration was observed as an independent predictor for surgical site infection among our sample.

Not following standard care bundle protocol for antiseptic use during perioperative period also revealed to be an independent predictor for surgical site infection.

Table 4 :- Multivariate analysis result

Variables	Category	Surgical site infection		Bivariate analysis		Multivariate analysis	
		No	Yes	P-value	COR95%CI	P value	AOR95%CI
Length of stay before operation	< 24 hr	66	44	1.000	1.000	1.000	1.000
	>= 24 hr	1	10	0.011	15.000(1.854;121.361)	0.032	14.110(1.264;157.495)
Infection predisposing factor	no	66	35	1.000	1.000	1.000	1.000
	yes	1	19	0.001	35.829(4.602;278.931)	0.002	38.932(4.015;377.481)
Laparotomy	no	66	41	1.000	1.000	1.000	1.000
	yes	1	13	0.004	20.927(2.638;166.000)	0.013	30.774(2.057;460.286)
Standard care bundle meet for antibiotics	poor	10	19	0.011	3.094(1.291;7.414)	0.044	4.542(1.330;15.514)
	good	57	35	1.000	1.000	1.000	1.000
Standard care bundle meet for antiseptic	poor	11	27	<0.001	5.091(2.202;11.770)	0.016	3.402(1.036;11.172)
	good	56	27	1.000	1.000	1.000	1.000

6. Discussion

This is a prospective observational study aims at determining rates of surgical site infection and identifying factors associated with it among postoperative patients at Attat hospital from January 1 to August 30 ,2018 . Despite worldwide advancement of surgical care peculiarly in ensuring patients safety during perioperative period from basic life support to prevention of surgical site infection secondary to surgical incision (Standards of surgical care bundle criteria for prevention of surgical site infection),it have been found inconsistently employed and overlooked particularly in developing world .

Consistent to this though evidence based surgical care which was revealed to be cost effective even feasible to developing world higher prevalence of surgical site infection was observed among our sample accounting for 35%. over half (56%) of respondents whom found to develop surgical site infections found to be secondary to superficial surgical site infection while organ space reported in about 20% of cases diagnosed with surgical site infection. Our finding was in line with figure reported 40% in other part of our country at Jimma University specialized Hospital by Sahile et al.

Inconsistently our finding found lower than figure reported form other part of our country done in Mekelle at Ayder teaching and referral hospital, which reports surgical site infection, was reported among 75%. These discrepancies might be explained by variation in enrollment characteristics, in Ayder cases only enrolling from general surgery and orthopedic wards which might increase level of infection that might be due to high chance of underlying infection predisposing factors among orthopedic cases. Besides this it also employed culture for enrolment which was not evaluated in our cases.

The finding from many studies reviewed found to be lower than our figure , like those studies done in other parts of our country such as those done at Yakattit ,Hawassa and those done in Nigeria ,Uganda ,India ,Malaysia &Brazi, in which 9.8%,19.1%,27.56%,16.4%,16.6%,18.8 %and 3.4% was reported in each ,respectively . This variance would be explained by the variability in sample size, source population and patient's characteristics as we reveal while reviewing. In most of those studies large sample and longitudinal method was employed which was not so in our cases. In among a number of those studies patients from all age group were included on the other side a number of those studies found as multicenter, in addition to this

some of them recruit sample focusing at single procedures (i.e. either general surgical cases, orthopedic or gynecologic cases) in contrary to those studies those were not found to be consistent due to time constraint and limited cases relative to those studies. Besides this majority of those studies revealed to employ culture investigation which might reduce gap of syndromic approach diagnosis which might able to include those whom might have hidden underlying infection condition prior to surgery.

Though multiple patients related and procedure related variable found as risk factors in our study about five variable was observed as a predictor for surgical site infection, Preoperative hospital stay longer than 24 hour AOR 14.110(1.264;157.49, Laparotomy procedure AOR 30.774(2.057;460.286), Presence of infection predisposing factor AOR38.932(4.015;377.481), not following protocol for standard care bundle for surgical site infection prevention on antibiotics AOR 4.542(1.330;15.514), not following protocol for standard care bundle for surgical site infection prevention on antiseptics AOR3.402(1.036;11.172).

As revealed from study done in Brazil by Carvalho RLR et al ,Ahmadabad ,Karnataka ,and other two studies in other part of our country at Hawassa & Mekkelle preoperative hospital stay was found to be significant risk factor for prevalence of surgical site infection which was found to be consistent to our observation, which was revealed that those respondents whom found to stay longer than 24 hours reported to have over fourteen times higher chance of being diagnosed with surgical site infection than their counter parts. On the other hand those finding reported in study done in Nigeria by Ahmed Olowo-okere et al, revealed those whom found to stay longer than a week were found to have higher chance to develop surgical site infection than those stay less postoperatively. This discrepancies might be explained by increased chance to develop nosocomial infection as patient stay longer than 48 hour in general thus it might be either from other source such as mechanical ventilation, intravascular rout or from catheter rout thus it might misled figures in case of Nigerian study .

Preexisting medical condition too was revealed as predictor for surgical site infection in studies done in India at Ahmadabad and Punjab which was observed to be concurrent to our finding ,that revealed among samples whom found to have infection predisposing factor were found to have over thirty times more likely to be diagnosed with surgical site infection during perioperative period .

Type of surgical procedure was revealed to be significant predictors for surgical site infection in two studies done in India at Ahmadabad and in our country at Mekelle which found to be consistent to our study which showed those whom underwent laparotomy procedure were observed to have nearly forty times much higher chance of being diagnosed with surgical site infection than their counter parts. this might be due to evidence on most standard guidelines recommendation exploratory and diagnostic noninvasive laparotomy procedure wouldn't recommend prophylaxis thus setting and per protocol variance compared to other may not expected as uniform as recommended in guidelines .

Concerning to antibiotics administration during perioperative period finding from study done in other part of our country at Hawassa and in Greek revealed that prophylactic antibiotics administration longer than an hour and longer than 24 hour was significant predictors for surgical site infection respectively . our study finding was found incongruent to those finding though not revealed in each parameters we observe variance as general according to standard surgical care bundle for prevention of surgical site infection, which was revealed among our samples whom found not to meet parameters was found to have over four & half times more likely to develop surgical site infection than their counter parts.

Moreover ,antiseptics use during perioperative period was also revealed as significant predictors for surgical site infection in study done in Uganda at Mbarara Regional Referral Hospital which was observed that variance in suture material property was found to be significant predictor for surgical site infection . similarly ,in our study revealed that those whom found not to meet bundle criteria for antiseptic use during perioperative period was found to have over three times more likely to have surgical site infection than their counter parts . This might be explained by poor hygiene during perioperative period would increase likely hood of surgical site infection.

Strength and limitation

Being prospective adds a term of strength up on which our recommendation would increase possibility be generalizable to our source population. Besides to reduce the technical sort of bias in selection of our sample we try to enroll those postoperative patients whom found to underwent surgery by other wing of surgical case team.

Though as explained above strength our study had number of limitations , firstly , being cross sectional in design limit us to get as sufficient sample size and a sort of referent bias in missing some hidden factor which might be identified in case of large sample . Secondly, limited

procedure were performed at our study site limits us to get comprehensive data on surgical procedure thus it might reduce level of inference to the target population. Thirdly, limited access to confirmatory culture investigation rather than clinical syndromic approaches which we had employed. Finally, we revealed in proportionate surgical procedure which might limit those factors though they were identified to be predictors to be missed due to left because of most cell found not meet criteria for association.

7. Conclusion and recommendation

7.1, Conclusion

According to current international infection society report hospital acquired infection is found to become huge burden globally , out of which surgical site infection is the leading infection of all nosocomial infection. Consistent to this surgical site infection was observed to be prevalent among our sample which found to account for 35%. Multiple risk factors were reported in most studies , inline to this we had identified being male in gender, type of surgical condition, duration of operation ,length of preoperative hospital stay ,duration that patients put on netting per oral ,other than cesarean section procedure ,laparotomy ,resection and anastomosis ,appendectomy ,presence of infection predisposing factor ,standard care bundle criteria for antibiotics and antiseptics were observed as bivariate risk factors for surgical site infection. After adjusting for confounding factors by multivariate analysis we end up with, Preoperative hospital stay longer than 24 hour, Laparotomy procedure, Presence of infection predisposing factor, not following protocol for standard care bundle for surgical site infection prevention on antibiotics, not following protocol for standard care bundle for surgical site infection prevention on antiseptics were significant predictors for surgical site infection among our sample.

7.2, Recommendation

Up on our study finding we went to note the following recommendations:-

To Attat Hospital surgical case team

It would better if we give due emphasis for preoperative patient care which in our study we identified as preoperative stay and preexisting medical condition found to be predictor for surgical site infection that would even be controlled either by matron and admission related technical decision and thorough evaluation of recent as well as medical experience of patient at admission

Though evidence based guidelines of infection prevention forward recommendations giving basic surgical care decision not only from perspective of surgical case team it would revealed in our study deciding from comprehensive prospect peculiarly from patient prospect as laparotomy found to predict surgical site infection in our study

It was found wrathful if we stick to per protocol meeting minimum standards by using feasible ways to accomplish infection prevention goal for all surgical patients whom need surgical care

To Attat Hospital management

It would better to plan on overlooked clinical conditions which found to be escalating predominantly hospital acquired infections of which surgical site infection was ever overlooked

Planning and implementing or adopting global standards for the setting based guideline or protocol particularly infection prevention protocol

Give due emphasis on on job and off job training on infection prevention in clinical setting

To Jimma University:-

This topic was ever be an issues in this setting this was the first research conducted at Attat thus it would better for those successor batches be perform similar topic to elaborate and extensively refine the topic so that it would better be part of solid evidence even to infer to target population in general

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Annex

Annex I

Informed Consent

My name is Markos Bitana. I am working as data to conduct our study, I would like to ask you some questions which may take about 30 minutes. As your participation is very important to the outcome of the study, we kindly request you to give us your sincere and truthful answer. All the information that you and other respondents are going to provide us will remain confidential and you don't need to mention your name and you are also free to withdraw at any time and if you have question during interview you can ask and discuss with the interviewer.

Research title: To assess rate of surgical site infection and associated risk factors among surgical patients admitted to post-operative ward of Attat Hospital from January 1 to July 30, 2018.

1. I confirm that I understand the information sheet for the above study and have had the opportunity to ask question
2. I understand that my participation is completely voluntary and that I am free to Withdraw at any time, without giving any reason, without my medical care or legal Rights being affected.
3. I understand that my medical notes will be looked at by data collectors of this study and necessary information will be extracted. I give permission for these individuals to have access to my records.
4. I agree to take part in the above study.
5. I would like to confirm my agreement by signing.

Name of the data collector: _____ Signature: _____ date_____

Name of the principal investigator: _____Signature: _____ date_____

Thank you for your participation and cooperation!

Annex II

Data collection form for surgical site infection

Patient

Patient identification

Age (years)

Gender ☐ male ☐ female

Date of admission (in the hospital) (dd/mm/yy)

Date of discharge (from the unit) (dd/mm/yy)

Operation

Date of operation (dd/mm/yy)

Main procedure (code)

Wound class ☐ Clean ☐ Contaminated ☐ Clean-contaminated ☐ Dirty/infected

ASA score ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Duration of operation (minutes)

Urgent ☐ Yes ☐ No

Prosthesis/implant ☐ Yes ☐ No

Multiple procedures ☐ Yes ☐ No

Coeliosurgery ☐ Yes ☐ No

Antibiotics

Antimicrobial prophylaxis	☐ Yes	☐ No
Starting date	(dd/mm/yy)	
Duration	(days)	

Surgical site infection

Surgical site infection	☐ Yes	☐ No	
Date of infection	(dd/mm/yy)		
Infection site	☐ superficial	☐ deep	☐ organ/space
Microorganism 1			
Microorganism 2			
Date of last contact	**(dd/mm/yy)**		

Patient exposure

Surgical procedure (during the last month)	☐ Yes	☐ No
Urinary catheter	☐ Yes	☐ No
Mechanical ventilation	☐ Yes	☐ No
Intravascular catheter	☐ Yes	☐ No
Antibiotic	☐ Yes	☐ No

If yes, prescription for

☐ Prophylaxis ☐ Therapy ☐ Other/unknown

Anti-microbial prophylaxis

List of Procedure done for the patients	Agent given for the prophylaxis	Route of anti-microbial giv	Dose given	Time of administration	Remark

Standard of care bundle criteria for health care related factors

Appropriate Anti-biotic Timing, Ansewer by Y/N(Y=Yes,N=No)

Y/N ☐	Was Antibiotic administered within 0 - 60 min prior to surgical incision?
	For vancomycin and fluoroquinolones, antibiotic was started & infused over 120 minutes and completely absorbed within 0 - 60 min prior to surgical incision.
Y/N ☐	Antibiotic not given, OR not given in appropriate time frame (as described above) OR not recorded.
Y/N ☐	Patient was already receiving an antibiotic for a pre-existing condition.

Appropriate Antiseptic Skin Preparation

Y/N ☐	2% chlorhexidine gluconate with 70% isopropyl alcohol (e.g. Chlora Prep) or iodine povacrylex with 74% isopropyl alcohol (e.g. Dura Prep) AND a non-emergent procedure AND a procedure not involving eye/ear/mouth/neural tissue.
	Povidone iodine or aqueous chlorhexidine gluconate AND an emergent procedure.
	Povidone iodine AND a procedure involving eye/ear/mouth/neural tissue.
Y/N ☐	Not one of the "Y" scenarios above, OR not recorded.

Appropriate Hair Removal

Y/N	No hair removed Or removed in-hospital with clippers or depilatory cream prior to surgical incision.
Y/N ☐	Razor used in-hospital Or not recorded.
Y/N ☐	Patient removed own hair prior to surgery.

Maintaining Normo-thermia

Y/N	Patient's core temperature is 36.0°C to 38.0°C at end of surgery or upon arrival in PACU/recovery (first set of vitals).
Y/N	Patient's core temperature < 36.0°C or > 38.0°C at end of surgery or upon arrival in PACU/recovery Or not recorded.

Appropriate glucose control

Y/ N ☐	Blood glucose reading closest to 6:00 AM for a diabetic patient on post-operative Day 1 or Days 1 & 2 (if in-hospital > 48h) is ≤ 10 mmol/L.
Y/N ☐	Blood glucose reading closest to 6:00 AM for a diabetic patient on post-operative Day 1 or Days 1 & 2 (if in-hospital > 48h) is > 10 mmol/L.
Y/N( )	Patient is diabetic Or has patient gestational diabetes? (Y/N).

Tools used to assess type of SSIs	Yes	No
Infection occurs within 30 days after the operative procedure?		
Involves only skin and subcutaneous tissue of the incision?		
Purulent drainage from the superficial incision?		
Organisms isolated from an aseptically-obtained culture of fluid or tissue from the superficial incision?		
Superficial incision that is deliberately opened by a surgeon, attending physician, or		

other designee and is culture-positive or not cultured?(NOTE: A culture-negative finding does not meet this criterion)		
Diagnosis of superficial incisional SSI by the surgeon, attending physician, or other designee?		
Involves deep soft tissues of the incision? (e.g., fascial and muscle layers)		
Purulent drainage from the deep incision?		
A deep incision that spontaneously dehisces or is deliberately opened by a surgeon, attending physician, or other designee? and is culture-positive? or is not cultured (NOTE: A culture-negative finding does not meet this criterion)		
An abscess, or other evidence of infection involving the deep incision, that is detected on direct examination, during an invasive procedure or imaging test?		
Abscess involves any part of the body, other than skin incision; fascia, or muscle layers, that is opened or manipulated during the operative procedure?		
Purulent drainage from a drain that is placed into the organ/space?		
Organisms isolated from an aseptically-obtained culture of fluid or tissue in the organ/space?		
An abscess, or other evidence of infection involving the organ/space, that is detected on direct examination, during an invasive procedure, or by imaging test?		
Fever (> 38°C)		
Localized pain or tenderness		
Pain or tenderness		
Localized swelling		
Redness		
Heat		

Tools used to assess respondents wound category	Yes	No
Uninfected operative wound where respiratory, GI, genital, and urinary tracts aren't entered?		
Wounds are primarily closed? or a drain is connected to a closed system?		

Any inflammatory condition is encountered?		
Operative wound that enters the respiratory, GI, genital, or urinary tract under controlled conditions?		
Major break in sterile technique?		
Presence of Spillage?		
Open, fresh, accidental wounds?		
Gross spillage from the GI tract ?		
Acute, non-purulent inflammation is encountered?		
Necrotic tissue without evidence of purulent drainage?		
Old traumatic wounds with retained devitalized tissue?		
Presence Perforated viscera?		
Presence of purulence or abscess?		
Operation complications (wound dehiscence)?		
Comorbid disorders (HTN, DM, other chronic disorder, Acute illness) HIV/AIDS?		

	Yes	No
History of surgical site infection?		
History of hospital exposure during past 30 days?		
List of comorbid disorders :_____		
Number of hour /days put NPO :_____		
Pre-operative hospital stay :_____		

List of tools used; to assess the access of basic supplies and medications used for post-operative care (by name). Is it used? If yes list it.	Yes	No