

**FACTORS ASSOCIATED WITH POST CESAREAN SECTION SURGICAL SITE  
INFECTION AMONG MOTHERS WHO UNDERWENT CESAREAN SECTION IN  
MIZAN TEPI UNIVERSITY TEACHING HOSPITAL, SOUTH WEST ETHIOPIA**

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**JIMMA UNIVERSITY INSTITUET OF HEALTH, FACULTY OF HEALTH SCIENCE  
SCHOOL OF NURSING AND MIDWIFERY**

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## **Abstract**

**Back ground:** *Wound infection is a common complication of caesarean section (CS) and may lead to maternal sepsis, increased health costs, related to prolonged hospital stay, and negatively influences the outcome of the patient. Even though the extent of the problem is expected to be high in Ethiopia, it was not studied well.*

**Objectives:** *The objective of this study was to assess factors associated with post cesarean section surgical site infection among mothers who underwent cesarean section in Mizan Tepi university teaching hospital, south west Ethiopia,2017.*

**Methods:** *Institution based descriptive, quantitative cross sectional study was conducted from March 10/2017 to March 30/2017 in Mizan Tepi university teaching hospital. A total of 325 records of mothers were reviewed based on CDC criteria for SSI after selecting the cards by simple random (lottery) methods. Data were entered in epidata version 3.1 and analyzed with SPSS version 20. Bivariate and multivariable logistic regression analysis was done to identify independent factors of surgical site infection.*

**Result;** *overall post cesarean section surgical site infection rate was 12.9%. Rupture of membrane <24 hours (AOR= 0.35, 95%CI: 0.129, 0.897), pre-op hematocrite count of <30% (AOR=2.598, 95%CI: 1.125, 6.003) and post-op admission for less than 8 days (AOR= 0.109, 95%CI: 0.043, 0.276) were significant independent factors for post cesarean section surgical site infection.*

**Conclusion and recommendation :** *Post cesarean section surgical site infection was high in Mizan Tepi University teaching hospital and Rupture of membrane <24 hours ,pre-op hematocrite count of <30% and post-op admission for less than 8 days were significant factors for post cesarean section surgical site infection. Effort should be made to prevent prolonged rupture of membrane by awareness creation and accessing maternal waiting rooms. Accessing and proper counseling on the purpose and appropriate utilization of iron folate at ANC setting should be stressed. Furthermore, standard infection prevention techniques and excellent surgical techniques would reduce surgical site infections harbored by prolonged admission*

**Key words;** *cesarean section, surgical site infection, post cesarean section infection, risk factors for CS wound infection.*

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## List of acronyms or abbreviations

<b>ANC</b>	Antenatal care
<b>ASA</b>	American society of anesthesiologists
<b>CDC</b>	Communicable disease control
<b>CS</b>	Cesarean section
<b>GA</b>	Gestational age
<b>HAI</b>	Hospital acquired infection
<b>HCT</b>	Hematocrite
<b>HTN</b>	Hypertension
<b>HIV</b>	Human immune deficiency virus
<b>JUMC</b>	Jimma University medical center
<b>ML</b>	Milliliter
<b>MTUTH</b>	Mizan Tepi University teaching hospital
<b>NGO</b>	Non governmental organization
<b>PRE-OP</b>	Pre operation
<b>PROM</b>	Premature rupture of membrane
<b>POST OP</b>	Post operation
<b>SSA</b>	Sub Saharan Africa
<b>SNNPG</b>	South nations, nationalities and peoples government
<b>SSI</b>	Surgical site infection
<b>SPP</b>	Species





## **Chapter one: - Introduction**

### **1.1:-Back ground**

Cesarean section is an operative technique by which a fetus is delivered through an abdominal and uterine incision (1). Essential and emergency obstetric care has been prioritized politically in many low- and middle-income countries in order to reduce maternal and child mortality and morbidity (2). In the developing world, access to cesarean section (CS) is one hallmark of emergency obstetric services (3).

For more than three decades, the international healthcare community has considered the optimal rate for caesarean sections to be between 10% and 15% and caesarean section can effectively prevent maternal and perinatal mortality and morbidity (4).

According to Demographic and Health Survey report of 2011, the national cesarean rate is 1.5 % (5). Even though this figure is very low hospital based reports show increased rate of cesarean section in Ethiopia (6-8).

Even if, caesarean section has been a life saving procedure for mothers and new born, it also carries many risks than normal vaginal delivery (9-11). These complications include complications relating to anesthesia, bleeding and damage to the bladder, aspiration pneumonia, cardiac arrest, drug-related complications and post-operative infections including thrombophlebitis are among the common short term complications, whereas scar dehiscence and high rate of repeat cesarean section are cited as the common long term complications.(10)

Surgical site infections (SSI) are a significant cause of post-surgical morbidity and mortality and can be an indicator of surgical quality (12). CDC defines SSI as Infection occurs within 30 days (for caesarean sections) after the operative procedure. SSI is classified as Superficial Incisional Surgical Site Infection, deep Incisional Surgical Site Infection and Organ/Space Surgical Site Infection (13). Any breach in the integrity of skin and mucous membranes is a risk factor to acquisition of infection by endogenous or exogenous organisms. Surgery is a risk factor for acquisition of infection and nosocomial infections (14)

The development of clinical infection is dependent on a complex balance between host defense mechanisms and bacterial virulence factors. Cesarean delivery alters this balance so as to predispose the patient to infection. During labor and abdominal delivery, the endometrial and peritoneal cavity invariably is contaminated with large numbers of highly pathogenic aerobic and anaerobic bacteria. The serosanguineous fluid that collects in the abdomen after surgery and the injured uterine tissue at the site of the incision provide excellent culture media for microbial growth. The bacterial inoculum is particularly large when cesarean section is performed after multiple vaginal examinations and extended duration of labor and ruptured membranes (15). Endometritis is the most common cause of fever and infection after the caesarean delivery and caesarean is one of its main risk factors.

Staphylococcus was the most commonly isolated bacteria in SSI (16) and other organisms include Escherichia coli, Klebsiella, Pseudomonas, Nonfermenting gram-negative bacilli, enterobacter, Acinetobacte, serratiamacescens, proteusspp, streptococcusfaecalis, group streptococcus (17.)

## **1.2:-statement of the problem**

Caesarean section (CS) is the most commonly performed major abdominal operations among women in both developed and developing countries (18). Though it has become increasingly a safe and common surgical operation, it is still associated with significant morbidity and mortality (19). These morbidities can have short-and long-term health implications for the mother and the newborn. Mothers with post cesarean infections are prone to severe morbidity and long-term disabilities such as chronic pelvic pain, fallopian tube blockage, and secondary infertility and maternal infections before or during childbirth are associated with an estimated one million newborn deaths annually. In addition it can lengthen hospital stays and increase health care costs (20-22).

Infection remains the third leading cause of direct maternal mortality in the globe (23). Cesarean carries five to 20-fold increased risk of infection compared to vaginal delivery (24) and is the main risk factor of endometritis which was the common cause of fever and infection after cesarean delivery (25). SSI is a great threat to health; however, 26%–54% of these cases can be prevented (26).

In addition to the burden to patients, these episodes represent a significant financial burden to the health service. In a recent clinical and cost analysis in England, the Plymouth hospital, reviewed the impact of SSI following all surgical procedures to an individual hospital and found that they accounted for almost 4694 avoidable bed days over a two year period (27). The data released in 2009 by the United States Centers for Disease Control and Prevention (US CDD) showed that SSI increased medical costs by \$10,443–\$20, 842. (28).

The rate of post CS SSI varied from 5-18% globally (29). One research (30) report explained, the magnitude of the problem in developing countries was underestimated or even unknown largely for the reason that HAI diagnosis is complex and surveillance activities to guide interventions require expertise and resources. In SSA research findings show post cesarean section infection is still high and roots of complications. The incidence of post CS infection in the region reported by literatures ranges from 4.9 - 12.5(31-37), the lowest from Rwanda highest rate from Nnewi, Nigeria(31,37).According to a study conducted in Ethiopia, the incidence of surgical site infection was 51%.(38). Another study revealed surgical site infection rate among obstetric cases was 11.4 % (36).

Research report illustrated factors associated with a post c-section surgical site infections were, pregnancy induced hypertension, prolonged labor duration. Type of surgery (emergency and elective), prolonged operation time, multiple vaginal examinations during labor, Chorioamnionitis, presence of meconium, large intraoperative blood loss and Perioperative blood transfusion Absence of antenatal care follow up. Younger age, premature rupture of the membranes, and neonatal death Co morbidities such as HIV, severe anemia and gestational diabetes were also reported as factors associated with post CS SSI (31-36)

Similar to other low income countries, the extent of the problem expected to be high in Ethiopia (30), but the problem was not studied well in our country. Only one research was done in JUMC on "surgical site infection rate and risk factors among obstetric cases" and it had a limitation to show the association of Obstructed Labor, Pregnancy induced HTN, Uterine rupture, APH, previous cesarean section Malpresentation Multiple gestation Cord prolapsed, co morbidities with post c-section SSI, so this study is aimed to find out factors associated with post cesarean section SSI among mothers underwent c-section in MizanTepi university teaching hospital attempting to draw information that helps for increasing maternal quality of care, the implementation of better infection prevention practice in the study setting.

### 1.3 Significance of the study

Even if it is very common to see post CS infection complications, “factors associated with post c-section SSI” was not adequately studied.

So study on this issues will have significant by filling the previous research gaps by examining association of important variables / Obstructed Labor, Pregnancy induced HTN, Uterine rupture, Malpresentation, Multiple gestation Cord, prolapsed, co morbidities, APH, previous cesarean section/ to post c-section wound infection in detail, because these factors were not addressed on the previous study.

Plus to that, it will have significance

- ✓ By being base line information for researchers, for government, NGOs as well as other concerning bodies.
- ✓ Help in implementation of better infection prevention practice in the study setting

## **Chapter two:-literature review**

### **2.1 prevalence of post cesarean section infection**

According to study conducted in India, among 5864 cesarean deliveries, 254 (4.33%) found to be infected (39). Another study was conducted in southern part of this country by collecting data from the post-operative lower segment CS (LSCS) on a day-to-day basis and Patients with SSI were identified. According to this study similar finding was reported to the above study result (4.1% of subjects had SSI) (40).

A study was done to find out the incidence of wound infection and to survey the risk factors for wound infection in obstetrics and gynecology department of Nepal medical college teaching hospital (NMCTH) and the frequency of wound infection was found to be 5.87 % (41).

The department of prevention and infection control Fêmina in Brazil performed retrospective study at the Hospital Fêmina, and evaluated all cesarean deliveries from January 2009 to December 2012 for SSI. A total of 8180 patients underwent cesarean at the hospital over the four-year study period, of which 118 (1.44%) were diagnosed with SSI after cesarean delivery (42)

According to study conducted in Pakistan, Department Of Obstetrics and Gynecology Hayatabad Medical Complex, Peshawar from April 2012 to September 2012 on 241 patients who underwent emergency c-section. Out of which 29(12%) patients developed SSI post-operatively (43).

Study conducted on 1611 patients by following each patient from the time of admission until discharge in Saudi Arabia. Surgical wounds were inspected at the time of the first dressing and weekly thereafter for 30 days. Also, swabs from deeper part of the wound were taken from the infected surgical sites, and routinely from the surface of non-infected sites. The specimens were gram stained and examined for the presence of organisms. The incidence rate of surgical site infections was found to be 11.4% (44).

Records of mothers four hundred and eighty five hospital records were reviewed, and 44 (9.1%) developed SSI after cesarean delivery in Aminu Kano Teaching Hospital (16).

Similarly, high incidence of post c-section infection rate was also reported from finding of study conducted in Nnamdi Azikiwe University Teaching Hospital Nnewi Nigeria (12.5%) (37). A study of patients delivered by caesarean section in this country Amaku General Hospital found Fifty-six (56) patients (11%) had developed wound infection (45).

According to study done in Tanzania among pregnant women who underwent CS at Bugando Medical Centre, the overall cumulative incidence of SSI was 10.9 (33).

Among women who had cesarean delivery in Rwanda, Butare university teaching hospital, 4.9% developed SSI majority of infections were superficial surgical site infection (75%) and most of the infections developed after discharged (62.5%) and there were two deep SSI and two organ SSI and no infection related maternal deaths(31).

A research report from Burundi, Democratic Republic of Congo (DRC), and Sierra Leone from 1,276 women underwent CS Showed the incidence of SSI was 7.3 % and 93 % of SSI were superficial (32).

Study done in JUMC showed prevalence of SSI of 10.6% in women underwent hysterectomy, 11.4%, in women underwent CS, and 30% among mothers underwent destructive delivery (36).

## **2.2 Factors associated with post CS infection**

A study conducted in a tertiary care center and a teaching hospital at Kerala, South India, mothers with body mass index (BMI) (above 25) were 1.5 times more likely to develop post cesarean section surgical site infection than mothers whose BMI was < 25, hypertensive mothers were 3.97 times more likely to be affected with post c-section surgical site infection. Prolonged pre-operative hospital stay was 2 times risk for post cesarean section surgical site infection (40). Another study done in similar country, Major factors related to wound infection were poor nutrition (iron deficiency anemia and protein calorie malnutrition), poor hygiene, and pregnancy induced hypertension, and prolonged labor. No significant difference was found in emergency and elective surgeries (39).

A study which was carried out in the tertiary care teaching hospital, in India over a period of two years on 3498 surgeries and illustrated that Overweight, previous laparotomy scars, emergency surgery and caesarean section following prolonged labor were the common risk factors associated with the development of SSI. In addition, Suboptimum peri-operative conditions related to preparation of patient for surgery, below ideal operation theatre conditions, humidity, long list of operations, practice of shaving of part day prior, water scarcity in summer and casual approach by health professionals while surgical scrubbing and donning and uncontrolled movement of patient's relatives in the postoperative ward predisposed patients for development of SSI according to this finding (47).

SSI was found to be common in women who had rupture of membrane before surgery, who underwent emergency surgery, the women who had vertical skin incision and interrupted skin suturing during surgery in Dhulikhel, Nepal. (48)

A retrospective Study from Brazil demonstrated an association following univariate analysis between post-cesarean SSI and number of internal vaginal examinations, time of membrane rupture, emergency



cesarean and improper use of antibiotic prophylaxis. Only emergency cesarean associated with cesarean section SSI following multivariate analysis. (42)

According to study done in four countries in SSA (Burundi, the Democratic Republic of Congo (DRC), and Sierra Leone.), Younger age, premature rupture of the membranes, and neonatal death were also reported associated with increased risk of SSI, while antenatal hemorrhage was associated with a lower risk of developing a SSI. According to this study, age 30 years and below were 2.1 times more likely to develop CS SSI than that of greater than 30 years old. Mothers with premature rupture of membrane had 2.1 times more likely to acquire CS infection than those mothers without membrane rupture. Neonatal death has 2.7 times risk, while ante partum hemorrhage was protective for post cesarean section SSI (32).

Research from Kanu, Nigeria illustrated Statistically significant determinants of post c-section infection were Long duration of labor before CS, Long operation time, heavy intraoperative blood loss and blood transfusion (16). Another study from this country also showed body mass index >25, prolonged rupture of membranes, prolonged operation time, post-op anemia, blood transfusion, multiple vaginal examinations during labor and long duration of labor prior to caesarean section were found to be significantly associated with cesarean wound infection (45).

Research conducted in Tanzania mother with Hypertensive disorders of pregnancy were 2.9 times more likely to develop post CS SSI than mothers without Hypertensive disorders of pregnancy, Mothers with multiple vaginal examinations were 2.6 more likely to develop post CS SSI than those without multiple vaginal examinations, prolonged duration of operation and an operation performed by an intern or junior doctor were significant predictors for post CS SSI (33).

Study in JUMC reported that Women from rural areas had more severe form of surgical site infection compared to those from urban, Surgical Site Infections prevalence in women who underwent emergency surgery was twice as high as those who were operated on elective basis. Chorioamnionitis was significantly associated with SSIs. Women with intra-operative blood loss of more than 1000 ml were more likely to have perioperative blood transfusion and had a statistically significant association with increased severity of SSIs Presence of meconium was strongly associated with increased severe form of SSIs(36)

## Conceptual framework

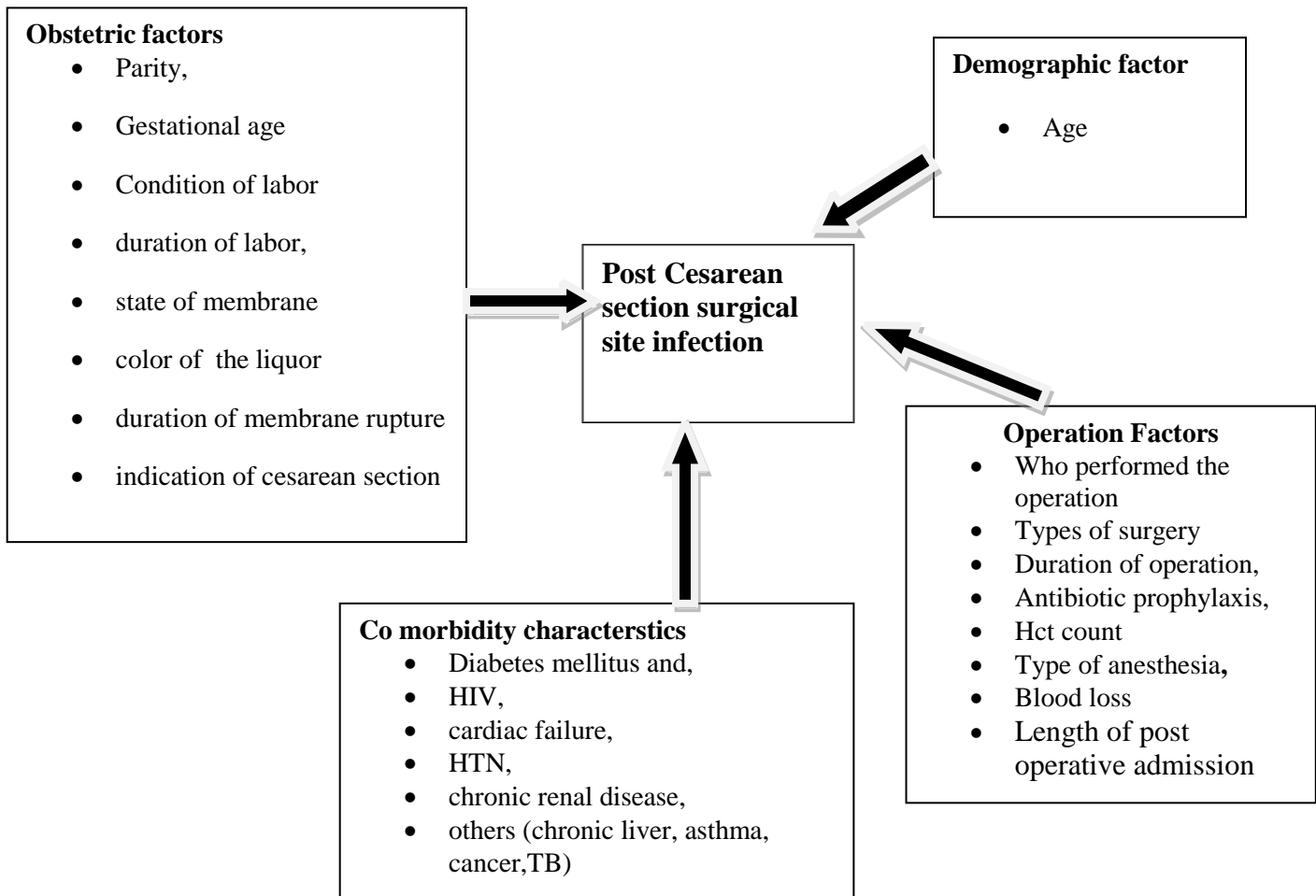


Figure1 conceptual framework after reviewing literatures (adapted from literatures)

## **Chapter three- objectives of the study**

### **3.1 General objective**

To assess factors associated with post cesarean section surgical site infection among mothers who underwent cesarean section in Mizan Tepi university teaching hospital, south west Ethiopia, 2017.

### **3.2 Specific objectives**

1. To determine the prevalence of post cesarean section surgical site infection among mothers who underwent cesarean section in MTUTH.
2. To identify associated factors of post cesarean section surgical site infection among mothers who underwent cesarean section in MTUTH.

## **Chapter four:-methods and materials**

### **4.1 Study area and period**

Data collection period was from March 10/2017 to March 30/2017.

Mizan Tepi university teaching hospital is found in south nations, nationalities and peoples regional government (SNNPRG), Bench maji zone. It is 561 km away from Addis Ababa, the capital city of Ethiopia, in south west direction. It was established in 1971 during the “Derg” regime and has been serving bench maji zone, keffa zone, sheka zone and partial Gambella regions (Mejag zones).as referral center. Currently, there are 2 general surgeons, 2 gyneocologists,22 GPs,103 nurses and 23 midwives, in the hospital.

From 11/9/2013-10/9/2016 Or from “meskerem” 1/2006-“pagume” 5/2008 E.C 1317 CS delivery services Provided in the hospital. Four hundred fourteen (414) CS delivery services provided from 11/9/2013-10/9/2014, 538 from 11/9/2014-11/9/2015 and 365 CS services given from 12/9/2015-10/9/2016.

### **4.2 Study design.**

Institution based cross-sectional descriptive quantitative study was conducted in Mizan Tepi university teaching hospital.

### **4.3 Population**

#### **4.3.1 Source population**

All cards of mothers who underwent cesarean section from 11/9/2013-10/9/2016 in the hospital

#### **4.3.2 Study population**

All sampled cards of mothers who underwent cesarean section from 11/9/2013-10/9/2016.

### **4.4 Eligibility criteria**

#### **4.4.1 Inclusion criteria**

All cards of the mother who underwent CS from 11/9/2013-10/9/2016

#### **4.4.2 Exclusion criteria**

In complete cards or not clear to read were excluded.

### **4.5 Sample size**

The sample size was calculated using single population proportion formula

P was taken from research done at JUSH on “*surgical site infection rate and risk factors among obstetric cases*” according to this finding, the incidence of SSI is **11.4 % ( 36)**

$$n = \frac{z \left( \frac{\alpha}{2} \right)^2 * P(1 - p)}{d^2}$$

Where n = minimum sample size required for the study.

Z= standard normal distribution (Z=1.96) with confidence interval of 95% and  $\alpha=0.05$

P=prevalence/ population proportion (p=0.114)

d= is a tolerable margin of error (d=0.03)

$$\Rightarrow 1.96^2 \times 0.114 (1-0.114) / (0.03)^2 = 431.12 \Rightarrow 432$$

To get sample from the total population correction formula was used. The final sample size therefore was calculated as follows

$$nf = \frac{n}{1 + n/N}$$

n = calculated sample size

n f = exact (final sample)

N = sample population

$$nf = 432 / (1 + 432/1317) = 325$$

#### 4.6 sampling procedures

All cards of mothers who underwent CS from 11/9/2013-10/9/2016 were collected, incomplete cards; cards which were not clear to read were filtered and excluded. Complete cards were separated and categorized according to the year of surgery. Sampling frame was prepared for each category of cards. To allocate samples proportionally, to each year, the formula  $\frac{N_i * N_f}{N}$  was used.

Where  $N_i$  = total number of complete cards in each year

$N_f$  = the final sample size

$N$  = total number of complete cards in the 3 years

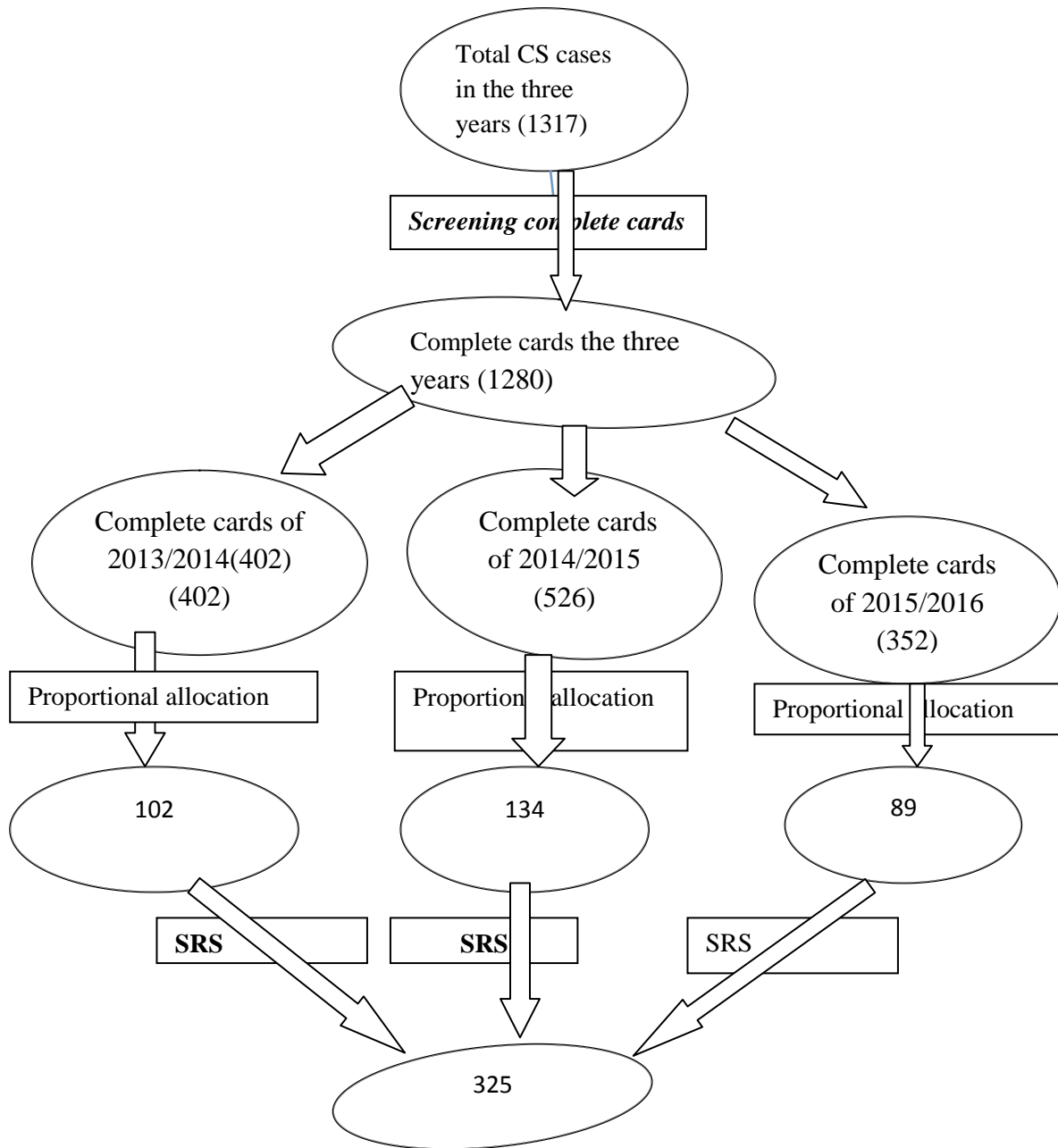
According to data obtained from the hospital, there were 1317 total CS case in the last three years. 414 CS cases in 2006 (from 11/9/2013-10/9/2014) from which 402 were complete. 538 in 2007 (from 11/9/2014-11/9/2015) and 526 were complete and 365 CS services given in 2008. (From 12/9/2015-10/9/2016) of which 352 cards were complete. Total of 1280 cards were complete. Therefore numbers of samples were calculated from each year as follows.

$$n_{2006} = \frac{402 \cdot 325}{1280} = 102$$

$$n_{2007} = \frac{526 \cdot 325}{1280} = 134$$

$$n_{2008} = \frac{352 \cdot 325}{1280} = 89$$

Finally, Samples were extracted by simple random sampling (by lottery) method.



**Key SRS;** Simple random sample

Figure 2 schematic presentation of sampling procedure

## **4.7 Data collection methods and procedures**

### **4.7.1 Data collection instrument**

Data were collected by pre-designed questionnaire which was adapted and modified from different reviewed literature and it had 4 parts: Demographic, obstetric, co morbidity and operation factors.

### **4.7.2 Data collectors' selection and training**

The data were collected by 5 diploma midwives using the predesigned record review data collection tools from record after having two days training. Two Bsc midwifery supervisors were trained and strictly follow the data collection process.

### **4.7.3 Data collection procedures**

All cards of mothers who underwent cesarean section from 11/9/2013-10/9/2016 were screened from medical log books. After sampling procedure was done as described above, demographic character of women, obstetrics factors, co morbidity factors, Operation Factors, were collected by using the predesigned record review data collection tools from mothers' card. The CDC standardized surveillance criteria for defining surgical site infections, was used to detect post cesarean infections.

### **4.7.4 Pre test**

Before the main data Collection pre-test was made on 5% of the actual samples at GebretsadikShawo hospital which is 100km far away from MTUTH. The questionnaire was modified based on pretest result.

## **4. 8 Variables**

### **4. 8.1. Dependent variable**

- Post CS SSI infection

### **4. 8.2 independent variables**

#### **4.8.2.1. Demographic character of women**

- ❖ Age

#### **4.8.2.2 Obstetric related factors**

- ❖ Parity ,
- ❖ Gestational age,
- ❖ condition of labor, duration of labor,
- ❖ membrane state, duration of membrane rupture,
- ❖ type of liquor



- ❖ Indication of CS

#### **4.8.2.3. Co morbidity factors**

- ❖ Diabetes,
- ❖ cardiac failure,
- ❖ chronic renal disease,
- ❖ HTN,
- ❖ HIV status,
- ❖ others (chronic liver disease, cancer, Asthma, tuberculosis)

#### **4.8.2.1.4. Operation factors**

- ❖ Who performed the operation?
- ❖ types of surgery
- ❖ Duration of operation,
- ❖ Antibiotic prophylaxis,
- ❖ Hct count
- ❖ type of anesthesia,
- ❖ amount of blood loss during surgery,
- ❖ length of post-op stay at hospital,

### **4.9. Operational definitions**

**Post cesarean section surgical site infection.** Is identified as Infection occurred within the first 30 post-operative days and with any one of the following signs and symptoms

- *Purulent discharge from surgical site or other organ/space*
- *Organisms isolated from fluid/tissues*
- *At least one sign of inflammation (indurations, erythema, local rise of temperature)*
- *Wound intentionally opened by the surgeon for drainage*
- *Fever (> 38°C)*
- *Localized pain or tenderness*
- *abscess*

• **OR**

- ✓ *Surgeon, attending physician or other designee declares the wound is infected.*

#### **4.10. Data quality management**

To ensure the quality of data, two days of training was given for data collectors and supervisors on the objective and relevance of the study, the whole contents of the record to be reviewed, and the contents of the tool, Pre data Collection test was made .The questionnaire was modified based on pretest result. Reliability of the tool was checked and chronbach'S Alfa was 0.81. Principal component analysis was done to check validity of the tools and cumulative variance was 73%. Two Bsc midwifery supervisors were trained and strictly follow the data collection process closely.

#### **4.11. Data analysis procedures**

Data were checked for completeness, categorized, coded and entered into epi data 3.1 and exported in to SPSS 20.0 for analysis. Descriptive analysis such as percentage and frequency distribution was used. Binary logistic regression was used to describe the association of dependent and each independent variables and result from bivariate analysis of  $p < 0.25$  was moved to multivariable logistic regression and Significance of statistical association was tested using 95% confidence interval and p value ( $< 0.05$ )

#### **4.12. Ethical consideration**

Official letter was obtained from ethical review board of Jimma University; permission was requested from Mizan-Tepi university teaching hospital. The name of the sampled mothers was not be included in the questionnaire.

#### **4.13. Dissemination plan**

The results of the finding will be communicated with the hospital &with Jimma University. Furthermore, efforts will be geared to publish in different trustworthy journals.

## Chapter five; Results

A total 325 records of mothers who underwent cesarean section in three years period (11/9/2013-10/9/2016) in MTUTH were reviewed from March 10/2017 to April 8/2017.

Majority of the participants (71.7%, N=233) were in 20-34 age groups, only 13.2% (N=43) were >34 years old. (See table 1)

Table 1-Age distribution of mothers included in the study in Mizan Tepi university teaching hospital, 2017

Variable	Frequency	Percent
<b>Age</b>		
<20	43	13.2
20-34	233	71.7
>34	49	15.1
Total	325	100.0

Two hundred nine of participants (64.3%) were multi Para. Only eight percent (N=26) were nullipara at the time of admission. The mean parity of the study sample was 2.07( $\pm 0.075$ ). Majority of the women, 75.7% (n= 246) had caesarean section during their 37-40 weeks gestation period. Two hundred eighty nine participants (88.9%) had been in labor before the operation. Among them 81.3% (n=235) underwent CS before 24 hours of the start of labor. More than half of the mothers (54.8) had a record of membrane rupture of which 25.6 % (n=41) had a record of more than 24 hours duration. The most indication for CS was obstructed labor/failure to progress (20.6%) followed by fetal distress (18.8%, N=61). Nearly eleven percent (10.8%) of the operation was due to pregnancy induced hypertension, while only 11 (3.4%) of the mothers indicated due to other cases. Table 2 summarizes obstetric characteristics of the subject in the study.

Table 2-Obstetric characteristic of study participants in Mizan Tepi university teaching hospital 2017

CHARACTERSTICS	FREQUENCY	PERCENT
<b>parity</b>		
nulipara	49	8
primipara	76	23.4
multipa	209	64.3
grand multipara	14	4.3
Total	325	100
	Mean parity( $\pm$ SE of mean)	2.07( $\pm$ 0.075)
<b>Gestational age</b>		
<37wk	66	20.3
37-40wk	246	75.7
>40wk	13	4.0
Total	325	100.0
<b>Client has been in labor in labor before operation</b>		
yes	289	88.9
no	36	11.1
Total	325	100.0
<b>Duration of labor</b>		
<24hr	235	81,3
>24hr	54	18.7
Total	289	100.0
<b>Membrane state</b>		
Intact	132	45.2
ruptured	160	54.8
Total	292	100.0
<b>Duration of membrane rupture</b>		
<24hr	119	74.4
>24hr	41	25.6

>24hr Total	160	100.0
<b>Color of the liquor</b>		
clear	121	75.5
meconium stained	30	18.8
bloodstained	9	5.6
Total	160	100.0
<b>Indication of CS</b>		
Obstructed Labor	67	20.6
Pregnancy induced hypertension	35	10.8
Uterine rupture	18	5.8
Antepatem hemorrhage	15	4.6
Previous CS	58	17.8
Mal-presentation	44	13.5
Multiple gestation	19	5.8
cordprolapse	12	3.7
Fetal distress	61	18.8
<b>other*</b>	11	3.4
Total	325	100.0

\*others include induction/augmentation failure, PROM, malposition, postdated pregnancy, c/s by request.

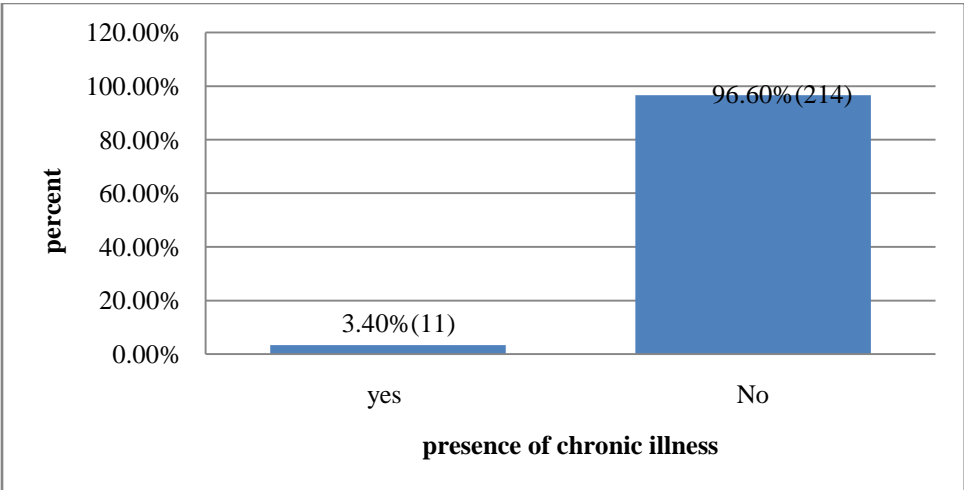


Figure 3 bar graph showing Percent of co morbidity among participant mothers in MTUH, March 2017

Eleven clients (3.4%) had known chronic disease, five (45.5%) of which were diabetic patients and three (27.3%) were hypertensive.

Table 3 Diagnosis of chronic disease among mothers underwent cesarean section in MTUTH, March 2017

Variable	frequency	Percent
<b>Diagnosis of diagnosis</b>		
Cardiac	1	9.1%
Diabetes	5	45.5%
Hypertension	3	27.3%
HIV	2	18.2
TOTAL	11	100

Two hundred fifty four (78.2%) operations were done by gynecologists; nearly ninety percent (89.2%) of the operation were done under emergency basis. Nearly 60% operations were performed within 15 minute, while only (0.3%) within 45-60minutes. Only one third (33.5%) participants given regional anesthesia

Only twelve (3.7%) participants didn't receive prophylaxis. Nearly half of the mother's (48.6%) estimated blood loss was less than 500ml. Four percent clients were transfused with blood. Majority of the study participants (81.8%.N=266) were admitted for less than eight days after surgery. (See table 3)

Table 4 Operational characteristics of study participants in Mizan Tepi university teaching hospital March 2017

Variables	Frequency	Percent
<b>Who performed the operation?</b>		
Emergency surgeon	58	17.8
Resident	13	4.0
gynecologist	254	78.2
Total	325	100.0
<b>Type of operation</b>		
Emergency	290	89.2
Elective	35	10.8
Total	325	100.0
<b>Duration of the operation</b>		
<15min	192	59.1
15-30min	114	35.1
30-45min	18	5.5
45-60min	1	0.3
Total	325	100.0

<b>Type of anesthesia</b>	109	33.5
Regional	216	66.5
General	325	100
Total		
<b>Had Prophylaxis given?</b>		
Yes	313	96.3
No	12	3.7
Total	325	100.0
<b>Estimated blood loss</b>		
<500ml	158	48.6
500-1000ml	145	44.6
1001-1500ml	17	5.2
>1500ml	5	1.2
Total	325	100.0
<b>Pre-op hct count</b>		
<30%	48	14.8
>30	277	85.2
Total	325	100.0
<b>Was client transfused?</b>		
Yes	13	4.0
No	312	96.0
Total	325	100.0
<b>Post –op hospital stay</b>		
<8days	266	81.8
>14days	59	18.2
Total	325	100.0

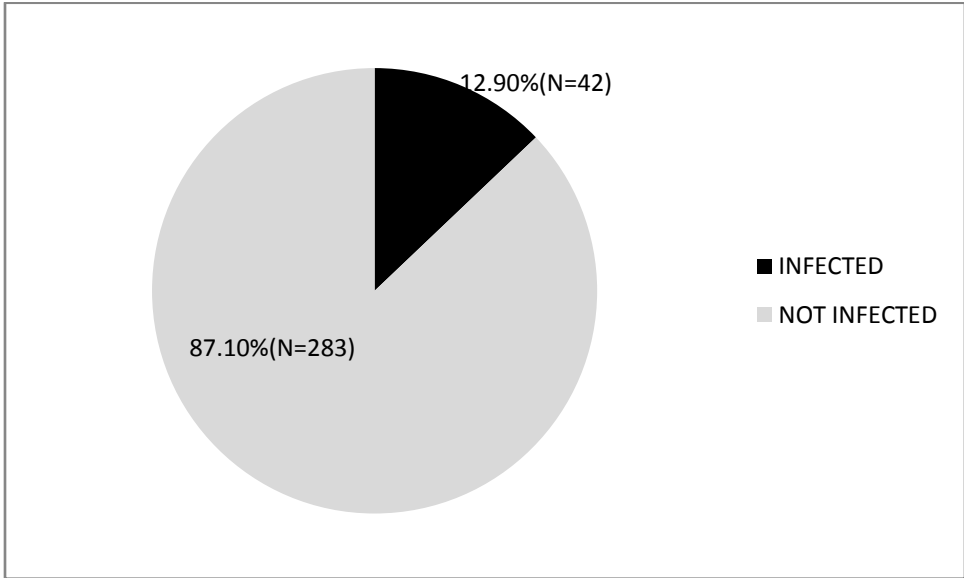


Figure 4 Pie chart showing Status of infection among mothers (participants) in MTUTH, March 2017

According to this study 42 (12.9%) of mothers developed infection after cesarean section and 87.1% of mothers didn't develop surgical site infection.

### Factors associated with post cesarean section surgical site infection

In multivariable analysis, duration of membrane rupture <24 hours, pre-op Hct count<30% and length of post op-hospital admission for less than 8 days had a statistically significant association with post cesarean section surgical site infection.

Women with rupture of membrane less than 24 hours had 64% times lower odds of developing post Caesarean wound infection than mothers whose membrane ruptured for more than 24 hours, women with pre-op hct count less than 30% were 2.6 times more likely to develop pos C-section surgical site infection than those mothers with Hct count more than 30%. The likely hood of post CS SSI infection in mothers admitted for less than eight days was 89.1% times lower than mothers admitted for more than 8 days post operatively(see table 5).

Table 5 Multivariable logistic regression analysis for factors associated with post cesarean section surgical site infection among mothers underwent CS in MizanTepi university teaching hospital, 2017

VARIABLE	INFECTION STATUS		COR (CI 95%)	AOR (95% CI)
	Yes(N=42)	No(N=283)		
	N (%)	N (%)		
<b>Age</b>				
<20	15(30.6)	34(69.4)	0.672(0.239,4.320)	3.447 (0.805,14.760)
20-34	19(7.7)	227(92.3)	3.462(0.112,8.334)	1.250 (0.163,9.568)
>34	8(26.7)	22(73.3)	1	1
<b>Parity</b>				
nuliparus	8(30.7)	18(69.3)	1.250(0.316, 4.940)	1.097 (.065, 18.468)
primipara	10(13.2)	66(86.8)	<b>3.667(1.020, 13.183)*</b>	3.574 (.213, 9.971)
multi para	19(9.1)	190(90.9)	5.556(1.689, 18.272)	3.617(.231, 16.629)
grand multipara	5(35.7)	9(64.3)	1	1



<b>Duration of membrane rupture</b> <24hr >24hr	11(9.2) 11(26.8)	108(81.8) 30(83.2)	<b>3.60(1.423,9.110)*</b> 1	<b>0.359 (0.129, 0.897)*</b> 1
<b>Pregnancy induced hypertension</b> Yes No	10(28.6) 32(11)	25(71.4) 258(89)	<b>3.225(1.420,7324)*</b> 1	0.318(.045, 2.232) 1
<b>Previous CS</b> Yes no	4(6.9) 38(14.2)	54(83.1) 229(85.8)	0.446(.153, 1.304) 1	4.310(.375, 9.551) 1
<b>Uterine rupture</b> Yes no	5(27.8) 37(12.1)	13(72.2) 270(87.9)	0.356(0.120,1.057) 1	0.443(.038, 5.201) 1
<b>Did the client have known chronic disease?</b>  yes no	3(27.3) 39(12.4)	8(82.7) 275(97.6)	0.378(0.096,1.486) 1	1.599(.346, 7.397) 1
<b>Type of anesthesia</b>  regional general	18(16.5) 24(11.1)	91(83.5) 192(89.9)	0.632(0.818,3.062) 1	.320 (.087, 1.175) 1
<b>Had Prophylaxis given?</b>  yes no	38(12.1) 4(33.3)	275(87.9) 8(76.7)	<b>3.618(1.040,12.595)*</b> 1	.385(0.088,2.688) 1
<b>Estimated blood loss</b>  <500ml 500-1000ml 1001-1500ml >1500ml	14(8.9) 19(13.1) 6(35.3) 3(60)	144(91.1) 126(86.9) 11(64.7) 2(40)	1 0.645 (0.311,1.339) <b>0.178(0.057,0.555)*</b> <b>0.065(0.010,0.421)*</b>	1 0.686(0.313,1.504) 0.452(0.127,1.608) 0.86(0.011,1.686)
<b>Pre-op hct count</b>  <30% >30	14(29.2) 28(10.1)	34(70.8) 249(89.9)	<b>3.618 (1.756,7.635) *</b> 1	<b>2.598 (1.125,6.003) *</b> 1
<b>Post –op hospital stay</b>  <8days 8 days and above	19(7.1) 23(39)	247(92.9) 36(61)	<b>6.402(3.224,12,715) *</b> 1	<b>0.109(0.043,0 .276)*</b> 1

\* Had statistically significant association for multivariate logistic regression (p <0.05)

## **Chapter six; Discussion**

The present study showed that the prevalence of surgical site infection among mothers under went cesarean section was 12.9%. This finding was higher than a study done in Jimma university medical center (JUMC) which was 11.4 % (36). This might be due to the fact that JUMC is one of a training institute among the country and has more experts and cesarean section procedures done by more skilled and experienced specialist doctors. This finding was much higher than reports from India, where the prevalence was 4.1 % (40), Nepal (5.87%) (41), Brazil (1.4%) (42). This could be explained by the presence of high standard of hygiene practice and presence of surveillance and infection control mechanisms in developed countries. The present finding was similar to reports from many African countries (31-33, 35-37, 45). The reason could be due to similarities in socio economic status.

My research result was similar with a research conducted in NnamdiAzikiwe University Teaching Hospital Nnewi Nigeria which was (12.5%) (37). This similarities might be due to the environment of the facilities. But, this research findings was much higher than finding from Butare University teaching hospital, Rwanda (4.9%) (31). This discrepancy might be 53.6% of the participants operation in this study were done in elective basis however, in my study, 89.2% of CS was done in emergency base.

According to this study, mothers who had a history of membrane rupture <24 hours were 64.1% times less likely to develop post cesarean section surgical site infection than those mothers whose membrane ruptured for > 24 hours. This may explain that when the length of duration of membrane rupture increases the chance of bacterial multiplication increases and ascending infection easily enters in the uterus and causes wound infection. This fact was supported by a research done in NnamdiAzikiwe University Teaching Hospital (NAUTH), Nigeria; the research revealed that the chance of post cesarean section SSI infection was 89 % (OR=0.11) less likely among mothers whose membrane was ruptured within 24 hours than those of more than 24 hours (37).

The role of anemia as predisposing independent factor for post CS wound infection report by Vijaya, K etal (39), was confirmed in my study. The likelihood of infection increases 2.6 times in pre-op anemic mothers ( Hct <30%) than mothers without pre-op anemia(Hct >30%). This may be because of iron deficiency anemia results in impaired oxygen transport in the uterus and causes delay in wound healing. Moreover, lack of oxygen causes tissue deaths, dysfunction of oxidative activities in the tissues and this creates conducive environment for wound infection. This finding was not correspondent with Jido and Garba (p=0.245) (16).

Post operative admission less than 8 days was found to be 89.1% times less risk for post CS SSI than that of post operative admission 8 days and above. This may explain fact that patients admitted for long duration are risk for nosocomial (hospital acquired infection). This infection may complicate cesarean section wound. Length of post -op hospital admission was not significantly associated with other published study (45).

## **Chapter seven; Strength and limitation of the study**

### **Strength**

This study included more variables (Obstructed Labor, Pregnancy induced HTN, Uterine rupture, Malpresentation, Multiple gestation Cord, prolapsed, co morbidities, APH, previous cesarean section) that were not dealt in the previous research.

### **Limitation**

Since the study was cross sectional, it did not include other factors like frequency of wound care; sterility techniques while the operation takes place, the environment of the ward in the study. Plus to that since this study was institution based study, the infection rate may be under estimated since most infections occur after discharge.

## Chapter eight; Conclusion and recommendation

### 8.1. Conclusion

Post cesarean section surgical site infection was high in Mizan Tepi University teaching hospital. Duration of membrane rupture <24 hours, Hematocrite count less than 30% and post op admission for less than 8 days duration were associated with post cesarean section surgical site infection.

### 8.2. Recommendation

1. **For Mizan Tepi university teaching hospital**, standard infection prevention techniques and excellent surgical techniques should be applied to reduce surgical site infections harbored by prolonged admission
2. **Catchment zones (bench Maji, Kefa, Sheka, Mejang zones)**; Effort should be made to prevent prolonged rupture of membrane by awareness creation and by accessing maternal waiting rooms at suitable environments for mothers and for easy referral. Accessing and proper counseling on the purpose and appropriate utilization of iron folate at ANC setting should be stressed and health professionals equipped with midwifery skills should be accessed so that early detection of problems and referral will be made
3. **For federal ministry of health**; active surveillance for post cesarean section surgical site infection should be established in hospitals and trainings for prevention of infection should be given.
4. **Researchers**: further studies should be conducted on other factors using other designs other than cross sectional.

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## Annex data collection tool

Jimma university of institute of health, faculty of health, school of nursing and midwifery

Data collection tool for assessment of factors associated with post cesarean section surgical site infection among mothers who underwent Cesarean section in Mizan Tepi university teaching hospital south west Ethiopia 2017

### 1. Demographic information

variables	Category
1.1 Age in years	_____

### 2. Obstetrics factors

2.1 parity	1. Para 0    2. Para 1    3. para 2 1. Para 3    5. Para 4    6. para $\geq 5$
2.2 Gestational age	1. <37wk s    2. 37-40 wks    3. >40 wks
2.5. Was the patient in labor before the operation?	1. yes 2. no
2.6 If yes for how long?	1. <24 hrs    2. >24 hrs.
2.7 What was State of membrane before the operation	1. Intact 2. Ruptured
2.8 If ruptured how long from rupture to operation?	1. <24 hours 2. >24 hours
2,9 What was the color of the liquor?	1. Clear    2. Meconium stained    3. blood stained
2.10 What was the indication of cesarean section?	1. O b s t r u c t e d L a b o r , 2. pregnancy induced hypertension, 3. Uterine rupture, 4. Ante partum hemorrhage , 5. Previous cesarean section 6. Malpresentation, 7. Multiple gestation,

	8. Cord prolapse, 9. Fetal distress 10. Other specify _____
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### 3. Co morbidity factors

variables	category
3.1. Did the pt have known chronic disease?	1. Yes      2. No
3.2. If yes what was the diagnosis?	1. cardiac disease 2. diabetes 3. hypertension 4. HIV 5. Renal diseases 6. Other specify _____

### 4. Operation factors

Variables	Categories
4.1 who performed the operation?	1. Emergency surgeon    2. Gp doctor 3. Resident                      4. Gynecologist
4.2 What was the type of operation performed?	1. Emergency      2. Elective
4.3. How long it took for the operation?	1. Less than 60 minutes      2. 60 to 90 minutes. 3. More than 90 minutes
4.4. What was the type of anesthesia given for the operation?	1. Regional      3. General
4.5 was prophylactic antibiotic administered to the pt?	1. Yes                      2. No
4.6. If yes, how long before the operation?	1. <15 min    2. 15-30min    3. 30-45min    4. 45 mins -60mins    5.> 1 hour
4.7 What was the estimated blood loss in ml?	1. Less than 500      2. 500-1000 3. 1001-1500              4. more than 1500

4.8 What was pre-op Hct count of the pt?	1. <30%	2. >30%
4.10. Was the pt transfused?	1. yes	2.No
4.11. Post-op hospital stay	1. <8 days	>=8 days

## 5. Assessment of infections

Infection indicator	Result
5.1 Has the pt had the following S/s within 30 days of operation?	<ol style="list-style-type: none"> <li>1. fever&gt;38<sup>0</sup>C</li> <li>2. purulent drainage from incision site or other adjacent organ/space</li> <li>3. Pain, tenderness, localized swelling, tenderness. Heat</li> <li>4. a deep incision spontaneously dehisced</li> <li>5. an abscess</li> <li>6. diagnosed wound infection</li> </ol>
5.2 Is SSI detected?	<ol style="list-style-type: none"> <li>1. Yes</li> <li>2. No</li> </ol>

