Journal of Medicine, Nursing & Public Health

Labor Related Factors That Contribute To Surgical Site Infections among Post Caesarean Section Mothers in Thika Level 5 Hospital

Jane Wanjiku Ndege, Prof. Sherry Oluchina & Dr. Benard Mbithi

ISSN: 2706-6606

Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 5||Issue 4||Page 39-51||December||2022|
Email: info@stratfordjournals.org ISSN: 2706-6606

Labor Related Factors That Contribute to Surgical Site Infections among Post Caesarean Section Mothers in Thika Level 5 Hospital

[*1]Jane Wanjiku Ndege, [2]Prof. Sherry Oluchina & [3]Dr. Benard Mbithi

[1]Master's Student, Jomo Kenyatta University of Agriculture and Technology

[2]Lecturer, Jomo Kenyatta University of Agriculture and Technology

[3]Lecturer, Jomo Kenyatta University of Agriculture and Technology

***E-mail of corresponding author: ndegejane6@gmail.com**

How to cite this article: **Ndege, J. W., Oluchina, S. & Mbithi, B. (2022). Labor Related Factors That Contribute to Surgical Site Infections among Post Caesarean Section Mothers in Thika Level 5 Hospital,** ***Journal of Medicine, Nursing & Public Health,*** **5(4), 39-51.** https://doi.org/10.53819/81018102t4112

Abstract

Caesarean Section is one of the most performed major surgical procedures carried out in obstetrics and constitutes about 15% of all deliveries worldwide, with Latin America being the highest at 29.2%. The study aimed to assess the labor related factors that contribute to surgical site infections among post caesarean section mothers in Thika Level 5 Hospital. The study design was a mixed unmatched case-control study which followed all mothers who had undergone caesarean section in maternity unit at Thika Level 5 Hospital and who had or did not have Surgical Site Infection from delivery up to two weeks post-delivery and nurse in-charges of maternity unit. The findings of the study informed the institution management on the determinants of surgical site infection following caesarean section, and took necessary precautions and surgical site care and management to prevent occurrence of surgical site infection in future. The findings revealed that prevalence of SSI was low among post Caesarean Section mothers at Thika Level 5 Hospital, with only 24.4% of the Caesarean Section mothers at Thika Level 5 Hospital found to have experienced SSI. The study in addition found that labor related factors had significant association with surgical site infections. Cases who had labor more than 8 hours were 3.12[95%CI=1.881 – 9.279, p<0.013] times more likely to have surgical site infections compared to controls. Cases who had ruptured membrane more than 24 hours were 3.85[95%CI=2.810 – 12.027, p=0.000] times more likely to have surgical site infections compared to controls. Finally, Cases whose indication of CS was previous CS scar were 7.41[95%CI=3.88 – 9.56, p=0.022] times more likely to have surgical site infections compared to controls. The study also concluded that most SSIs are preventable as Thika Level five hospital is employing different measures to reduce cases of SSI at the facility. It is thus recommended that the management of Thika Level 5 Hospital should pay a close attention to labor related factors that are likely to cause surgical site infections among post caesarean section mothers

being admitted in the facility. The study also recommended that a continuous education program for healthcare workers and young new mothers is necessary and can be feasible and potentially successful, given the interest expressed by healthcare workers in the management of surgical site infections.

Keywords: *Labor Related Factors, Surgical Site Infections, Post Caesarean Section*

1.0 Background of the study

Caesarean section is a surgical procedure where an incision is made through the mother's abdomen and uterus to deliver a baby /babies (WHO 2012). The surgery can either be elective or emergency. It is the most common major operation carried out in obstetrics and constitutes about 15% of all deliveries worldwide, with Latin America being the highest at 29.2% (Vogel *et al*., 2015). This is consistent with the assertions of Angela *et al*. (2006) that the incidence of caesarean sections has risen dramatically over the last few decades, with an estimated global number of 22.9 million caesarean section deliveries having been carried out in 2012.

Caesarean section may be necessary when vaginal deliveries pose a risk to the mother or the baby, when there is prolonged labor, obstructed labor, fetal distress, and malpresentation or on mother's choice (Teshager, Tilaye, Tesfaye & Antehun, 2017). Though caesarean section is an essential component in health care, complications after surgery significantly account for maternal morbidity and mortality. Similarly, Angela *et al*. (2006) asserts that caesarean sections are accompanied by a number of complications which include Surgical Site Infections (SSI).

Surgical Site Infections are infections occurring within thirty days after the surgical operation or within one year if an implant is left in place after the procedure and affecting either the incision or deep tissue at the operation site Horan *et al*. (2008). In Vietnam, Nguyen *et al*., (2011) asserted that 15% to 80% of Surgical Site Infections occurred after initial discharge from the hospital. The rate of Surgical Site Infections ranges from 3% to 15% worldwide. Likewise, a study by Mitt *et.al*. (2015) showed that in 2014, nearly 1.3 million caesarean sections were performed and 32% were associated with Surgical Site Infections.

In Sub-Saharan Africa, many mothers who undergo caesarean section deliveries had Surgical Site Infections as a common complication. According to Chu *et al*., (2015), risks of Surgical Site Infections are more in developing countries due to malnutrition, anaemia, poverty, poor preoperative preparation, wound contamination, poor antibiotic selection or inability of an immune-compromised patient to fight against the infection. In Ethiopia, a study on prevalence and root causes of surgical site infection among women undergoing caesarean section in Ethiopia Abay Mulu *et al.* (2019.) reported that Surgical Site Infections as the commonest cause of nosocomial infection in obstetrics and gynecology with a prevalence rate of 14.8% to 59%.

Kenya is no exception with many cases of Surgical Site Infections being reported. For example, a study done on incidence and determinants of Surgical Site Infections after caesarean sections at Kenyatta National Hospital indicated that, despite improvements in professionalism among healthcare providers, operating room practices, instruments sterilization methods, and infection prevention strategies, Surgical Site Infections are still high (Kabau, 2014). Similarly, in Thika Level V Hospital, cases of Surgical Site Infections amongst mothers after Caesarean Sections had been reported. A study by Alken *et al*. (2013) found that the rate of Surgical Site Infections among Caesarean Section mothers is 7.3%. Despite this, very few studies have been done in maternity unit at Thika Level 5 Hospital on determinants of Surgical Site Infections among post caesarean

section mothers. Therefore, there was need of a study to assess the labor related factors that contribute to surgical site infections among post caesarean section mothers in Thika Level 5 Hospital.

1.1 Statement of the Problem

The risk of postpartum infections is five to twenty times higher after Caesarean Sections than vaginal birth. The rate of surgical site infections following caesarean section ranges from 3% to 15% worldwide (Angela *et al*., 2006). These infections are associated with higher maternal morbidity and mortality rates. In Thika Level 5 Hospital the mortality rate was reported to be 2% in the year 2019 (Statistics of Thika Level 5 Hospital mortality, 2019). Cases of Surgical Site Infections had been on the rise among mothers who had undergone Caesarean Section in Thika Level V Hospital. A study conducted by Alken *et al.* (2013) on evaluation of surveillance for SSIs at Thika Level V Hospital established that the rate of Surgical Site Infections among Caesarean Section mothers was 7.3%.

Surgical site infections are the most common reported Health Acquired Infections (HAIs) arising from surgery. They account for significant cost of care as a result of increased morbidity and mortality, prolonged hospital stays and re-admissions. They contribute to approximately 20% of unplanned admissions. The development of a Surgical Site Infection causes an increase in the clinical, economic and financial burden of surgery increases due to direct costs and indirect costs incurred (Andrew *et al.*, 2012). In a study conducted by Broex *et al.* (2009) it was demonstrated that in European hospitals patients who developed a Surgical Site Infection constitute financial burden approximately double that of patients who do not develop a Surgical Site Infection. The length of hospitalization was more than twice as long for patients with a Surgical Site Infection than the uninfected patients.

Surgical Site Infections negatively impact on patients' physical and mental health. Increased patient morbidity, mortality and loss of jobs during recovery are some of the indirect costs associated with Surgical Site Infections (Melling *et al.*, 2005). Thika Level 5 hospital has an average of 200 caesarean sections per month which is a rate of approximately 30 per cent of total deliveries. Despite the relatively high Caesarean Section in the facility, there are few documented evidences for determinants contributing to Surgical Site Infections among post caesarean section mothers. The study therefore set out to assess the labor related factors that contribute to surgical site infections among post caesarean section mothers in Thika Level 5 Hospital.

1.2 Research Question

What are the labor related factors contributing to surgical site infections among post caesarean section mothers at Thika Level 5 Hospital?

1.3 Research Objective

To assess the labor related factors that contribute to surgical site infections among post caesarean section mothers in Thika Level 5 Hospital.

1.4 Hypothesis

There is no significant association between labor related factors and surgical site infection among post caesarean section mothers in maternity unit at Thika Level 5 Hospital.

2.1 Theoretical Framework

The study used the Imogene King's Theory of Goal Attainment. This theory states that, 'Nursing is a process of action, reaction and interaction by which nurse and client share information about their perception in a nursing situation' and 'a process of human interaction between nurse and client whereby each perceives the other and the situation, and through communication, they set goals, explore means, and agree on means to achieve goals,' (Alligood & Tomey, 2010). According to King (Imogene, 2014), the goal of a nurse is to assist individuals to maintain their health so that they can perform their roles. The role of the nurse includes promoting, maintaining and restoring health, and caring for the sick, injured and dying.

Imogene King's Theory of Goal Attainment has the following propositions:

1. If perceptual interaction accuracy is present in nurse-patient interaction, transaction will occur.
2. If the nurse and patient make transaction, the goal or goals will be achieved.
3. If the goal or goals are achieved, satisfaction will occur.
4. If the goal or goals are achieved, effective nursing care will occur.
5. If transactions are made in nurse –patient interactions, growth and development will be enhanced.
6. If role expectations and role performance as perceived by the nurse or the patient are congruent, transaction will occur.
7. If the role conflict is experienced by either the nurse or the patient (or both) stress in the nurse-patient interaction will occur.
8. If a nurse with special knowledge communicates appropriate information to the patient, mutual goal-setting and goal achievement will occur.

Goal attainment represents outcomes which indicates effective nursing care, a critical element to provide cost effective quality care (Parker, 2006). The nurse meets, interacts and communicates with the mothers. If the nurse and mother agree upon the goals and means to achieve them, the goals are 99% achieved. Assessment is done by data collection based on relevant concepts. The mother's perception and history taking may help the nurse to know the morbidities such as diabetes mellitus, hypertension and HIV, which can lead to the patient developing Surgical Site Infections. Physical exam will reveal factors that can lead to poor wound healing, for example high body mass index (WEIGHT), pallor (anaemia).

Laboratory investigations would reveal whether a mother is predisposed to Surgical Site Infections. High blood sugar, low haemoglobin levels can lead to Surgical Site Infections. Based on the assessment done, the clinical judgement of mothers' actual and potential health problems, the nursing diagnoses are formed. According to King in process of this goal attainment, the nurse identifies the problem, concerns and hindrances about who should be approached for help (Black & Hawks, 2005). Evaluation would help in finding out whether the mother developed Surgical Site Infections or not. According to King, evaluation tells us about goal attainment and effective nursing care. Short term goals must not be met before the mother is discharged from hospital (Black & Hawks, 2005).

Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 5||Issue 4||Page 39-51||December||2022|
Email: info@stratfordjournals.org ISSN: 2706-6606

2.2 Conceptual Framework

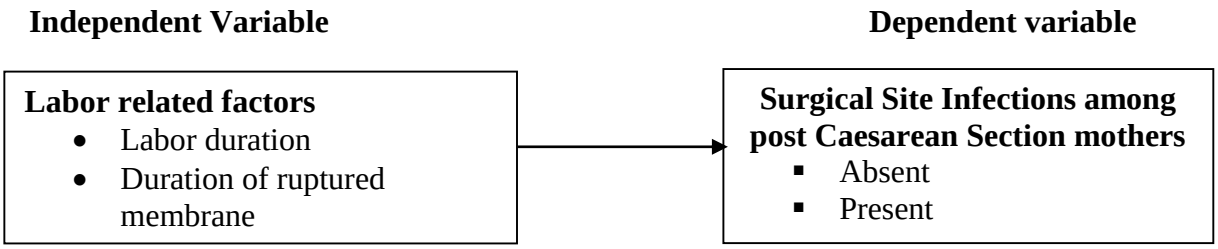

Figure 1: Conceptual framework

2.3 Empirical Review

Various Studies have demonstrated that some factors during labor may predispose the mother to surgical site infections post caesarian section. For example, a study done by Wodajo *et al.* (2017) at Hawassa University Teaching and Referral Hospital, Southern Ethiopia showed that the prevalence of surgical site infections was 11.0%. Prolonged labor for mothers (OR=6.78 at 95% CI: 2.54-18.00) and prolonged membrane rupture (OR=5.83 at 95% CI: 2.14-15.89) significantly increased the odds of Surgical Site Infections. Similarly, another study conducted by Gelaw *et al.*, (2017) on surgical site infection and its associated factors following caesarean section at a public hospital in Ethiopia, established that mothers who were in labor for more than 24 hours before caesarean section were more than three times at risk for surgical site infections than those who were in labor less than 24 hours (AOR=3.48; 95% CI: 1.25, 9.68). Likewise, the study showed that the chance for developing surgical site infections among mothers who had rupture of membrane before caesarean section was more than three times than in those who had intact membranes before caesarean section AOR=3.678; CI: 1.13, 11.96). Likewise, mothers who had a midline abdominal incision were more than five times more likely to develop surgical site infections compared to those who had pfannenstiel abdominal incision (AOR=5.733; 95% Cl: 2.05, 16.00).

According to a study done by Duff, (2015) on Diagnosis and Management of Postoperative Infection, frequent digital pelvic examination of the established preoperative factors increases the risk of post caesarean wound infection. Repeated vaginal examinations can introduce endogenous vaginal flora capable of causing Surgical Site Infections to the upper genital tract. This study also found that, in comparison to women with no digital examination, those with 1-4 and more than 4 examinations had three- and nine-times increased odds of Surgical Site Infections. A study done by Mpogoro *et al.* (2014) on Incidence and predictors of surgical site infections following caesarean sections at Bugando Medical Centre, Mwanza, Tanzania, it was reported that women who had three or more pelvic examinations had increased risk of post caesarean section wound infection with a hazard ratio of 2.6.

Risk of surgical site infection doubles with each additional operative hour. The longer the operation time the higher the risk of surgical site infection. Meconium-stained amniotic fluid is also associated with increased peripartum infection, independent of other risk factors for infection and thick meconium had higher infection rates than clear amniotic fluid (44% versus 13%) (Urquhart, Hanna, Brennan, Wluka, Leder, Cameron & Cicuttini, 2010). Presence of meconium is associated with increased severity of surgical site infections (Salim *et al.*, 2012).

Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 5||Issue 4||Page 39-51||December||2022|
Email: info@stratfordjournals.org ISSN: 2706-6606

3.0 Research Methodology

The study design was a mixed unmatched case-control study. In a mixed study design both quantitative and qualitative data is collected. A case control study compares patients who have a disease or outcome of interest (cases) with patients who do not have a disease or outcome (controls), and looks back retrospectively to compare how frequently the exposure to a risk factor is present in each group to determine the relationship between the risk factor and the disease (Himmelfarb Health Sciences, 2019). Cases included mothers who have been exposed to factors that contribute to Surgical Site Infections while the controls were made up of mothers who had undergone caesarean section but did not develop surgical site infection after the exposure to the risk factors.

The study was carried out at Thika Level Five Hospital reproductive health unit. Thika Level Five Hospital is strategically located at Thika Town, Kiambu County. It is the main referral hospital and serves patients from Nairobi, Machakos, Kirinyaga and Murang'a Counties. The hospital has an average of 200 caesarean sections per month which is a rate of approximately 30 per cent of total deliveries. (Health Information System, Thika, 2019). Thika Level five hospital reproductive unit has a daily average occupancy of one hundred patients. It consists of antenatal ward which is on the ground floor right wing, labor ward on the first-floor right wing, postnatal ward on the left wing, maternity theatre on the second-floor left wing, newborn unit on the right wing and gynae ward on the third floor. There is a capacity of two hundred adult beds and seventy cots. The study population was made up of all mothers who had undergone caesarean section in maternity unit at Thika Level 5 Hospital and nurses of reproductive health unit.

The study used Kelsely *et al.* (1996) formula

$$N_{Kelsey} = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \, p \, (1-p) \, (r+1)}{r \, (p_0 - p_1)^2}$$

α = the probability of type I error
β = the probability of type II error
r = ratio of cases to controls 1:3k,
p_0 = proportion of cases with exposure
p_1 = proportion of controls with exposure
95% Confidence Interval
N_{Kelsey} – Required sample size for the cases using Kelsey formula

p_0 – 0.5
p_1 – 0.21
r = 1:3
p = 0.5
q = 1-p = 1-0.5
= 0.5

$$n = [(1.96 + 0.842)^2 * (0.5 * 0.5) * (3 + 1)]/ [3 * (0.5-0.21)^2]$$

n = 32

Thus, based on the formula of Fleiss (1981) sample size for cases was 32, whereas for the control was 32*3=96.

Census is a statistical method that studies all the members of a population. The data collected through census is more reliable, accurate and representative. This is because data is collected from every individual on a personal level. Census as a method of data collection helps one study more than one aspect of all subjects of the population (U.S Census Bureau, 2019). The researcher adopted census technique to sample all clients who came for review at maternal child health clinic at 2 weeks in the hospital. Study participants who met the inclusion criteria were recruited consecutively into the study as they sought the routine clinical care services in the clinic. Once the client had been attended to at the clinic, and had received all the services they came for, the investigator approached and invited her for participation in the study. This ensured that the services she came for were not interrupted with the informed consent administered to the illiterate after explaining about the study, procedure, risk, benefits, discomfort and confidentiality.

Census was used to select the key informants from the population of reproductive health nurses. From them, information for the qualitative aim of the study was collected. Semi structured questionnaires were used to collect quantitative data from the mothers on the third day post-operatively or during discharge. Part I of the questionnaire was designed to collect social demographic characteristics and maternal factors, part II of the questionnaire was designed to collect labor related factors from the patient file and part III of the questionnaire was designed to collect institutional factors from the mothers. The key-informant guide was used to collect qualitative data from the nurse in charges working in the reproductive health unit.

Consent was sought from the participants before conducting the interview. On the third day post caesarean section or during discharge, socio- demographic/maternal characteristics, labor factors and institutional factors were filled in the questionnaires. Wounds were opened to ascertain whether the study participants had surgical site infections. They were explained to on how to identify signs of surgical site infections to include swelling on the operation site, oozing of pus, fever. They were advised to come back at two weeks for a check-up or before two weeks if there were signs of surgical site infections.

At two weeks the mother was assessed for any signs of surgical site infections after routine blood pressure check and assessment of the baby. Those found to have surgical site infections were taken for treatment while those without surgical site infections were given a phone number to call in case of any inquiries. The researcher made weekly follow up calls to find out the progress of study subjects. Return date was given on the sixth week for routine services for all the mothers. On the other hand, interview was used to collect qualitative data from nurse in charges in reproductive health unit at their convenient time to avoid interference with services.

Qualitative data was analyzed using content analysis while Quantitative data from the field questionnaires was double entered into a designed computer database. Data cleaning and validation was performed in order to achieve a clean dataset that was exported into Statistical Package for Social Sciences (IBM SPSS) software version 26 ready for analysis. Regular file back-up was done to avoid any loss or tampering of data. Qualitative data captured using, notes and verbatim expressions were transcribed into MS-Word into various areas and categories. All questionnaires and interview records were stored in lockable drawers for confidentiality.

Data analysis commenced by exploratory data techniques at the initial stage of analysis to uncover the structure of data and identify outliers or unusual entered values. Descriptive statistics such as

proportions was used to summarize categorical variables while measures of central tendency such as mean, standard deviations, and median were used to summarize continuous variables. In order to determine factors associated with being a case (having surgical site infection), Pearson's Chi-square test or fisher exact test was used to test for the association at bivariate level of analysis (statistical significance was be set at $p<0.05$.). All independent variables identified to be significantly associated with 'surgical site infection' at bivariate analysis were included in multivariable analysis to adjust for possible confounders and effect modifiers. This was performed using multivariable binary logistic regression. Adjusted odds Ratios (AOR) and their respective 95% Confidence Interval were used to estimate the strength of association between the retained independent factors and the outcome variable.

An introductory letter was sought from Jomo Kenyatta University of Science and Technology (JKUAT) School of Nursing while ethical clearance was obtained from JKUAT Ethical Research Committee. A permit to collect data was obtained from National Commission for Science, Technology and Innovation (NACOSTI) while an authority to collect data from Thika Level 5 was obtained from the Hospital Research Committee and also the from management of Maternity Unit. Informed consent was obtained from research participants and confidentiality of the participants was maintained. There was no risk or direct benefits to participants participating in the study.

4.0 Findings and Discussion

Response rate refers to the number of questionnaires sent to the field divided by the number of questionnaires completed and returned. The study targeted to collect data from 128 mothers who had given birth at Thika Level 5 Hospital, Kiambu County (32 cases and 96 controls). The study distributed 128 questionnaires to the mothers and 127 were returned hence achieving 99.2% response rate.

4.1 Descriptive Analysis

Table 1 showed descriptive analysis results on labor related factors of the respondents. The results depicted that majority of the respondents had had normal delivery (75, 59.1%); majority of the mothers had labor lasting between 4-8 hours (77, 60.6%). This study found that the duration of membrane rapture among most of the women was between 4 and 8 hours. Moreover, majority of the mothers had raptured membrane during delivery (92, 72.4%). Similarly, it was evident that majority of the mothers had their membrane rapture lasting at most 24 hours (90, 75%). It was also clear from the findings that most of the respondents agreed prolonged labor was an indication of CS (90, 70.9%). Regarding history of other infections, majority of the respondents did not have history of other infections (76, 59. 8%). The study also found that majority of the respondents had prolonged labor (66, 52%). Finally, the results showed that majority of the mothers believed the prolonged labor was capable of giving the infections (101, 79.5%).

Table 1: Descriptive Analysis on Labor Related Factors of the Respondents

	Cases		Controls		Total	
Variables	**N**	**%**	**N**	**%**	**N**	**%**
Have you ever had a normal delivery?						
No	3	9.7	49	51.0	52	40.9
Yes	28	90.3	47	49.0	75	59.1
What was the duration of labor?						
4-8 hours	11	35.5	66	68.8	77	60.6
More than 8 hours	20	64.5	30	31.3	50	39.4
Were the membranes ruptured?						
No	8	25.8	27	28.1	35	27.6
Yes	23	74.2	69	71.9	92	72.4
If Yes, indicate duration of ruptured membrane?						
24 hours and less	12	38.7	78	81.3	90	75.0%
More than 24 hours	19	61.3	18	18.8	37	25.0%
What was the indication of CS?						
Previous CS scar	19	61.3	18	18.8	37	29.1
Prolonged labor	12	38.7	78	81.2	90	70.9
History of any other infection?						
No	21	67.7	55	57.3	76	59.8
Yes	10	32.3	41	42.7	51	40.2
Did you have prolonged labor?						
No	14	45.2	47	49.0	61	48.0
Yes	17	54.9	49	51.0	66	52.0
Do you believe prolonged labor was capable of giving you infection?						
No	4	12.9	22	22.9	26	20.5
Yes	27	87.1	74	77.1	101	79.5

4.2 Association between Labor Related Factors and Surgical Site Infections

The study also conducted binary logistics regression to determine the relationship between labor related factors and surgical site infections. The findings were presented in Table 2. The table depicted that mothers who had had normal delivery were 0.53 times less likely to get SSI (OR=0.53 [95%CI=0.491-3.961]; p=0.012); the mother who underwent labor for a period of more than 8 hours were 4.09 times more likely to get SSI as compared to those who were on labor for between 4-8 hours (OR=4.09 [95%CI=0.872-3.733]; p=0.035). Additionally, the study established that women whose membranes raptured for more than 24 hours were 8.10 times more likely to get SSI as compared to those whose membrane rapture lasted at most 24 hours (OR=8.10 [95%CI=2.335-9.326]; p=>0.001).

Furthermore, it was evident from the table that respondents with history of other infections were 3.19 times more likely to get SSI compared to those who had no such history (OR=3.19 [95%CI=1.109-4.820]; p=0.011). Finally, the study established that mother who had prolonged

labor were 1.66 times more likely to get SSI as compared to those who did not have prolonged labor (OR=1.66 [95%CI=0.772-3.511]; p=0.036).

Table 2: Association between Labor Related Factors and Surgical Site Infections

	Cases		Controls			95%CI		
Variables	**N**	**%**	**n**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Have you ever had a normal delivery?								
No	3	9.7	49	51.0	Ref			
Yes	28	90.3	47	49.0	0.53	0.491	3.961	**0.012**
What was the duration of labor?								
4-8 hours	11	35.5	66	68.8	Ref			
More than 8 hours	20	64.5	30	31.3	4.09	0.872	3.733	**0.035**
Duration of ruptured membrane								
24 hours and less	12	38.7	78	81.3	Ref			
More than 24 hours	19	61.3	18	18.8	8.10	2.335	9.326	**0.001**
What was the indication of CS?								
Previous CS scar	19	61.3	18	18.8	Ref			
Prolonged labor	12	38.7	78	81.2	0.72	0.551	1.183	1.092
History of any other infection?								
No	21	67.7	55	57.3	Ref			
Yes	10	32.3	41	42.7	3.19	1.109	4.820	**0.011**
Did you have prolonged labor?								
No	14	45.2	47	49.0	Ref			
Yes	17	54.9	49	51.0	1.66	0.772	3.511	**0.036**
Do you believe prolonged labor was capable of giving you infection?								
No	4	12.9	22	22.9	Ref			
Yes	27	87.1	74	77.1	1.82	0.627	1.813	1.093

OR= Odds Ratio, CI= Confidence Interval, Ref = Reference

4.3 Predictors of Surgical Site Infections among post Caesarean Section mothers

Stepwise multivariate binary logistic regression was fitted on all significant (P<0.05) factors at bivariate analysis to model factors that contributes to surgical site infections among post caesarean section mothers. Backward conditional method was specified and variable removal threshold set at P < 0.05. Four factors were retained in the reduced model after five iterations were run. Cases who were aged more than 35 years were 7.82 [95%CI=2.669 – 11.208, p=0.007] times more likely to have surgical site infections compared controls.

Cases who had labor more than 8 hours were 3.12[95%CI=1.881 – 9.279, p<0.013] times more likely to have surgical site infections compared to controls. Cases who had ruptured membrane more than 24 hours were 3.85[95%CI=2.810 – 12.027, p=>0.001] times more likely to have surgical site infections compared to controls. Similarly, respondents who indication of CS was prolonged labor were 6.19[95%CI=3.112 – 9.544, p=0.009] times more likely to have surgical site infections compared to controls.

Table 3: Predictors of Surgical Site Infections among post Caesarean Section patients

		95%CI		
Variables	**AOR**	**Lower**	**Upper**	**P-Value**
Age				
<35 Years				
>35 Years	7.82	2.669	11.208	**0.007**
The duration of labor				
4-8 hours	Ref			
More than 8 hours	3.12	1.881	9.279	**0.013**
Duration of ruptured membrane				
24 hours and less	Ref			
More than 24 hours	3.85	2.810	12.027	**0.001**
The indication of CS				
Not prolonged labour	Ref			
Prolonged labor	6.19	3.112	9.544	**0.009**

AOR= Adjusted Odds Ratio, CI= Confidence Interval, Ref = Reference

5.0 Conclusion

Labour related factors associated with SSI were duration of labor, duration of ruptured membranes, prolonged labour and previous c/s scar. The study further concludes that when analyzing type of caesarean section, an unplanned procedure, especially if it occurred after the onset of labor, and it was associated with an increased risk of Surgical Site Infection. A high caesarean section rate among women is extremely important because of the subsequent increased risk of caesarean section, compared to vaginal delivery, in future pregnancies.

6.0 Recommendations

Based on the findings and the conclusions, this study makes a number of recommendations. The study starts by recommending that the management of Thika Level 5 Hospital should pay a close attention to the maternal, labor and institutional related factors that are likely to cause surgical site infections among post caesarean section mothers being admitted in the facility. The study also recommends to the government through the ministry of health that they should put in place policy measures which compels hospitals to adhere to some set standards which will ensure that mother's deliver in an environment conducive for them and one that may not enhance chances of SSI.

The study also recommends to the management of Thika Level 5 Hospital that they should ensure that Obstetric ward of the facility are encouraged to properly use the WHO surgical safety checklist and examine how to sensibly integrate these essential safety steps into their normal operative workflow. Prophylactic antibiotic administration should be provided within one hour before the

surgical incision or within two hours if the patient is receiving vancomycin or fluroquinolones. The study further recommends that healthcare workers in Obstetric ward services have to be clinically trained and skilled on comprehensive on issues related to SSI especially among mothers who deliver through CS. The study also recommends that access to and utilization of adequate, quality obstetric services should be encouraged and this will most likely reduce the cases of SSI among mothers delivering in the facility. A continuous education program for healthcare workers and young new mothers is necessary and can be feasible and potentially successful, given the interest expressed by healthcare workers.

It is without a doubt that this study will assist policy makers in coming up with policies geared towards improving the interventions of prevention of SSI among women delivering in Kenyan hospitals. This study makes a useful contribution to the advancement of academic knowledge on the determinants of surgical site infections among post caesarean section mothers in maternity across Kenya. However, the study is not exhaustive and so there are gaps. For instance, the study was only conducted at Thika Level Five Hospital in Kiambu County and therefore the findings presented in this study may not give the exact picture of the prevalence of SSI among mothers delivering in hospital in other parts of the country. It is, therefore, suggested that similar studies be carried out in other major referral hospitals in Kenya such as Moi Teaching and Referral Hospital, Kenyatta University Teaching and Referral Hospital and others, so that the findings can be compared with those of the current study.

References

Alligood, M. & Tomey, A. (2010). Nursing theorists and their work (7th ed.). Maryland Heights: Mosby-Elsevier

Andrew, B., O'Keeffe, T. & Stana, B. (2012) Oxford craniotomy infections database: a cost analysis of craniotomy infection. Br J Neurosurg. https://doi.org/10.3109/02688697.2011.626878.

Black, J. M., & Hawks, J. H. (2009). *Medical-surgical nursing:* Clinical management for positive outcomes. St. Louis, Mo: Saunders/ Elsevier.

Broex EC, van Asselt AD, Bruggeman CA, van Tiel FH. Surgical Site Infections: how high are the costs? *J Hosp Infect*. 2009 Jul;*72(3):*193-201. doi: 10.1016/j.jhin.2009.03.020.

Epub 2009 May 31. PMID: 19482375.*Journal of Health, Medicine and Nursing*. ISSN 2520-4025 (Online). Vol.3, Issue 4 No.1, *pp 1-18*,2018. www.iprjb.org

Himmelfarb Health Sciences Library, (2019) Case control - Study Design. https://himmelfarb.gwu.edu

Imogene King Biography, (n.d.) Retrieved July 7, 2014, from

http://ing.clubexpress.com/content.aspx?page_id=22&club_id=459369&module_id=59920

Melling, A., Hollander, D. A., & Gottrup, F. (2005). Identifying surgical site infection in wounds healing by primary intention. EWMA Position Document: Identifying criteria for wound infection. *EWMA Journal 1609-2759.*

Mpogoro, F. J., Mshana, S. E., Mirambo, M. M., Kidenya, B. R., & Gumodoka, B. (2014) Incidence and predictors of surgical site infections following caesarean sections at Bugando Medical Centre, Mwanza, Tanzania. Antimicrob Resist Infect Control. 2014; 3: 25. https://doi.org/10.1186/2047-2994-3-25

Teshager, M., Tilaye, W. A., Tesfaye, Y. C., & Antehun, A. A., (2017). Risk factors for surgical site infe ctions in obstetrics: a retrospective study in an Ethiopian referral hospital. Patient Safety in Surgery.

Urquhart, D. M., Hanna, F. S., Brennan, S. L., Wluka, A. E., Leder, K., Cameron, P. A., ... & Cicuttini, F. M. (2010). Incidence and risk factors for deep surgical site infection after primary total hip arthroplasty: a systematic review. *The Journal of arthroplasty*, *25*(8), 1216-1222. https://doi.org/10.1016/j.arth.2009.08.011

Wloch, C., Wilson, J., Lamagni, T., Harrington, P., Charlett, A., & Sheridan, E. (2012). Risk factors for surgical site infection following caesarean section in England: results from multicenter cohort study. BJOG 2012; 119:1324-33. https://doi.org/10.1111/j.1471-0528.2012.03452.x

Zuarez-Easton, S., Zafran, N., Garmi, G., & Salim, R. (2017). Postcesarean wound infection: prevalence, impact, prevention, and management challenges. *International journal of women's health*, *9*, 81. https://doi.org/10.2147/IJWH.S98876.