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Prevalence and Factors Associated with Postpartum Infections among Mothers Attending Immunization Service at Health Centers of Nyanza District, Rwanda

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Abstract

Postpartum infections are life-threatening conditions leading to 10% of maternal deaths worldwide; in sub-Saharan Africa, the estimated prevalence of postpartum infections is 11.5%. In Rwanda maternal sepsis contribute up to 56% of all maternal complications, where 5% of them die and most cases come from rural areas. In line with the above-mentioned background, this research aimed to find out the prevalence and factors contributing to postpartum infections in Nyanza District/ Rwanda. This study employed a cross-sectional design, with participants being mothers attending immunization services at health centers in Nyanza district. A sample size of 384 was determined for all health centers, with systematic sampling used to select individual participants. Data collection involved a structured questionnaire and a review of medical records. A case of postpartum infection was identified if self-reported signs or symptoms were also documented in the participant's medical records. Data analysis was conducted using IBM® SPSS 21. Descriptive statistics were utilized, and a bivariate analysis was performed to identify independent variables associated with postpartum infections. Variables significantly associated with the outcome were further analyzed using a multivariate logistic regression model. As results, the prevalence of postpartum infection among mothers attending immunization service at health centers of Nyanza District was 9.6%; and the identified factors associated with postpartum

infections were delivering by caesarean (aOR=6, 95%CI: 5.082-8.229, P<0.001); frequent vaginal examinations (≥5 times) during labor (aOR= 2.7, 95% CI: 1.331-5.843, P<0.001); prolonged labor (>24 hours) (aOR=2.0, 95% CI: 1.205-6.010, P<0.001); and Farming occupation (aOR=1.9, 95% CI: 1.120-4.966, P=0.048). Hence, the study recommends that healthcare professionals should aim to minimize C-section deliveries and the frequency of vaginal examinations when possible. Prophylactic antibiotics and aseptic techniques should be employed during delivery, especially for mothers with prolonged labor, frequent examinations, C-section deliveries, and farming occupations. Policymakers should develop guidelines to reduce cesarean sections, discourage frequent vaginal examinations, and promote prophylactic antibiotic use for high-risk mothers. Healthcare workers should prioritize infection prevention practices for mothers undergoing C-sections. Additionally, efforts should focus on reducing labor duration and ensuring timely interventions to prevent complications leading to postpartum infections. High-risk groups should be targeted for health education programs promoting hygiene practices and preventing exposure to microbial reservoirs. Further research is needed countrywide to determine the real burden of postpartum infections and identify measures to mitigate these life-threatening infections.

Keywords: *Postpartum infections, mothers, immunization service, Health Centers, Nyanza District, Rwanda*

1.0 Introduction

Postpartum infection, a type of maternal infection, manifests between the day of birth and the 42nd day thereafter, presenting symptoms like foul-smelling discharge from the vaginal/incisional site, pelvic pain, and/or fever (World Health Organization, 2015). These infections are a leading cause of maternal mortality worldwide, with 75,000 deaths out of 500,000 cases. These infections are notably more common in low-income countries, with many of the factors contributing to these infection-related deaths being preventable and manageable (Alkema et al., 2016). Recent studies conducted in sub-Saharan Africa have indicated that infections related to pregnancy are among the common causes of maternal mortality, with a prevalence rate of 11.5%; postpartum septicemia is the main cause of death among these infections following postpartum hemorrhage and high blood pressure during pregnancy (Musarandega et al., 2021).

Rwanda has made substantial progress in curbing maternal mortality, achieving Millennium Development Goal 5 by lowering the maternal mortality rate from 1,071 per 100,000 live births in 2000 to 210 in 2015. Despite this progress, the rate of maternal death in developing countries remains high compared to developed countries. In Rwanda, postpartum hemorrhage and infections were the main causes of maternal mortality in 2016, accounting for 46% of maternal deaths. The majority of these deaths, over 70%, occurred in referral and district hospitals, with 64% happening between delivery and the 6th week post-delivery. The majority of maternal deaths reported in referral or teaching hospitals were associated with complications, particularly postpartum infections that originated in district hospitals or health centers (Tuyishime et al., 2020).

Given the significant global impact of postpartum infections as a cause of maternal mortality, particularly in low-income countries, and the recognition that many of these deaths are preventable (World Health Organization, 2015; Alkema et al., 2016), there is a pressing need for further

investigation into the prevalence and contributing factors of these infections. This urgency is particularly evident in regions like sub-Saharan Africa, where pregnancy-related infections are a common cause of maternal mortality (Musarandega et al., 2021). Furthermore, the high incidence of maternal deaths due to postpartum infections in district hospitals and health centers (Tuyishime et al., 2020) underscores the importance of these healthcare settings in addressing this public health issue. Therefore, the current study aimed to ascertain the prevalence and identify the factors contributing to postpartum infections among mothers attending vaccination programs for their newborns at health centers in Nyanza District. This research will provide valuable insights into targeted interventions to prevent and manage postpartum infections, ultimately aiming to reduce maternal mortality.

1.1 Problem statement

Maternal mortality is the global health concern especially in sub-Saharan Africa. According to RDHS 2019-2020, 14% of women's death are attributable to maternal causes. (Rwabizi et al., 2016) revealed that the main cause of maternal morbidity in Rwanda is postpartum infections mainly postpartum peritonitis (56%) which is frequently occurred in District Hospitals. Among those cases of postpartum complication cases, 5% were died. Among maternal deaths related to postpartum infections, sepsis account for 67%. According to data retrieved from HMIS 202021, Nyanza district hospital is one among hospitals reported more cases of Postpartum infections (19%) in 2021. Those numbers represent only cases managed at hospital level while there are other cases identified at health centers community level. That is the reason why the purpose of this research is to identify prevalence and factors associated with postpartum infections among mothers attending immunization for their newborns at health centers of Nyanza district. The results of this study will help to set preventive measures against infections which are health burden facing developing countries including Rwanda.

1.2 Research objective

To determine prevalence and factors contributing to postpartum infections among mothers attending vaccination program for their newborns at health centers of Nyanza District.

2.1 Theoretical review

The postpartum period is very important for mothers, it starts from the time of delivery to the 42nd day after delivery. During this period a woman experience many health problems that can affect negatively the quality of life (Milani et al., 2017). During postpartum period the health status of mothers become susceptible to many health problems including infections. According to WHO, Postpartum infections, severe hemorrhage, hypertension (pre-eclampsia, and eclampsia) and unsafe pregnancy termination are the main maternal health problems that lead to 80% of all maternal deaths. The other complications are those health conditions that comes secondary to diseases such as malaria, and AIDS and other chronic diseases during or before pregnancy

2.1.1 Postpartum infection

WHO have been defined such postpartum infections as an entrance of micro-organisms in reproductive organs of a mother any time between the day of delivery and to the 42nd day after delivery. Those micro-organisms can inter the body either through genital tract, post C-sections wound or any other extra-genital portal of entry. Infections that come after delivery was known since many years ago, and was first identified by both Hippocrates and Gallen. Later, in the 17th century many researchers continued to work on this topic where Willis in England wrote on that subject. In the 19th century 15% of all women delivered in hospitals died due to postpartum infections. To identify the specific causative micro-organisms Louis Pasteur cultivated micro-organisms with samples taken from postpartum infection cases. Afterward, Lister identified that antiseptic techniques were very crucial in midwifery.

According to (Hallett, 2005) Postpartum infection is resulted bacterial infection of the genital tract, and Beta hemolytic streptococcus was identified as the most common causative organism agent. In 1822 the physician William Campbell observed that it is difficult to specify symptoms of postpartum infections. The majority of patients present symptoms like fever, shills, lower abdominal pain, foul smelling vaginal discharge, and delay in uterine size reduction, infective mastitis, infection of endometrium, urethritis, cystitis and wound infections may results into peritonitis. Postpartum infections can be prevented at all stages of pregnancy and after pregnancy for example by attending antenatal care mothers become screened for infectious and non-infectious diseases for early diagnosis and treatment, receiving health education about hygiene, avoiding traditional practice, promoting clean delivery, avoiding unnecessary vaginal examination, proper management of 3rd stage of labor, avoiding routine episiotomy, frequent hand washing and proper decontamination of materials, use of antibiotics as prophylaxis, early detection and management of complications such as Fistula, prolonged rupture of membrane, and retained placenta.

2.2 Empirical Literature

2.2.1 Prevalence of Postpartum infections

Postpartum infections continue to be a significant health concern, contributing to maternal mortality and accounting for approximately 10% of the worldwide burden of maternal deaths. Despite a global decrease in the maternal mortality rate due to postpartum infections over recent decades, it remains a substantial health issue in developing countries, particularly in sub-Saharan Africa. A 2019 study by Axelsson in southern Sweden aimed to identify the extent of postpartum infections and associated factors, revealing that more than 10% of women experience infections such as post-cesarean wound infection, endometritis, cystitis, and breast infection during the postpartum period (Axelsson, 2019).

In 2018, a study in Ethiopia sought to assess the prevalence and factors associated with health problems during the postpartum period. The study found a 32.8% prevalence of complications after delivery, with sepsis being highly prevalent (50.5%) (Talie et al., 2018). A 2016 study at the Kilimanjaro Christian Medical Center in Tanzania, focused on the causes and risk factors contributing to postpartum sepsis, discovered an 11.5% prevalence of postpartum infection

(Kajeguka et al., 2020). A systematic review aimed at assessing the causes of maternal mortality in sub-Saharan Africa found that 11.5% of maternal mortality was attributable to pregnancy-related infections (Musarandega et al., 2021).

A study conducted in 2016 at Kigali University Teaching Hospital (KUTH) aimed to identify the severity of morbidity and mortality secondary to postpartum infections. It found that among mothers referred to KUTH for maternal complications, intra-abdominal infection was the most prevalent (63%), followed by post-cesarean fasciitis (15%), endometritis (15%), and other infections (7%). The study also showed that 79% of infection cases had undergone cesarean section at District hospitals, and like other studies, it highlighted cesarean section as a significant risk factor for postpartum infections. This study reported a 4% maternal death rate following treatment with strong antibiotics (Rwabizi et al., 2016). A 2019 study by the University of Global Health in Rwanda, aimed at assessing the extent and factors contributing to wound infection following cesarean section in rural areas, found that the prevalence of Surgical Site Infections was 10.9% (Nkurunziza et al., 2019).

In Rwanda, Tuyishime et al. (2020) noted that the top five causes of maternal deaths have remained constant for the past six years. In 2016, postpartum hemorrhage and infections accounted for 46% of maternal deaths in Rwanda, with around 70% of maternal deaths occurring in teaching hospitals following transfer from district hospitals. Of these deaths, 64% occurred during the sensitive postpartum period. According to Rwabizi et al. (2016), postpartum peritoneum membrane infections were the most prevalent in Rwanda (57%), followed by post-cesarean wound infections, including fasciitis (17%), and endometritis (15%). Among mothers with postpartum infections, systemic infection was the leading cause of maternal deaths during the postpartum period (83.9%).

2.2.2. Factors associated with postpartum infections

Most research on postpartum infections has occurred in high resource countries, where risk factors include low socioeconomic status, primiparity, prolonged labor, caesarean section, and frequent vaginal exams intrapartum. Caesarean delivery appears to be the single most important risk factor for postpartum infection. In low-resource settings, risk factors for postpartum infection are poorly defined and may differ from high-resource settings due to patient, environmental and healthcare system factors (Ngonzi et al., 2018). According to World Health Organization (2015) several factors contribute to risk of developing infections after delivery, those factors are subdivided in two main groups namely; medical history of mother (e.g undernutrition, metabolic disorders such as diabetes, parity, and Overweight) and complications or procedures performed during delivery (e.g delayed tear of amniotic sac, frequent physical examinations of birth canal, mechanical placenta removal, and surgical method of delivery).

According to Oakley, 2018. Factors associated with postpartum infections are subdivided in four groups: Maternal Factors (such as malnutrition, Obesity, Anemia, pre-existing urinary or genital tract infections, gestational diabetes, advanced age and multiparty). Labour factors (such as hemorrhage during delivery, fetal death in uterus, perineal injury, prolonged rupture of amniotic sac, delayed fetal engagement, frequent vaginal exam). Health services factors (Such as poor utilization of antenatal and postnatal care, limited accessibility to health facilities). Community

risk factors (such as low socio-economic level, illiteracy or ignorance, poor hygiene, Traditional or cultural practice). The above-mentioned factors are more common in low-income countries including sub-Saharan Africa. the most common factor contributing to postpartum infection as highlighted by many literatures is cesarean section, which may lead to high prevalence of systemic infections that comes as results of increasing cases of surgical procedures during delivery.

3.0 Research methodology

This study was health facility based descriptive cross-sectional, conducted in Nyanza District; composed of 10 Sectors with 17 health centers and one district hospital. Participants of this study were mothers who came to health centers for immunization service on their immunization appointment date. the maximum sample size estimation was used, and n were 384. each health center was represented by a number of participants proportional to its population or catchment area. This study has been used structured questionnaire to collect data related to objectives. That questionnaire was adopted from a similar study conducted by Kajeguka et al., 2020 in Tanzania. It was composed of two sessions: session one was about factors that may contribute to postpartum infections; the second session aimed to find out the prevalence of postpartum infections. After completing questionnaire, Data were recorded in Microsoft excel then imported to IBM SPSS 21 for appropriate analysis. Descriptive statistics was performed to show the frequency and percentage of independent variables and dependent one. Then after, bivariate analysis was done to check the association between outcome variables and predictor variable at significant level of 5%, then variables that was significantly associated with outcome variable was processed into multivariate analysis to quantify the association between them. Results was presented by using APA tables in Microsoft Word to explaining how different factors are associated with postpartum infections.

4.0 Research findings and Discussion

Research findings and discussion are two critical components of any research paper and are usually presented in separate sections. The research findings and discussions present the data and results obtained from the study in a clear and concise manner, using visual aids to make it easy for the reader to understand the data.

4.1. Prevalence of postpartum infection among mothers attending immunization service at health centers in Nyanza district.

The first objective of this study was to determine the prevalence of postpartum infection among mothers attending immunization service at health centers in Nyanza district. After data collection and analysis, the study has found that 37 respondents (9.6%) have experienced postpartum infections as presented by figure 1.

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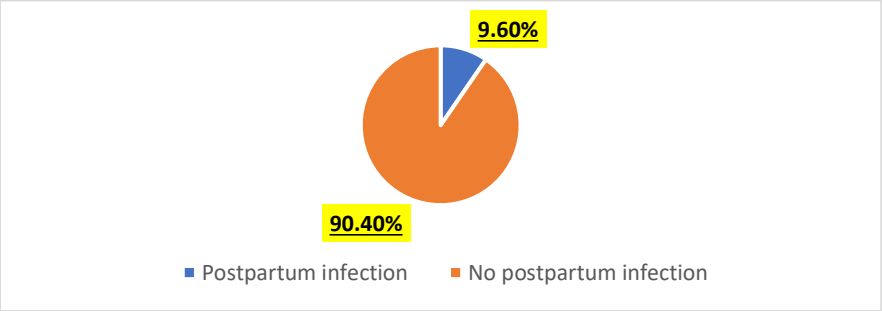

Figure 1: **Prevalence of postpartum infections**

4.2 Factors associated with postpartum infections among mothers attending immunization service at health centers in Nyanza district.

Table 1 summarizes the results of the socio-demographic factors associated with postpartum infection

Table 1: Socio-demographic factors associated with postpartum infection

Independent variables	Postpartum infection		P-value
	Yes (%)	No (%)	
Mother's age(years)			0.616
>21	3(9.7)	28(90.3)	
21-30	15(10.7)	125(89.3)	
31-40	12(9.2)	139(90.8)	
>40	7(11.3)	55(88.7)	
Education level			0.06
Not completed primary	5(16.6)	25(83.4)	
Completed primary	19(12.1)	137(87.9)	
Secondary	8(7.7)	135(92.3)	
University	5(9.1)	50(90.9)	
Marital status			0.573
Single	4(11.7)	30(88.3)	
Married	24(9.4)	132(90.6)	
Divorced	2(8.3)	22(91.7)	
Cohabitant	5(10.4)	43(89.6)	
Widow	2(9.0)	20(91)	
Mother's occupation			**0.042**
Unemployed	3(7.9)	35(85.2)	
Farmers	27(11.9)	200(90.9)	
Other Occupations	7(5.9)	112(90.5)	
Social category			0.880
Category one	4(12.9)	27(87.1)	
Category two	14(8.8)	145(91.2)	
Category three	18(9.8)	165(90.2)	
Category four	1(9.0)	10(91)	

Source: Primary data (2022)

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As demonstrated in the table 1 among social-demographic factors studied in this research only mother's occupation was significantly associated with postpartum infection (p=0.042), where farmers are more likely to experience postpartum infections. Even though analyzed data do not show a significant association between postpartum infections and age, the proportion of those who experienced postpartum infection was higher among mothers of age above 40 years (11.3%) compared to other age groups. Mothers who did not completed primary school were more likely to experience postpartum infection (16.6%) than others; but there is no significant association (P=0.060) between education level and postpartum infections. Again, the proportion of postpartum infection among first social category was higher (12.9%) compared to other categories, but there is no significant association between social category and postpartum infection (P=0.880). Table 2 shows the medical history-related factors associated with postpartum infection

Table 2: Medical history related factors associated with postpartum infection

Independent variables	Postpartum infection		P-value
	Yes (%)	No (%)	
HIV status			0.716
Positive	1(9.0)	10(91.0)	
Negative	36(9.6)	348(90.4)	
Non-Communicable diseases			0.844
Yes	6(10.3)	52(89.7)	
No	31(9.5)	295(90.5)	
Parity			0.694
One	6(8.9)	61(91.1)	
Two	8(8.0)	91(92.0)	
Three	13(9.4)	125(90.6)	
Four and more	10(12.5)	70(87.5)	
Body mass index			0.823
≤18.4	5(10.6)	42(89.4)	
18.5-24.9	24(8.8)	246(91.2)	
≥25	8(11.9)	59(88.1)	
Use of Traditional medicine on pregnancy			0.939
Yes	2(7.4)	25(92.6)	
No	35(9.8)	322(90.2)	

Source: Primary data (2022)

As illustrated in the table 2, among factors related to medical history of mothers, there is no factor that is significantly associated with postpartum infections. Among 11 HIV positive mothers, 9%

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have experienced postpartum infection. By considering non-communicable diseases, 10.3% of mothers suffering from non-communicable diseases have experienced postpartum infection but the association is not significant (P=0.844). Data also shows that there is higher percentage of postpartum infections (12.5%) among mothers with parity 4 compared to mothers with parity 1,2, and 3. The proportion of postpartum infection was also higher (11.9%) among overweigh mothers compared mothers with normal and weight. Concerning the use of traditional medicine, there is no significant difference between percentage of postpartum infection among users and non-users of traditional medicine or practice (P=0.939). Table 3 illustrates labor and delivery-related factors associated with postpartum infections.

Table 3: Labor and delivery related factors associated with postpartum infections

Independent variables	**Postpartum infection**		**P-value**
	Yes (%)	**No (%)**	
Vaginal exam Frequency			**<0.001**
≤5 times	17(6.0)	263(94.0)	
>5 times	20(19.2)	84(80.8)	
Hours spent on labor			**<0.001**
>24 hours	16(16.1)	83(83.9)	
≤24 hours	21(7.4)	264(92.6)	
Mode of delivery			**<0.001**
Cesarean section	25(26.9)	68(73.1)	
Normal delivery	12(4.1)	279(5.9)	
Postpartum hemorrhage			0.802
Yes	3(10)	27(90)	
No	24(9.6)	330(90.4)	
Days of after delivery			**0.049**
>3days	14(16.3)	72(83.7)	
≤3 days	23(7.7)	275(92.3)	

Source: primary data (2022)

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As summarized by table 3, frequency of vaginal exam on labor (P<0.001), time spent on labor(P<0.001), mode of delivery(P<0.001), and days of admission after delivery (P=0.049) were significantly associated with postpartum infections. Among mothers examined 5 times or more, 19.2% have experienced postpartum infection, against 6% of mothers examined less than 5 times. Mothers who spent more than 24 hours on labor are more likely to experience postpartum infection (16.1%) than mothers who spent less than 24hours on labor (7.4%). The proportion of postpartum infections was higher among mothers who delivered by c-section (26.9%) when compared to mothers who had vaginal delivery (4.1%). The proportion of postpartum infections among mothers who were hospitalized for more than 3 days was higher (16.3%) than the proportion of postpartum infections among mothers hospitalized for less than 3 days (7.7%). Table 4 presents factors related to the use of health services.

Table 4: Factors related to the use of health services

Independent variables	Postpartum infection		P-value
	Yes (%)	No (%)	
Distance to facility			0.844
>10 km	11(10.3)	96(89.7)	
≤10 km	26(9.4)	251(90.6)	
Antenatal consultation			0.325
<4 ANC			
≥4 ANC	23(10.6)	193(89.4)	
	14(8.3)	154(91.7)	
Level of health facility			**0.027**
Hospitals (DH&RH)			
Health centers	18(14.4)	107(89.6)	
Home or in way to HF	17(6.9)	229(91.1)	
	2(15.3)	11(84.7)	
Postnatal consultation			**0.046**
<4 PNC			
≥4PNC	33(10.6)	279(89.4)	
	4(5.5)	68(94.5)	

Source: Primary data (2022)

As shown by table 4, the level of health facility (P=0.027) and the number of post-natal consultation (P=0.046) were significantly associated with post-partum infections; Where among 125 mothers who delivered at hospitals (District, and referral hospital), 14.4% of them have experienced postpartum infections; while among 246 mothers who delivered at health centers, 6.9% of them have experienced postpartum infections. Concerning Post-natal or postpartum consultation, the risk of postpartum infection for mothers who were consulted 4 or more times was low (5.5%), compared to the risk of mothers consulted 3 times and less (10.6%). There is no significant difference between mothers located far and near from health facilities; the same

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situation as the number of antenatal consultations. Table 5 illustrates the multivariate analysis of factors that are significantly associated with postpartum infections among mothers attending immunization service at health centers of Nyanza District.

Table 5: Multivariate analysis of factors that are significantly associated with postpartum infections among mothers attending immunization service at health centers of Nyanza District.

Variables	Description	aOR	95%CI		P value
			Lower	Upper	
Mother's occupation	Farmers	1.9	1.120	4.966	**0.048**
	Others occupations	Ref			
Frequency of vaginal Exam	≥5 times	2.7	1.331	5.843	**<0.001**
	<5times	Ref			
Hours spent of labor	>24 hours	2.0	1.205	6.010	**<0.001**
	≤24 hours	Ref			
Mode of delivery	C-section	6.0	5.082	8.229	**<0.001**
	V. delivery	Ref			
Days of admission	>3 days	2.1	0.998	3.472	**0.037**
	≤ 3 days	Ref			
Health facility level	Hospitals	1.9	0.979	5.182	**0.049**
	HC	Ref			
Post-natal consultation	< 4 PNC	1.6	1.022	7.380	0.291
	≥4 PNC	Ref			

Source: Primary data (2022)

As shown in table 5, all independent variables that were significantly associated with postpartum infections in bivariate analysis were taken to multivariate analysis to quantify how they are associated with dependent variable. That analysis has indicated that Farmers were 1.9 times more likely to experience postpartum infections, compared to mothers with other occupations aOR=1.9, 95% CI: 1.120, 4.966, P=0.048). Mothers who have undergone frequent vaginal examinations (≥5 times) during labor were 2.7 times more likely to experience postpartum infections, compared to mothers who were examined less than 5 times during labor (aOR= 2.7, 95% CI: 1.331, 5.843, P<0.001). Mothers who have experienced prolonged labor (>24 hours) were 2 times more likely to have postpartum infections compared to mothers whom labor has spent ≤24 hours (aOR=2.0, 95% CI: 1.205, 6.010, P<0.001). multiple regression analysis has also shown that mothers who were delivered by caesarean section were 6 times more likely to have postpartum infections compared to mothers who were delivered by spontaneous vaginal delivery (aOR=6.0, 95%CI: 5.082, 8.229, P<0.001).

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4.3 Discussion of findings

4.3.1 Prevalence of postpartum infections

Among 384 mothers who have participated in this study, 37 mothers (9.6%) have experienced postpartum infection. In sub-Saharan Africa, the estimated prevalence of postpartum infection was 11.5% (Musarandega R et al., 2021). According to the global report of the epidemiology and burden of sepsis, 2020 by WHO, the prevalence of postpartum infection in low-middle income countries is 10.6% while in high income countries is 3.9%. this could be the fact that high income countries have strong health care system that effectively prevent postpartum infections. The prevalence of postpartum infection in this study was slightly lower than the estimated prevalence of postpartum infection in region; the reason could be the fact that other studies conducted in the region were hospital based where participants of their studies were patients admitted in hospital for medical care; while this study considered general population of mothers who came to health centers of immunization of their newborn. A countrywide study concerning the prevalence of postpartum infection and associated factors is needed in Rwanda and that study could serve as the basis for mitigating the health burden of postpartum infections that raise maternal mortality rate.

4.3.2 Factors associated with postpartum infections

Concerning the factors associated with postpartum infections, this study has shown that significant risk factor was delivery by Cesarean section, followed by frequent vaginal examination(>5times), prolonged labor, and Farming occupation. According to (International Journal of Women's Health 2021) Caesarean section is the most common variable associated with an increased probability of postpartum bacterial infection when compared with vaginal birth, with reported rates of infection ranging from 1% to 25%; about 5 to 20 times higher than that of vaginal delivery. In this this study, data showed that mothers who delivered by C-section was 6 times more likely to experience postpartum infections. Among 384 participants, 93 (24.2%) were delivered by c-section, and 26.9% of those operated mothers have experienced postpartum infections. A study intitled as Preventability of maternal near miss and mortality in Rwanda was conducted in 2016 and has shown that 79% of maternal infection cases transferred to Kigali University Teaching Hospital were operated (caesarean section) at district hospitals prior to being transferred at tertiary level (Rwabizi et al., 2016). This association between postpartum and c-section was also identified by different studies. For example, a study conducted in Uganda (Mbarara Referral hospital) aimed for determining the incidence of postpartum infection and associated factors, has found that Cesarean delivery was the most common factor associated with postpartum infection(aOR= 3.9) (Ngonzi et al., 2018). The reason could be the fact that caesarian section is a surgical procedure that exposes out the inner tissues. Hence, infections may take that opportunity to invade those exposed tissues either during procedure or after delivery. Contrarily to the finding of this study, research conducted in Kilimanjaro Christian medical center/ Tanzania has found that the most common factors and causes of postpartum sepsis was prolonged labour followed by caesarean section (Kajeguka et al., 2020). In fact, even though caesarean section is a common factor associated with postpartum infections, the magnitude problem varies depending on the nature of study.

Data analysis from this study, has shown that frequent vaginal examination was a risk factor of postpartum infections, where mothers who were frequently examined (5 or more vaginal exams) were 2.7 times more likely to develop postpartum infections compared to unfrequently examined mothers. Association between frequent vaginal exam and postpartum infection, were also identified in different studies; for instance, a study conducted by Zafra-Tanaka et al,.2019 has found that frequent vaginal examination was associated with postpartum infections. Frequent vaginal examinations when performed without appropriate aseptic practices could be the opportunity for infections to enter the vaginal canal.

Prolonged labor was also identified by different studies as a common factor that is significantly associated with postpartum infection. In this study, mothers who spent more than 24 hours on labor were 2 times more likely to develop postpartum infection, compared to mothers who spent less than 24 hours on labor. This association was also identified by a study conducted in Kenya by Naima S et al.,2020, where the mothers who spent more than 24 hours on labor were 3.97 more likely to develop postpartum sepsis, compared to mothers who spent less than 24 hours on labor (P=0.003). Association between prolonged labor and postpartum infection can be explained by the fact that the condition of spending much time on labor could increase the time of exposition to hospital infections, and expose mothers to various obstetrical maneuvers or procedures that can be the portal of entry for infections.

In this study, being a farmer was also identified as a risk factor of postpartum infections, where farmers were 1.9 times more likely to develop postpartum infection, compared to other occupations. The reason of this association, could be could be the matter of poor hygiene linked with farming occupation, inaccessibility to sanitation materials and exposition to microbial reservoir found in soil and pants (infected Animal, soil, water and plants). Association between postpartum infections and farming occupation seems as new in literatures. This could be caused by the fact that other related studies were retrospective hospital based, which did not considered occupation of mothers because it is not routinely recorded in reviewed mothers' records.

5.0 Conclusion

In conclusion, caesarean section, frequent vaginal examination, prolonged labor, and farming occupation were identified as significant risk factors associated with postpartum infections. Mothers who underwent Caesarean section were six times more likely to experience postpartum infections than mothers who delivered vaginally. Mothers who were frequently examined (5 or more vaginal exams) were 2.7 times more likely to develop postpartum infections compared to unfrequently examined mothers. Mothers who spent more than 24 hours on labor were twice as likely to develop postpartum infection compared to mothers who spent less than 24 hours. Being a farmer was associated with a 1.9 times higher risk of postpartum infection. The study results showed that the prevalence of postpartum infections was relatively low compared to other studies in sub-Saharan Africa. However, significant risk factors were identified, including Caesarean section, frequent vaginal examination, prolonged labor, and farming occupation. These findings highlight the importance of implementing infection prevention strategies during childbirth, especially among high-risk groups such as mothers who undergo Caesarean section or have

prolonged labor. The findings also suggest the need for further research on the association between farming occupation and postpartum infections, as well as the need for a countrywide study to establish the prevalence of postpartum infection in Rwanda. This study could serve as a basis for mitigating the health burden of postpartum infections that increase maternal mortality rates.

6.0 Recommendations

Health care professionals should make effort to minimize C-section deliveries where possible. frequency of vaginal examinations should also be minimized where applicable. This study further recommends the use of prophylactic antibiotics and aseptic technics during delivery especially to mothers with prolonged labor, frequently examined, delivered by c-section and those mothers with farming occupation. Policy Makers are recommended to elaborate guidelines purposed for minimizing caesarian section deliveries, discouraging frequent vaginal examinations, and promoting the use of prophylactic antibiotic particularly for mothers with farming occupation, and those with prolonged labor. The health workers should prioritize prevention of postpartum infections in mothers who undergo C-section by ensuring proper infection prevention practices during and after the procedure. Second, reducing the number of vaginal exams performed during labor could also help prevent postpartum infections. In addition, efforts should be made to reduce the length of labor and ensure timely interventions to prevent complications that can lead to postpartum infections. Moreover, high-risk groups should be targeted for health education programs to promote hygiene practices and prevent exposure to microbial reservoirs. Further researches should be conducted country wide to determine the real burden of postpartum infections, and to identify measures that should be put in place to mitigates those maternal life-threatening infections.

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