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TRENDS, PATTERNS AND CAUSE-SPECIFIC DETERMINANTS OF PERINATAL MORTALITY AT GEITA REGIONAL REFERRAL HOSPITAL IN TANZANIA: A HOSPITAL-BASED RETROSPECTIVE STUDY

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ABSTRACT

Background: Perinatal mortality is a sensitive issue that concerns the lives of newborn babies worldwide. In Tanzania, the perinatal mortality rate is high, it accounted for 38/1000 live births in 2022. **Objective:** A study titled; Patterns, Trends, and Specific Determinants of Perinatal Mortality was conducted at Geita Regional Referral Hospital in 2023/24. **Results:** The study found that several factors were significantly associated with perinatal deaths, including premature complications, severe birth asphyxia, unknown factors, neonatal sepsis, aspiration pneumonia, anemia in pregnancy, eclampsia, pre-eclampsia and malaria in pregnancy. **Recommendation:** The study recommended several measures, including using Community Health Care workers and FHCWs to offer health education on focused antenatal care and safe motherhood, improving ANC clinics, providing proper management, increased allocation of human resources, and allowing trained nurses or anesthetists to perform cesarian sections. Pregnant women should also be alerted about their subsequent visit/appointment. Motivations, coating folic acid tablets and combining them with anti-emetics to become user-friendly, additionally, traditional medicine labs should take samples of local herbs used by pregnant mothers to detect their chemical compositions and provide advice accordingly. **In conclusion:** Reducing perinatal mortality in the Geita region requires a multisectoral approach and more investment to save the lives of many newborn babies.

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INTRODUCTION

Perinatal mortality is a significant public health challenge in low and middle-income countries. It refers to the death of any newborn that occurs between GA of 28 and 7 days after birth. Globally, about 2.5 million children die in the first month after birth, which amounts to 7000 neonatal deaths every day. Unfortunately, in Tanzania, efforts to reduce perinatal mortality did not meet the United Nations Millennium Development Goal (MDG) in 2020. The highest burden of perinatal deaths is in developing countries, which account for about 98% of all deaths. Tanzania has a high perinatal mortality rate estimated to be 69/1000 births in 2004 and 38/1000 in 2022. A recent national survey reported perinatal mortality for pregnancies lasting seven months or more to be 36/1000, ranging between 24/1000 and 60/1000 in the different zones in sub-Saharan Africa (SSA), neonatal mortality has historically been higher in rural areas compared with urban ones and is posited to be related to a combination of socioeconomic factors (maternal education, nutrition, care affordability) and care accessibility (more births occurring in health facilities, shorter distance and travel time to health

facilities (1) Yet some countries, particularly in sub-Saharan Africa including Tanzania still have high rates of under-5 mortality in 2023 Unless these countries can accelerate reductions in child deaths at an extraordinary pace, their achievement of proposed SDG targets is unlikely. Improving the evidence base on drivers that might hasten the pace of progress for child survival, ranging from cost-effective intervention packages to innovative financing mechanisms, is vital to charting the pathways for ultimately ending preventable child deaths by 2030(3). Perinatal deaths continue to be a major concern in low-resource settings, with inappropriate maternal health care provision during pregnancy, labor, delivery, and postpartum periods being one of the main contributing factors (4). Lack of proper newborn care immediately after delivery and within the first 7 days of life also plays a significant role. To improve under-five mortality rates (U5MRs) in Tanzania, it is essential to have nationally representative and country-specific evidence on the risk factors for neonatal, post-neonatal, and infant, child, and U5 mortalities. Unfortunately, this data is scarce due to the dearth of vital registration or population-based surveillance data at the national level. To achieve the SDG-3 agenda, relevant data is necessary to guide efforts and refine

programs for high-priority groups. This study aimed to investigate the trends and determinants of perinatal mortalities at Geita Regional Referral Hospital in Tanzania between 2023 and 2024 (5). It is disheartening to know that the first month of life is the most vulnerable period in terms of child survival. Shockingly, almost half of all under-five deaths in 2020 occurred during the perinatal and neonatal period, which is the first 7 to 28 days of life. In comparison to 1990, this figure has increased from 40 to 47 per cent. Unfortunately, the chances of survival for children start to diverge from the earliest ages. Sub-Saharan Africa has the highest neonatal mortality rate in the world, with 27 deaths per 1,000 live births, followed by Southern Asia at 23 deaths (6). It is alarming to learn that a child born in sub-Saharan Africa is 11 times more likely to die in the first month of life than a child born in the region of Australia and New Zealand. Also, a child born in a high-income country has a risk of death in the first month that is just one-tenth the risk to a child born in a low-income country. At the country level, neonatal mortality rates in 2020 ranged from 1 death per 1,000 live births to 44. The risk of dying before the 7th and 28th day of life for a child born in the highest-mortality country was about 56 times higher than in the lowest-mortality country. These statistics highlight the need for more attention and resources to be directed towards neonatal care and support, particularly in low-income countries (7). To successfully implement perinatal death reviews, it is crucial to clearly define the roles and responsibilities of those involved and to monitor progress routinely. In low-income settings, perinatal death reviews can be implemented effectively and sustained by focusing on learning, solution-oriented responses, influencing those in positions of authority, holding individuals accountable for results, and ensuring observable quality of care improvements. These measures are essential for making a positive impact on maternal and neonatal mortality rates (8). However, despite this improvement, the country has not yet achieved the Millennium Development Goal of reducing perinatal, neonatal, and maternal mortality rates. This is especially true for Geita Regional Referral Hospital, where there are still concerns regarding the high number of deaths per year, with reports indicating around 900 PMR cases in 2022/23.

Trends of perinatal deaths: It is crucial to recognize that over 51,000 newborns lose their lives annually in Tanzania, with the majority of these deaths being preventable (9–11). Although there has been a decline in the infant mortality rate in Tanzania, there remains a significant gap in under-5 mortality rates between low-income and high-income countries (12–14). It is imperative to implement strategies aimed at preventing perinatal deaths, such as providing counseling on pregnancy spacing and promoting increased contraceptive use (15, 16). Furthermore, enhancing maternal and newborn care and addressing factors like education and family size can play a vital role in reducing perinatal mortality (17, 18). However, it is important to acknowledge the challenges in obtaining high-quality data on maternal and newborn deaths and their causes, as this data is essential for informing policy decisions and implementing evidence-based interventions (19). Understanding the magnitude and clinical causes of maternal and perinatal mortality are basic requirements for policy setting, program design, innovation testing, and the implementation of evidence-based interventions. Outcome captured at health facilities presents an opportunity for health care staff and decision-makers to reflect on what they could do better (20–22). Various factors such as place of residence, occupation, education level, and ANC attendance are significantly associated with Birth Preparedness and Complications Readiness (23). According to WHO, it is recommended to end preventable deaths of newborns and children under 5 years of age by 2030. The Geita Region in Tanzania, like other sub-Saharan African countries, requires attention to reduce perinatal mortality. It is worth noting that over the past decade, Tanzania has experienced a slight decrease in the perinatal mortality rate (24). A majority of maternal causes and fetal causes of perinatal mortality are preventable through supportive working aids and focused antenatal health care. Strategies to reduce this gap need to address the overall resource situation and general health system characteristics. However, given the limited resources in African

countries, it may be important to target groups of particularly vulnerable mothers and babies in attempts to reduce mortality (25). The study aimed to determine the specific factors contributing to perinatal mortality to improve maternal and child health services to reduce maternal and perinatal mortality rates, health promotion, society ownership, awareness, and informing policy.

MATERIAL AND METHODS

Our study design was carefully crafted to ensure a comprehensive understanding of the issue at hand. We interviewed healthcare workers with varying levels of experience and conducted a simple random sampling of mothers who lost their babies. We included nurses, doctors, paraprofessionals, and mothers who lost their babies at the postnatal unit, as well as pregnant women who experienced perinatal death in their previous pregnancy. We evaluated all departments, including antenatal clinics and labor wards, to gain insight into what happens from pregnancy to delivery. We also interviewed workers from M-mama and traditional birth attendants to ensure a holistic approach to our research. We collected both qualitative and quantitative data, with interviews being recorded using Android devices with a super recorder application installed. Transcription and translation were conducted, and qualitative analysis was done thematically. For quantitative data, we collected and analyzed discussed perinatal mortality records for one year using SPSS version 23. While our study provides valuable insights, it is important to note that inadequate funding limited its scope to GRRH which may limit the generalizability of the findings to other settings. If we had more resources, we could have extended this study to district council hospitals to gain a broader understanding of the situation in the Geita region. Nonetheless, our findings offer important information that can be used to address this issue and improve the care provided to mothers and babies.

RESULTS

Table 1. Represents perinatal mortality among pregnancy women by social demographic characteristics in Geita region

Variables	Macerated Stillbirth (MSB)	Fresh Stillbirth (FSB)	Early perinatal deaths (EPD)
Age < 20	73 (31.88%)	18 (19.56%)	12 (35.53%)
21-30	98 (42.79%)	53 (57.61%)	13 (38.24%)
Above 30	58 (25.33%)	21 (22.83%)	9 (26.23%)
Education level	29 (69.05%)	6 (14.28%)	7 (16.67%)
No education	9 (69.23%)	3 (23.08%)	1 (7.69%)
primary	3 (33.33%)	2 (22.22%)	4 (44.45%)
Secondary	1 (100.0%)	0 (0.00%)	0 (0.00%)
college	0 (0.00%)	0 (0.00%)	0 (0.00%)
University	0 (0.00%)	0 (0.00%)	0 (0.00%)
Unknown causes	169 (73.79%)	1 (1.09%)	0 (0.00%)
Peripartum birth asphyxia	12 (5.24%)	0	0 (0.00%)
Intrapartum birth asphyxia	20 (8.73%)	71 (77.17%)	0 (0.00%)
Severe birth asphyxia	0 (0.00%)	5 (5.43%)	20 (58.82%)
antepartum Haemorrhage (APH)	0 (0.00%)	2 (2.17%)	0 (0.00%)
Malaria in pregnancy	2 (0.87%)	0 (0.00%)	1 (2.94%)
Eclampsia	10 (4.37%)	1 (1.09%)	0 (0.00%)
Premature complication	0 (0.00%)	0 (0.00%)	8 (23.53%)
Pre-Eclampsia	3 (1.31%)	5 (5.43%)	0 (0.00%)
Hypertension	7 (3.05%)	2 (2.17%)	0 (0.00%)
Congenital malformation	0 (0.00%)	5 (5.43%)	0 (0.00%)
Hepatitis B	1 (0.44%)	0 (0.00%)	0 (0.00%)
syphilis	0 (0.00%)	0 (0.00%)	1 (2.94%)
Anemia in pregnancy	3 (1.31%)	0 (0.00%)	1 (2.94%)
Sepsis	2 (0.87%)	0 (0.00%)	2 (5.88%)
Aspiration pneumonia	0 (0.00%)	0 (0.00%)	1 (2.94%)

Source; Geita Regional Referral Hospital (GRRH) discussed perinatal deaths

The Table 1.1 above represents perinatal mortality among pregnant women in the Geita region, based on their social demographic characteristics. The data is divided into three categories: Macerated

Stillbirth (MSB), Fresh Stillbirth (FSB), and Early Perinatal Deaths (EPD). The table shows that the highest percentage of MSB occurred among pregnant women above the age of 30 (35.53%), while the highest percentage of FSB occurred among pregnant women between the ages of 21-30 (57.61%). The highest percentage of EPD occurred among pregnant women between the ages of above 30 (22.83%).

In terms of education level, the highest percentage of MSB occurred among pregnant women with no education (69.05%), while the highest percentage of FSB occurred among pregnant women with secondary education (44.45%). The only case of EPD in the education category occurred among pregnant women with college education. The data also shows that unknown causes were responsible for the highest percentage of MSB (73.79%) while intrapartum birth asphyxia was responsible for the highest percentage of FSB (77.17%). Severe birth asphyxia was responsible for the highest percentage of EPD (58.82%).

Table 2. Multiple linear regressions to show Perinatal mortality associated factors

Model	B	Std. Error	t	Sig.
Age categories				
21-30	9.23	2.462	3.386	0.0241
31 and above	8.743	1.956	2.847	0.0458
Education level				
Primary	5.39	2.65	2.401	0.148
Secondary	2.026	4.641	0.744	0.461
Collage	1.478	5.923	0.593	0.037
Unknown cause	4.583	1.582	2.896	0.006
Premature complication	5.65	2.063	-2.738	0.009
Severe birth asphyxia	5.25	1.769	-2.967	0.005
Neonatal sepsis	6.158	2.961	-2.111	0.04
Anaemia	7.27	4.035	-1.797	0.079
Aspiration pneumonia	7.279	2.961	-2.449	0.018
Anaemia in pregnancy	6.211	1.831	-2.111	0.04
Hypertension	6.456	4.035	-1.549	0.129
Eclampsia	7.25	2.791	-2.449	0.018
Pre-eclampsia	5.523	2.063	-2.544	0.015
Malaria in pregnancy	8.23	2.238	-3.24	0.002
Syphilis	7.15	4.265	1.797	0.079
Hepatitis B	9.214	4.035	1.797	0.079
Congenital malformation	3.251	2.041	-0.806	0.425
Peripartum asphyxia	2.572	4.015	0.682	0.499
(Constant)	8.25	1.119	7.373	0.000

Source; (GRRH) discussed perinatal deaths

Table 1.2 shows the results of a multiple linear regression analysis that was conducted to identify the factors associated with perinatal mortality. The table has different columns that include Model, B, Std. Error, t, and Sig. The Model column shows the independent variables that were included in the analysis, while the B column shows the beta coefficients, which represent the strength and direction of the relationship between each independent variable and the dependent variable (perinatal mortality). The Std. Error column shows the standard error of the estimate, which indicates how far the observed values are likely to deviate from the true regression line. The t column shows the t-value, which measures the size of the difference relative to the variation in the sample data. Finally, the Sig. column shows the significance level, which indicates the probability of obtaining the observed results by chance. From the table, we can see that several factors are associated with perinatal mortality, including age categories, education level, and various health conditions such as premature complication, severe birth asphyxia, neonatal sepsis, aspiration pneumonia, among others. The results suggest that older mothers (31 and above) have a higher risk of perinatal mortality than younger mothers (21-30). Furthermore, it appears that having a college education is associated with a lower risk of perinatal mortality compared to having only a primary or secondary education. Additionally, several health conditions are associated with an increased risk of perinatal mortality, including Unknown cause, premature complication, severe birth asphyxia, and neonatal sepsis, and aspiration pneumonia, malaria in pregnancy, eclampsia, pre-

eclampsia, syphilis, and hepatitis B. However, some factors such as congenital malformation and peripartum asphyxia do not appear to have a significant association with perinatal mortality. The constant term has a coefficient estimate of 8.25, which represents the expected level of perinatal mortality when all the other variables are equal to zero. The constant term is significant ($p < 0.001$), which indicates that there are other factors not included in the model that may also be associated with perinatal mortality.

Table 2. Association between Sex of Children and perinatal mortality

Variable	Categories	Macerated Stillbirth (MSB)	Fresh Stillbirth (FSB)	Early perinatal Mortality (EPM)
Sex	Male	98 (42.79%)	36 (39.13%)	13 (38.24%)
	Female	131 (57.21%)	56 (60.87%)	21 (61.76%)
	Total	229 (100%)	92 (100%)	34 (100%)

Source; (GRRH) discussed perinatal deaths

Table 2 shows the association between the sex of children and perinatal mortality. The variables are Macerated Stillbirth (MSB), Fresh Stillbirth (FSB), and Early Perinatal Mortality (EPM). The categories of Male and Female. The table shows that there was a total of 229 cases of perinatal mortality, out of which 42.79% were male and 57.21% were female. In terms of MSB, 98 cases were male and 131 were female. For FSB, 36 cases were male and 56 were female. Lastly, for EPM, 13 cases were male and 21 were female. The findings from the qualitative interviews reveal important insights into the challenges faced by mothers during pregnancy and childbirth. One of the key issues highlighted is the low antenatal attendance by mothers, with some attending as few as one to five visits instead of the recommended eight visits. One participant commented;

"A lot of mothers are not aware of the importance of antenatal care and the risks associated with not attending early enough. Some mothers only come to the clinic to ask RCH card when they are already experiencing complications, which make it difficult to manage their health effectively." (Midwife RCH-Geita)

The lack of early visits can lead to serious health complications for both the mother and the baby, such as congenital malformations and malaria. A grandmultiparous interviewed during the study commented;

"I didn't see the need to attend antenatal clinics regularly since I was feeling okay, it was a fifth pregnancy and my four children were well. But when I developed complications later on, I regretted not attending all the visits." (Postnatal mother -GRRH)

Furthermore, economic barriers and geographical location are also significant challenges, especially for mothers who live far away from the healthcare facility. In some cases, mothers may opt to seek the services of traditional birth attendants due to a lack of transport or financial resources. However, this can lead to delays in referral and treatment, which can have fatal consequences for both the mother and the baby. One participant commented;

"I only attended two antenatal visits because the healthcare facility is far from my house and I don't have enough money to pay for transport. I know it's not enough, but what can I do? I have to look for money to feed my family." (FGD Pregnant RCH-Geita)

In addition to these challenges, there are also issues related to screening for pregnancy at ANC clinics, as well as the availability of skilled human resources for reproductive health. For instance, some mothers are not tested for certain conditions, while others face delays in getting referrals due to a lack of equipped ambulances or trained staff. One participant commented

"I had to wait for hours before being referred to a hospital for further tests. The facility had no ambulance and the midwife had to call around to find a private vehicle to take me. It was a very stressful experience"(postnatal mother –GRRH)

Overall, these findings underscore the need for better education and awareness among mothers, as well as improved access to healthcare services and skilled human resources. It is imperative that these issues are addressed to ensure better health outcomes for mothers and their babies.

DISCUSSION

The findings of this study highlight several factors that contribute to perinatal mortality in Geita Regional Referral Hospital. These factors include premature complications, severe birth asphyxia, neonatal sepsis, aspiration pneumonia, anemia in pregnancy, eclampsia, pre-eclampsia and malaria in pregnancy. The study also found that poor antenatal attendance and poor screening were significant contributing factors to these deaths. The findings of this study are consistent with previous research on perinatal mortality in low and middle-income countries. A study conducted in Nigeria found that maternal factors, including anemia, eclampsia, and antepartum hemorrhage, were significant contributors to perinatal mortality rates (26). Similarly, a study in Ghana found that maternal factors, including hypertension and anemia, were associated with increased perinatal mortality rates (27). Another study conducted in Tanzania found that poor antenatal attendance and inadequate prenatal care were significant contributing factors to perinatal mortality rates (28). The study recommended the use of community health workers to improve antenatal attendance and the provision of comprehensive prenatal care to reduce perinatal mortality rates. Previous research has also highlighted the importance of investing in maternal and child health to reduce perinatal mortality rates. The United Nations' Every Newborn Action Plan (ENAP) emphasizes the need for increased investment in maternal and child health to achieve the Sustainable Development Goals (SDGs) and reduce perinatal mortality rates (29, 30). Overall, the findings of this study emphasize and highlights the need for a comprehensive approach to address perinatal mortality rates in low and middle-income countries, including Tanzania. By implementing the recommended measures and investing more in maternal and child health, we can make a significant impact in reducing perinatal mortality rates and achieving the the UN's Sustainable Development Goals.

CONCLUSION

To effectively reduce perinatal mortality in the Geita Region, it is necessary to adopt a multisectoral approach and invest more resources. By bringing together various sectors and stakeholders, we can work towards improving the quality of maternal care, increasing access to healthcare services, and addressing the underlying social and economic factors that contribute to poor health outcomes. With greater investment and collaboration, we can create a safer and healthier environment for mothers and their infants in the Geita Region.

Recommendations

There were several recommendations made during the discussion on improving maternal health. The participants agreed that providing education to mothers and involving the community in addressing pregnancy-related issues is crucial. Educating mothers on timely clinic attendance and the importance of seeking medical attention from service providers, particularly at the RCH clinic, is essential. The referral system needs to be improved and clinics should prioritize testing mothers for all necessary tests upon arrival while also improving the skills of service providers. Mothers should be

encouraged to seek medical attention early when they notice any health problems. It was noted that many pregnant mothers do not use folic acid tablets due to mild adverse effects such as nausea and vomiting. Therefore, service providers should provide education to mothers about the use of medicines given to them. Additionally, all RCH commodities should be made readily available to reduce challenges, along with IPC compliance. Mothers should be encouraged to visit the clinic early so that any health problems can be diagnosed and treated early. Service providers' advice should also be followed. It is recommended that mothers attend eight visits, with each visit tested for HB and RBG, to improve maternal health. The transport system and decision-making for referrals and training provision should be improved, and on-the-job training for service providers should be provided. It was suggested that all pregnant women attending within 12 weeks of pregnancy or earlier be given the motivated. Coating folic acid tablets and combining them with anti-emetics can help improve adherence to medication. Additionally, CHWs should remind pregnant women to attend subsequent visits within the appointment schedule. Male involvement is also crucial as they are decision-makers in the family and male partners/husbands should be educated about the importance of proper nutrition for both the mother and child.

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Declarations

Availability of data and materials: The raw data used in this study were generated at Geita Regional Referral Hospital from the discussed perinatal deaths for quantitative data. Qualitative data were obtained through focused group discussions, in-depth interviews, and key informant interviews. The corresponding authors [SPM, OS, ZS & MK, PL, AK, SM & JG] hold the data that support the findings of this study and they are available upon request.

Ethical Approval: The study protocol was reviewed and approved by the Ethics Committee of National Institute for Medical Research-Tanzania with approval number NIMR /HQ/R.8a/vol. IX/4510 before the commencement of the study. Informed consent was obtained from all participants, and their confidentiality and privacy were protected throughout the study. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Competing interests: none

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Authors' contributions

SPM and MK contributed equally to intellectual input, study design, data analysis, and interpretation of results. OS, PL, JG, SM, ZS, AK read and revised the manuscript.

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