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Evaluating Risk Factors for Perinatal Deaths in Dar Es Salaam

[1] Sidney Steven Mboya, [2] Tumaini Mujuni Katunzi, [3] Rehema Idriss Mzimbiri*

[1]Comprehensive Community Based Rehabilitation in Tanzania (CCBRT) P.O Box 23310, Dar es Salaam, Tanzania

[2,3] Eastern Africa Statistical Training Centre, P.O. BOX 35103 Dar Es Salaam, Tanzania

*Corresponding Author Email: rehema.mzimbiri@eastc.ac.tz

KEYWORDS

Perinatal Deaths, Neonatal Deaths, Stillbirths, Risk Factors, Dar Es Salaam

ABSTRACT

This study assessed the risk factors contributing to perinatal deaths in Dar es Salaam, Tanzania, where the perinatal mortality rate stands at 36 per 1,000 live births higher than the sub-Saharan Africa regional average. Despite various interventions, understanding of the underlying causes remains limited. The study aimed to identify key determinants to guide more effective strategies for improving maternal and neonatal health outcomes. Secondary data were obtained from eight health facilities in Dar es Salaam for the period 2015 to 2021. Statistical analyses were conducted using Stata Version 15. Chi-square and Cramér's V tests were used to examine associations, and binary logistic regression was employed to assess the relationship between selected risk factors and perinatal deaths, including both neonatal deaths and stillbirths.Out of 12,070 recorded cases, 3,520 (29%) were neonatal deaths, while 8,550 (71%) were stillbirths. The most significant causes of death included intrapartum asphyxia (27%) and intrauterine death (17%). Strong associations were identified between perinatal deaths and maternal or obstetric conditions, particularly spontaneous preterm labor, antepartum hemorrhage, hypertensive disorders, and intrauterine death. Maternal hypertension and obstetric hemorrhage were found to be major contributing factors.The study further revealed that a notable proportion of perinatal deaths occurred among mothers with no documented obstetric complications. These findings underscore the need for further research into risk factors affecting apparently healthy mothers during childbirth, to enhance preventive strategies and reduce perinatal mortality in similar urban settings.

1.0 Introduction

Perinatal death, defined as the death of a baby during pregnancy, at delivery, or within the first 28 days of life, remains a critical global public health issue. In 2021, approximately 2.3 million newborns died within their first month, representing nearly 47% of all under-5 deaths (WHO, 2023). Key causes include preterm birth, intrapartum-related complications (e.g., birth asphyxia and trauma), lower respiratory infections, congenital anomalies, and neonatal sepsis and meningitis. While congenital anomalies account for 5% of neonatal deaths globally, their proportion is higher in countries with lower neonatal mortality rates, reaching up to 20%. In contrast, infections are more prevalent in countries with higher neonatal mortality rates.

Low-income countries, where over 98% of stillbirths and neonatal deaths occur, are disproportionately affected. Sub-Saharan Africa holds the highest perinatal mortality rate globally, with an average of 27 deaths per 1,000 live births (WHO, 2022; Rent S. et al., 2024). In 2021, around 1.9 million stillbirths were recorded globally, equivalent to one stillbirth every 17 seconds (UNICEF, 2023). The Every Newborn Action Plan aims to reduce the stillbirth rate to 12 or fewer per 1,000 live births by 2030, with the global stillbirth rate in 2021 standing at 13.9 per 1,000 total births (WHO, 2023).

In Tanzania, the perinatal mortality rate is even higher at 39.5 per 1,000 total births, surpassing the regional average of 34.5 per 1,000 in Eastern Africa. In Dar es Salaam, the rate is even more concerning, averaging 54 per 1,000 births, exceeding both the national and global averages. Despite a high percentage of women in urban areas seeking delivery care in health facilities, over 90% of perinatal deaths remain a persistent challenge, raising concerns about the quality of healthcare services in urban maternity units. Common causes of perinatal deaths include asphyxia, maternal hypertensive disorders, infections, cord problems, and complications from obstructed labor (Allanson et al., 2015; Aminu, 2019; Dubie et al., 2021).

Addressing this issue requires a comprehensive assessment of the various risk factors contributing to perinatal death in Tanzania, such as maternal health, healthcare access, socioeconomic conditions, and environmental influences. Identifying these factors will allow for targeted interventions and policies aimed at reducing perinatal mortality, improving maternal and child health outcomes, and ensuring that resources are available to those most at risk. These efforts will contribute to the global health goal of reducing perinatal deaths and support Tanzania in meeting

the Sustainable Development Goals (SDGs), particularly Target 3.2, which seeks to end preventable deaths of new-borns and children under five (WHO, 2023). By understanding the causes of perinatal deaths and improving healthcare quality, Tanzania can work toward reducing its perinatal mortality rate and achieving better health outcomes for mothers and children.

Moreover, addressing the causes and risks associated with high perinatal death rates will support the development of effective prevention strategies, context-specific clinical guidance, and the enhancement of healthcare providers' skills in labor wards and neonatal units. This will ultimately improve maternal and neonatal health outcomes, promoting health equity for all.

2.0 Methodology

The study was conducted in the Dar es Salaam region, the central commercial hub in Tanzania, impacting congestions in health facilities, poor quality care and unacceptably high facility-based maternal and perinatal mortality (Dmello, 2021). Dar es Salaam also has high patient intake; 60% of births in the city were highly congested with low/ minimum resources such as on-duty/site health care providers (Dmello, 2021).

All health facilities that implemented the Perinatal Problem Identification Program, (PPIP) from 2015 until 2022 were used in this study. PPIP is a program developed by Dr. Johan Coetzee in the 1990s at the request of the Medical Research Council (MRC) in Pretoria to enhance the quality of care for mothers and babies (Allanson et al., 2015). It was subsequently implemented by the Dar es Salaam local health government, with support from CCBRT, as part of an ongoing quality improvement initiative that started in 2010. The aim was to track and measure progress through an in-depth investigation of the causes and circumstances surrounding deaths (both perinatal and maternal) occurring at public health facilities (Rhoda, 2014).

Study Design and Sample Size

A cross-sectional descriptive study design was used, with data collected at a single point in time. The study also adopted a retrospective approach, focusing on past events to examine potential risk or protective factors related to outcomes that were already established at the start of the study. The purpose was to assess the frequency, trends, and characteristics of perinatal death risk factors based on systematically collected data. Data were gathered from a total of eight facilities, as indicated in Table 1.

Table 1: Distribution perinatal death across the facilities used from 2015 - 2021

Facility	2015	2016	2017	2018	2019	2020	2021	Grand Total
Facility 1	724	697	650	639	539	279	278	3,806
Facility 2	745	526	652	535	475	313	248	3,494
Facility 3	543	439	452	451	469	438	162	2,954
Facility 4		116	250	277	247	236	141	1,267
Facility 5		191	239	234	200	187	139	1,190
Facility 6		31	35	53	50	86	34	289
Facility 7				75	82	49	43	249
Facility 8		15	15	19	17	22	6	94
Total	**2,012**	**2,015**	**2,293**	**2,283**	**2,079**	**1,610**	**1,051**	**13,343**

Source: PPIP secondary data, 2015 - 2021

Data Collection

Secondary data on all perinatal deaths, including both early and late neonatal deaths and stillbirths of various types (macerated and fresh), occurring between 2015 and 2021, were collected from eight health facilities. These facilities were part of an on-going quality improvement program implemented by the Dar es Salaam local health government in collaboration with Comprehensive Community Based Rehabilitation Tanzania (CCBRT). This initiative was carried out through the Perinatal Problem Identification Program (PPIP), a software tool developed in the 1990s to track and record the causes and circumstances surrounding perinatal and maternal deaths, with the goal of improving healthcare interventions and preventing future fatalities.

Studied heath facilities

From the eight (8) facilities in Dar es Salaam City, a total of 13,343 perinatal records contained both neonatal death and stillbirth were used, see Table 2.

Table 2: Total death as per facilities

Facility	Before data cleaning	After data cleaning
Facility 1	3,806	3,697
Facility 2	3,494	2,881
Facility 3	2,954	2,671
Facility 5	1,190	1,113
Facility 4	1,267	1,093
Facility 6	289	283
Facility 7	249	242
Facility 8	94	90
Total	**13,343**	**12,070**

Sources: PPIP secondary data, 2015 - 2021

The PPIP tools records include delivery and death dates, birth weight and location of delivery (e.g., facility, home, or in transit). Other factors like maternal age, parity, and antenatal care attendance were also documented, along with foetal characteristics such as gestational age, foetal quantity, and whether the foetus was born alive or dead. The outcome categories for neonatal death and stillbirth were also recorded which were subsequently examined by a medical team through a verbal autopsy process, based on available clinical data. Additional data on maternal medical conditions and obstetric risk factors, including serological tests for syphilis and HIV, were also collected. The authors also reviewed avoidable factors that could have been addressed to prevent perinatal death, emphasizing the improvement of prenatal care and intervention strategies.

The maternal factors, infant and foetus characteristics, as well as antepartum and intrapartum characteristics, are essential components in understanding the complex nature of perinatal outcomes. These factors can be broadly described within the following conceptual framework, which outlines how each category influences perinatal death risk. The maternal factors, infant and foetus characteristics, and antepartum and intrapartum conditions are key to understanding perinatal outcomes. Maternal factors such as health conditions, age, and prenatal care influence the mother’s ability to carry the pregnancy to term. Infant and foetus characteristics, including birth weight and gestational age, affect survival and the risk of complications. Antepartum

conditions, like infections or maternal health issues, can impact foetal development and increase the risk of stillbirth or neonatal death. Intrapartum factors, including delivery methods and complications, influence immediate health outcomes. This framework highlights the interconnectedness of these factors and guides healthcare interventions to improve maternal and neonatal health.

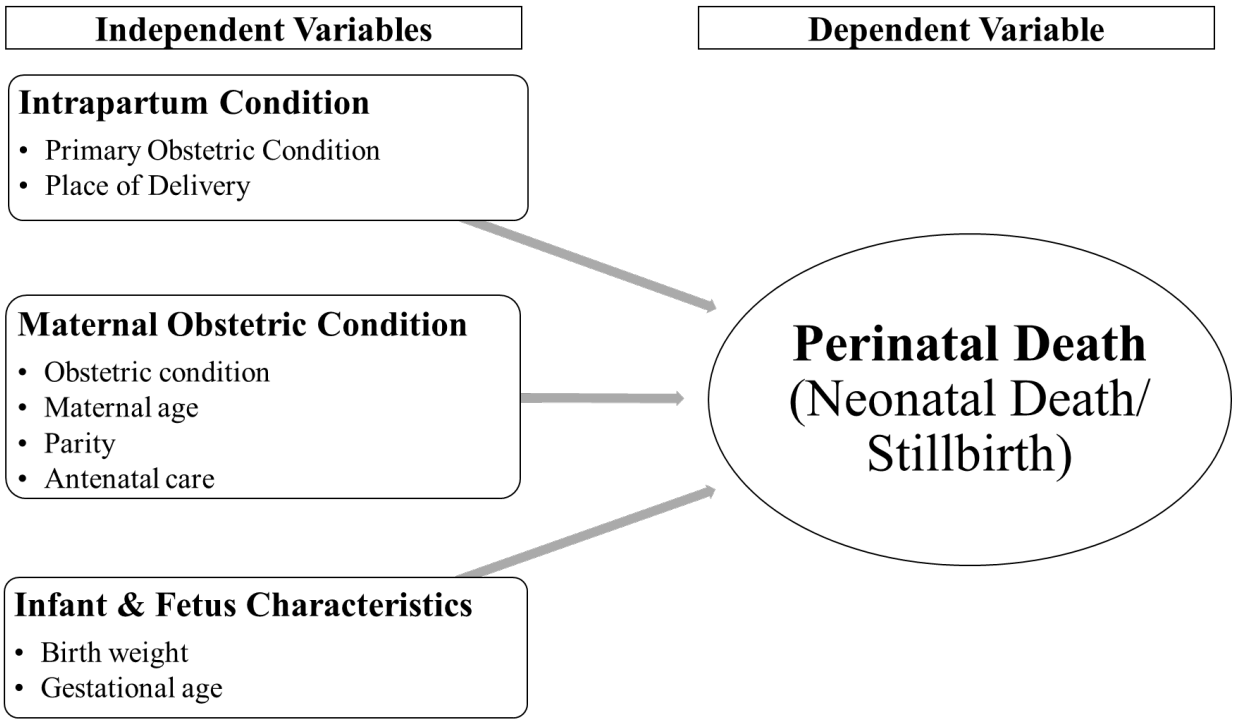

Figure 1: Flow chart showing how maternal, infant, and pregnancy conditions influence perinatal outcomes.

Source: Authors modified from Kibria and others, (2018)

Data Analysis

The collected data was coded and processed using the STATA Version 15 statistical software. Descriptive statistics such as frequency tables were generated to assess the characteristics of maternal and foetal factors associated with stillbirths and neonatal deaths Chi-square tests were employed to assess the relationships between independent and dependent variables at a 5% significance level, and Cramer's V tests was used to evaluate the strength of these associations.

The impact of various risk factors on perinatal death was assessed by binary logistic regression, as the dependent variable (perinatal death) had only two outcomes: stillbirth or neonatal death (Wilson, J. and Lorenz K., 2015). For this study, dependent variable, perinatal death, was categorized as 0 for stillbirth and 1 for neonatal death.

The Binary Logistic Model is:

$$\log it\,(\pi) = \beta_0 x_1 + \beta_1 x_2 + \beta_2 x_3 + \beta_3 x_4 + \beta_4 x_5 + \beta_5 x_6 + \ldots + \beta_n x_{n+1}$$

Where as:

$$\log it(\pi) = \log\left(\frac{\pi}{1-\pi}\right)$$

π is the probability of perinatal death occuring.
β_1, β_2 *and* β_3 represents regression coefficients.
x_1, x_2. *and* x_3 presents predictor variables - Antepartum or Intrapartum characteristics, Maternal Obstetric Factors, and Infant or Fetus Characterisitics respectively.

This regression model sought to predict the likelihood of perinatal death based on several factors, including maternal age, birth weight (Table 4), antenatal care attendance, and obstetric conditions. It incorporated multiple independent variables, as indicated in Table 3. including birth weight, maternal age, parity, antenatal care attendance, gestational age, fetal factors (such as single or multiple pregnancies), HIV and syphilis test results, and maternal obstetric conditions (like antepartum haemorrhage, fetal abnormalities, and intrauterine growth restriction).

Table 3. Independent variables and their corresponding coding in STATA 15

Category	Variable	Coding
Independent Variable	Birth Weight (in grams)	Low (500 – 2499),Normal (2500 – 3999), Big Baby (>=4000)
	Maternal Age Group	Risk below 20 (<20 years), Normal (20 – 34 years), Risk above 35 (>35years)
	Parity	Primi Para (1), Multi Para (2 – 4), Grand Para (>4)

Category	Variable	Coding
	Antenatal Care	Yes , No, Unknown
	Gestational Age week group	Premature (<37), Normal(37 – 40), Postmature (>40)
	Pregnancy Type	Single, Multiple Pregnancy
	HIV and Syphilis Serology	Negative, Positive, Not done
	Perinatal Obstetric Condition	Antepartum Hemorrhage, Fetal, Abnormality, Intrauterine Death, Intrauterine Growth Retardation, Intrapartum Asphyxia, Hypertensive, Disorders, Miscellaneous, Spontaneous Preterm Labour, Infections, Maternal Disease, No Obstetric Cause / Not Applicable, Trauma, Intrauterine Growth Retardation.
	Maternal Obstetric Condition	-No Obstetric Condition, Obstetric Haemorrhage, Hypertension, Non-Pregnancy (Related Infections), Coincidental Conditions, Medical And Surgical Disorders, Acute Collapse, Cause Unknown, Embolism, Anesthetic Complications

The odds of an event which are the ratio of its probability of occurring to the probability of it not occurring was applied to measure the odds change with a unit increase in a predictor: OR > 1 indicates an increase in odds, while OR < 1 indicates a decrease. Its formula is: $\frac{\pi_1/(1-\pi_1)}{\pi_0/(1-\pi_0)}$ where

$\pi_0/(1-\pi_0)$ is the odds of the event when the predictor is at the reference level $\pi_1/(1-\pi_1)$ and the odds at the level of interest.

Despite these, the study faced several challenges. A significant issue was data incompleteness, with missing information due to lack of access to supporting documents like antenatal clinic cards or medical records. Data accuracy was also compromised by computer literacy challenges among data entry staff, which led to potential errors.

Ethical Considerations

A letter from Eastern Africa Statistical Training Centre (EASTC) to CCBRT was sent to authorize the use of secondary data. It emphasized the need to protect privacy, maintain confidentiality, ensure transparency, and minimize bias and potential harm.

3.0 Results and Discussion of the Study

3.1 Antepartum/ Intrapartum Descriptive Characteristics

3.1.1 Description of Primary Obstetric cause of perinatal death

Based on the data, a total of 55 causes of perinatal death were grouped into six categories, with Intrapartum Asphyxia (27%), Intrauterine Death (17%), and Hypertensive Disorders (16%). Together, these three leading causes represent 59% of all perinatal death.

3.1.2 Description of maternal obstetric conditions

Maternal health conditions significantly impact perinatal outcomes. Among 59 recorded conditions, 64% of perinatal deaths occurred in mothers without any specific obstetric condition, while hypertension was linked to 18% of deaths. The majority of perinatal deaths (72.5%) were in women of typical childbearing age, with a mean age of 27, though ages ranged from 13 to 48 years. Parity also played a role, with 55% of deaths occurring in women with multiple pregnancies (multipara), and 37.6% in first-time mothers (primipara), who are considered higher-risk. Nearly all women (98.9%) who experienced perinatal death attended at least one antenatal clinic visit, although the frequency of visits as per MoH (2018) was not documented.

3.1.3 Description of Infant/ Fetus characteristics

In a study of 12,070 perinatal deaths, 51% occurred in infants with normal birth weight (2,500-3,999 grams), while 46% were due to low birth weight. The mean birth weight was 2,455 grams, but weights ranged from 500 grams to 8,000 grams. Infants with extremely low birth weight and

low gestational age face higher health risks, with 59% of low-birth-weight stillbirths being preterm (under 37 weeks).

Table 4. Birthweight and gestational age distribution in relation to perinatal death.

	Stillbirth			Neonatal death		
	Preterm %	**Normal %**	**Post-mature %**	**Preterm %**	**Normal %**	**Post-mature %**
Low birth weight	59	15	2	17	5	1
Normal birth weight	19	42	13	6	28	5
Big baby	1	3	1	0	1	0

Sources: PPIP secondary data, 2015 - 2021

In addition, 46% of infants were preterm, with a mean gestational age of 36 weeks, while 43% had a normal gestational age. Macerated stillbirths accounted for 46% of deaths, and neonatal deaths made up 29%. Overall, 71% of perinatal deaths were stillbirths, see Figure.

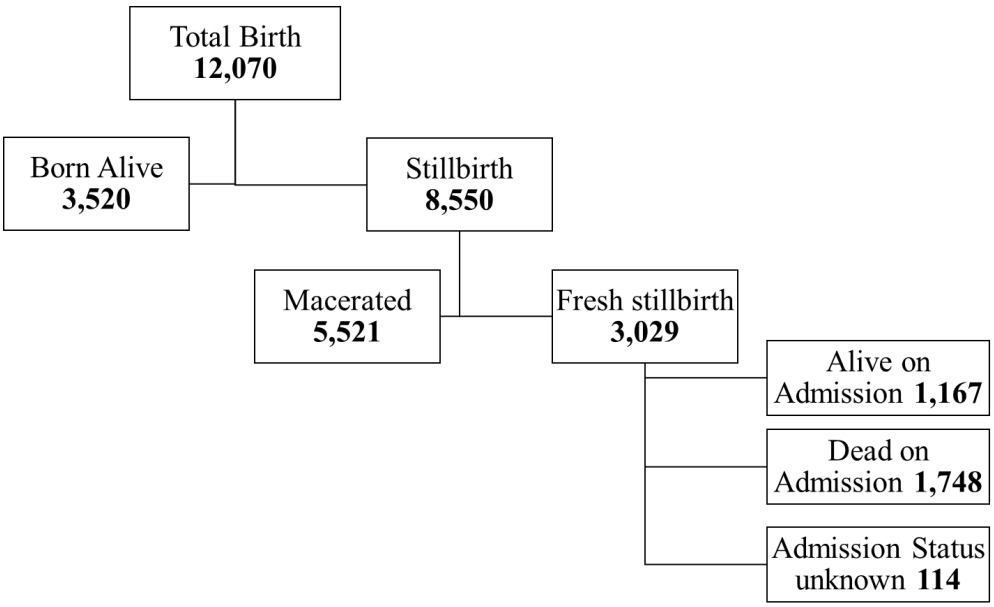

Figure 2. Status of Perinatal deaths

Source: Perinatal Death; PPIP secondary data, 2015 - 2021

The association between perinatal death and other variables

To depict the association between perinatal death and other variables, the Cramér's V and Effect Size (ES) was used. An ES value of 0.02 or less indicates a weak association, 0.2 to 0.6 indicates a moderate association, and above 0.6 indicates a strong association, with values closer to one showing a stronger relationship (IBM Corporation, 2005).

Table 5 Shows a statistically significant association between intrapartum condition and perinatal death, with a Chi-square p-value of 0.05 (5%).

Table 5. Association between intrapartum condition and perinatal death

Variable	Observation Name	Cramér's V	Chi - square	P - value
Perinatal Obstetric Causes	Intrapartum asphyxia	0.5193	3,300.00	0.000
	Intrauterine death			
	Hypertensive disorder			
	Antepartum hemorrhage			
	Spontaneous preterm			
	Other perinatal obstetric cause			

Sources: Perinatal Death; PPIP secondary data, 2015 – 2021

Table 6. presents the relationship between infant and foetus characteristics and perinatal death.

Variable	Observation Name	Cramér's V	Chi - square	P - value
Birth Weight	Low birth weight	0.1187	170.02	0.000
	Normal birth weight			
	Big baby			
Gestational Age	Normal	0.1414	241.49	0.000
	Postmature			
	Preterm			

Sources: Perinatal Death; PPIP secondary data, 2015 – 2021

3.3 The association results between perinatal death and maternal obstetric conditions

The analysis found a statistically significant relationship between birth weight and perinatal death (p-value < 0.05), though the association was weak (Cramér's V = 0.1187). Higher percentages of perinatal deaths were observed in normal and low birth weight infants (35% and 34%, respectively). Maternal age group and parity also showed statistically significant but weak relationships with perinatal death (p-value < 0.05; Cramér's V = 0.1183 and 0.1144). This is consistent with the study by Kahveci, B. et al. (2018), which found that low maternal age increases perinatal risks, such as preterm births and mortality, due to physiological and socio-economic factors, emphasizing the need for targeted interventions.

Antenatal care did not significantly relate to perinatal death (p-value = 0.085), with a very weak association (Cramér's V = 0.0202). Gestation age and pregnancy type both showed statistically significant relationships with perinatal death, but the associations were weak (p-value < 0.05; Cramér's V = 0.1414 and 0.0638). HIV and syphilis serology were statistically significantly related to perinatal death, though their associations were weak (Cramér's V = 0.047 and 0.0124).

The primary obstetric cause of perinatal death demonstrated a moderate statistical relationship with perinatal death (p-value = 0.000; Cramér's V = 0.5193), as did maternal obstetric conditions (p-value < 0.05; Cramér's V = 0.3232) (Table 7).

Table 7. Association results between perinatal death and maternal obstetric conditions

Variable	Observation Name	Cramér's V	Chi - square	P - value
Maternal Age	Normal_Age	0.1183	168.97	0.000
	Risk_above_35			
	Risk_below_20			
Parity	Grand multipara	0.1144	157.92	0.000
	Multipara			
	Primipara			
Antenatal care	No	0.0202	4.93	0.085
	Unknown			
	Yes			
Maternal obstetric	No obstetric condition	0.3232	1,300.00	0.000

	Hypertension			
	Extra-uterine pregnancy			
	Other maternal Obstetric Condition			

The study examined various factors related to perinatal death. **Birth weight** was statistically significant in relation to perinatal death, with normal and low birth weight infants contributing to the highest percentages of stillbirths, though the relationship was weak (Cramér's V = 0.1187). **Maternal age** also showed a statistically significant but weak association with perinatal death, with a Cramér's V value of 0.1183. **Parity** was statistically significant, but the association with perinatal death was weak, indicated by an EV of 0.1144.

Antenatal care did not show a statistically significant relationship with perinatal death, as its p-value was greater than 0.05, and the association was weak (EV = 0.0202). **Gestational age** was significantly related to perinatal death, but the relationship was weak (EV = 0.1414). **Pregnancy type** (single or multiple) showed a statistically significant relationship with perinatal death, but again, the association was weak (EV = 0.0638).

HIV and syphilis serology both had statistically significant associations with perinatal death, but the relationships were weak, as reflected by low Cramér's V values (0.047 for HIV and 0.0124 for syphilis). The **primary obstetric cause** of perinatal death had a moderate and statistically significant relationship with perinatal death, with an EV of 0.5193. Similarly, **maternal obstetric conditions** were statistically significantly related to perinatal death, with a moderate association (EV = 0.3232). In summary, while several factors were statistically significant, most showed weak associations with perinatal death, except for primary obstetric causes and maternal obstetric conditions, which showed moderate relationships combined with preterm birth, significantly increases the risk of health complications.

3.4 Modelling of the Risk Factors contributing to Perinatal Deaths in Dar Es Salaam City.

Logistic regression analysis was employed to assess and identify the risk factors associated with perinatal deaths in Dar es Salaam. This was conducted on a dataset of 12,057 observations. The results shows a statistical significance, with a Chi-square result (chi (22) = 4691.09, $p < 0.0000$)

indicating a good model fit. The findings suggest that the predictor variables significantly impact perinatal death as seen in Table 8.

Table 8. Correlation between risk factors and perinatal deaths

Perinatal_Death	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval
Obstretic Causes Perinatal Deaths						
Intrapartum asphyxia	1.35981	0.08035	5.20	0.000	1.21110	1.52679
Intrauterine death	0.00390	0.00149	-14.54	0.000	0.00185	0.00823
Hypertensive disorders	0.09913	0.01598	-14.34	0.000	0.07227	0.13596
Antepartum haemorrhage	0.18151	0.02696	-11.49	0.000	0.13567	0.24284
Spontaneous preterm labour	2.30563	0.20032	9.61	0.000	1.94462	2.73366
Maternal Obstetric Condition						
No obstetric condition	3.47909	0.32636	13.29	0.000	2.89479	4.18132
Hypertension	1.77635	0.26500	3.85	0.000	1.32600	2.37966
Obstetric haemorrhage	0.46857	0.07773	-4.57	0.000	0.33851	0.64860
Birth Weight category						
Low birth weight	0.76821	0.05076	-3.99	0.000	0.67489	0.87444
Big baby	0.65963	0.08709	-3.15	0.002	0.50923	0.85446
Gestational age						
Normal	2.16343	0.16869	9.90	0.000	1.85683	2.52066
Preterm	1.41246	0.12766	3.82	0.000	1.18316	1.68620
Antenatal Care						

Perinatal_Death	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval
No	1.03724	0.26198	0.14	0.885	0.63224	1.70166
Maternal age group yrs						
Risk_above_35	0.81338	0.07289	-2.30	0.021	0.68236	0.96956
Risk_below_20	1.37360	0.10069	4.33	0.000	1.18977	1.58583
_cons	0.12792	0.02004	-13.12	0.000	0.09410	0.17390

Source: Perinatal Death; PPIP secondary data, 2015 - 2021

Study findings shows that obstetric causes of perinatal death are strongly associated with perinatal death, with a Cramér's V of 0.5193 and a statistically significant result (chi(2) = 3300, p < 0.000). Specific conditions, such as intrapartum asphyxia, have a significantly higher odds ratio (1.36), indicating a 36% increased likelihood of stillbirth. In contrast, intrauterine death and hypertensive disorders show lower odds of stillbirth, with odds ratios of 0.0039 and 0.0991, respectively. Antepartum hemorrhage also shows lower odds (0.1815), while spontaneous preterm labor has a higher odds ratio (2.31), indicating a significantly increased likelihood of perinatal death.

Obstetric causes of perinatal death show a strong association with perinatal death, with a Cramér's V of 0.5193 and a statistically significant chi-square result (chi(2) = 3300, p < 0.000). Specific conditions significantly impacting perinatal death include intrapartum asphyxia, with a 36% higher likelihood of stillbirth (odds ratio = 1.36), and spontaneous preterm labor, which increases the likelihood by 2.31 times. In contrast, intrauterine death, hypertensive disorders, and antepartum hemorrhage all show lower odds of stillbirth, with odds ratios of 0.0039, 0.0991, and 0.1815, respectively, all statistically significant.

Maternal obstetric conditions are strongly associated with perinatal death, as shown by a Cramér's V of 0.3268 and a statistically significant chi-square result (chi(8) = 1300, p < 0.000). Notable conditions include "No obstetric condition," which has an odds ratio of 3.48, indicating a much higher likelihood of stillbirth. Hypertension increases the odds of stillbirth by 1.78 times, while obstetric hemorrhage is associated with a lower likelihood of stillbirth, with an odds ratio of 0.47,

all statistically significant with p-values of 0.000. This align with the study findings done in Chona which indicate that maternal obstetric conditions are significantly linked to perinatal outcomes, reinforcing the idea that early identification and management of these conditions could help reduce perinatal mortality rates. The study highlights the need for improvements in maternal healthcare systems to address these critical risks (Liu et al., 2022).

Antenatal care was not significantly associated with perinatal death, as indicated by a Cramér's V of -0.0082 and a p-value of 0.368, showing no difference in perinatal death odds between infants of mothers who received care and those who did not. These findings are consistent with Muwena et al. (2024), who also reported no significant association between perinatal deaths and care provided during labor, delivery, or the early postpartum period. In contrast, parity groups displayed a weak but statistically significant association (Cramér's V = 0.1144, $p < 0.000$), with primiparous mothers having 1.44 times higher odds of perinatal death compared to multiparous mothers, though the difference for multiparous mothers was not significant.

Maternal age was weakly associated with perinatal death (Cramér's V = 0.1183, $p < 0.000$), with mothers under 20 having 1.37 times higher odds of perinatal death compared to those over 35 years old, who had 0.81 times lower odds. Birth weight also showed a weak association (Cramér's V = 0.1228, $p < 0.000$), with low-birth-weight infants having 0.77 times lower odds of perinatal death than those with normal birth weight (Table 6) while high birth weight infants had 0.66 times lower odds. This resembles to Triggs T. et al., (2024).

Similarly, gestational age was weakly associated with perinatal death (Cramér's V = 0.1414, $p < 0.000$), with normal gestational age infants having 2.16 times higher odds of perinatal death compared to preterm infants, who had 1.41 times higher odds compared to those with normal gestational age.

In Dar es Salaam region, primary obstetric causes were the most statistically significant factors contributing to perinatal death, with a strong association indicated by a Cramér's V of 0.5193 and a p-value of 0.000. Among the primary obstetric causes, the conditions with the highest odds ratios for perinatal death were, in ascending order: Spontaneous Preterm Labour (OR 2.03), Intrapartum Asphyxia (OR 1.36), Antepartum Haemorrhage (OR 0.18), Hypertensive Disorders (OR 0.099), and Intrauterine Death (OR 0.004).

The findings on hypertensive disorders in this study are similar to previous research by Allanson (2015), though this study further differentiates types of pregnancy-related hypertension, including pregnancy hypertension without proteinuria (9%), proteinuria hypertension (7%), and eclampsia (1%). Intrapartum asphyxia, which includes conditions such as labour-related asphyxia (19%), cord prolapse, and meconium aspiration (5%), is consistent with findings by Mangu (2021) and Aminu (2019), but this study provides more detailed frequencies and descriptions of these conditions.

Table 9. Detailed primary obstetric causes of perinatal death

Row Labels	**Normal Delivery %**	**Still Births %**	**Perinatal Death %**
INTRAPARTUM ASPHYXIA	**15.09**	**11.95**	**27.04**
Labour related intrapartum asphyxia	12.75	6.49	19.23
Cord prolapses	0.33	2.94	3.27
Meconium aspiration	1.94	0.42	2.36
Ruptured uterus	0.08	2.11	2.19
INTRAUTERINE DEATH	**0.07**	**18.80**	**18.87**
Unexplained intrauterine death - macerated	0.05	17.13	17.17
Unexplained intrauterine death - fresh	0.02	1.27	1.29
HYPERTENSIVE DISORDERS	**0.77**	**17.30**	**18.07**
Pregnancy-induced hypertension without proteinuria	0.29	8.68	8.97
Proteinuria hypertension	0.16	6.87	7.03
Eclampsia	0.24	0.99	1.24
OTHER	**7.65**	**7.20**	**14.85**
No obstetric cause / Not applicable	6.88	0.18	7.06
Other cause of death not classified	0.44	2.50	2.94
Post maturity	0.30	2.55	2.85
Malaria	0.04	1.97	2.00

Row Labels	Normal Delivery %	Still Births %	Perinatal Death %
ANTEPARTUM HAEMORRHAGE	**0.58**	**11.26**	**11.84**
Abruptio placentae	0.39	7.66	8.06
Abruptio placentae with hypertension	0.12	2.69	2.81
SPONTANEOUS PRETERM LABOUR	**5.56**	**3.77**	**9.33**
Ideopathic preterm labour	4.60	2.34	6.94
Preterm premature rupture of membranes	0.76	0.67	1.43

Sources: PPIP secondary data, 2015 – 2021

The study findings on Obstetric Hemorrhage (Table 9), which include Abruption placentae and Abruption placentae with hypertension, are consistent with those of Allanson et al. (2015 and Dmello et al., 2024). However, the study's emphasis on spontaneous preterm labour, including Idiopathic preterm labour and preterm premature rupture of membranes, was not addressed in the empirical literature reviewed by other researchers.

Conclusion and Recommendations

This study examined the risk factors contributing to perinatal death in the Dar es Salaam region, focusing on antepartum/intrapartum conditions, maternal obstetric factors, and infant characteristics. The results showed that primary obstetric causes, such as Spontaneous Preterm Labour, Intrapartum Asphyxia, Antepartum Haemorrhage, Hypertensive Disorders, and Intrauterine Death, had a strong and statistically significant impact on perinatal death. While Syphilis serology and Antenatal care were not significantly associated with perinatal death, maternal conditions like Hypertension and Obstetric Hemorrhage were strongly linked to adverse outcomes. Notably, some mothers without significant obstetric conditions still experienced perinatal death, possibly due to other factors such as antepartum or intrapartum complications. For infant characteristics, birth weight and pregnancy type showed weak associations with perinatal death, with preterm and low-birth-weight infants facing higher risks compared to those with normal gestational age and weight. However, pregnancy type did not show a statistically significant relationship.

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