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Maternal and Fetal Characteristics of Stillbirths among Deliveries at Ndola Teaching Hospital, Ndola, Zambia

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Abstract

Background: Stillbirths remain a major contributor to perinatal morbidity and mortality globally, with the burden disproportionately higher in low- and middle-income countries, including Zambia. Despite interventions to improve maternal and neonatal health, adverse birth outcomes remain a significant challenge. This study investigated the prevalence and characteristics of stillbirths at Ndola Teaching Hospital (NTH), a major referral centre in Northern Zambia. **Methods:** A retrospective cross-sectional study was conducted using delivery records from January 2019 to December 2021 at Ndola Teaching Hospital in Zambia. The study included women who delivered stillbirths between 28 - 41 weeks of gestation. Data were extracted from clinical records and analyzed using SPSS version 25. **Results:** Out of 21,883 deliveries during the study period, 770 stillbirths were recorded, yielding a prevalence of 3.5%. Macerated stillbirths accounted for 71%, while fresh stillbirths made up 29%. **Conclusion:** The prevalence of stillbirths at NTH was high, with macerated stillbirths comprising the majority. Strengthening antenatal care services, ensuring access to obstetric ultrasound, and improving intrapartum care may help reduce the burden of stillbirths. Further research is warranted to explore the underlying causes of macerated stillbirths in this setting.

Keywords

Stillbirth, Macerated Stillbirth, Ndola Teaching Hospital, Antenatal Care,

Risk Factors, Zambia

1. Introduction

Stillbirth is defined as a baby born with no signs of life at or after 28 weeks of pregnancy [1]. Stillbirths can also be classified as Fresh Stillbirths (FSB) or Macerated Stillbirths (MSB). FSB is where fetal death happens during labour or delivery, while macerated stillbirth is intrauterine fetal death that happens before the onset of labour or delivery with signs of degeneration or degenerative changes [2].

At the global level, an estimated 2.6 million stillbirths occur every year [3], therefore stillbirths remain a public health concern and most of them occur during labour and childbirth. Therefore, investigating risk factors and ending preventable stillbirths are part of attaining the milestones set in the Sustainable Development Goals, in particular goal number three [4]. The rates of stillbirths vary across the world, but developing countries account for higher rates than the developed countries [5] [6].

In Southern Africa, Lesotho has the highest stillbirth rate of live births, currently estimated at 478 deaths per 100,000 live births, while Zambia is in eighth place [7] [8]. The Zambian government, through the Ministry of Health, launched the Integrated Antenatal Care package in 2018 to upscale interventions in improving maternal and neonatal outcomes [3]. Additionally, the Zambian government is also implementing the Global Every Newborn Action Plan (ENAP), which was launched in 2014 by member states of the World Health Organization (WHO), with its goal of ending preventable newborn deaths and stillbirths by 2030 [3]. Previous studies done in the urban African obstetric population in Lusaka revealed that stillbirth is a major contributor to poor perinatal outcomes [7] [9]. Therefore, despite milestones made toward universal health coverage, stillbirth rates continue to remain high in Zambia [9]. While previous studies on stillbirths in Zambia have largely been conducted in Lusaka, there is limited evidence from Ndola Teaching Hospital, the second largest referral hospital in the country and the main tertiary center for the northern region. Investigating this setting is therefore essential to provide region-specific data that can inform targeted interventions for reducing stillbirths. This study therefore sought to investigate the prevalence and characteristics of stillbirths at Ndola Teaching Hospital, a large regional referral hospital in Northern Zambia.

2. Materials and Methods

2.1 Study Site

The study was conducted at Ndola Teaching Hospital, a tertiary referral hospital in Ndola District, located in Zambia's Copperbelt province. Ndola is a major urban center, serving as the provincial capital and situated 320 kilometers north of

Zambia's capital, Lusaka. The hospital has an 850-bed capacity and primarily serves a district population of approximately 556,000 people [8] [10]. The hospital receives referrals from the northern part of Zambia and offers a wide range of healthcare services, including primary, secondary, and tertiary care, making it a representative specialized hospital in the Copperbelt province. Ndola Teaching Hospital provides various sexual reproductive health services, including Gynecological, Antenatal Care, Labour, Delivery and Postnatal care services, mainly catering to middle to low-income women.

2.2. Study Design and Population

This study was a retrospective cross-sectional study using routinely collected data over three years (2019-2021). Data were extracted from hospital clinical records, including patient files and delivery registers of women who had delivered at Ndola Teaching Hospital. A total enumeration of all patient files from 1 January 2019 to 31 December, 2021 was conducted. All records of stillbirths were obtained from delivery and postnatal hospital records. These included women who delivered and had an adverse birth outcome of a stillbirth between 28 weeks and below 42 weeks' gestation. Records of women who had miscarriages or women who had a fetal loss in less than 28 weeks' gestation were excluded from the study.

2.3. Data Collection Procedures

Collection of data was done from September 2022 to October 2022. Patient files were used to extract information on the mother, such as antenatal care history, history of index pregnancy, maternal medical conditions and other social demographic details. Delivery registers were used to collect information on the newborn. For the purpose of this study, data were collected on both fetal (stillbirth) characteristics and extensive maternal variables like sociodemographic, obstetric and clinical factors.

2.4. Data Analysis

Collected data were entered into Microsoft Excel for cleaning and then exported to SPSS version 25 (IBM, Armonk, NY) for statistical analysis. Data were analyzed as frequencies of various characteristics and presented in tables and graphs.

2.5. Ethical Considerations

Ethical clearance was obtained from the Tropical Diseases Research Centre Ethics Committee (IRB number 00002911). Authority to access hospital records at the labour and postnatal ward in the Department of Obstetrics and Gynecology was obtained from NTH management. There was no contact with the study participants and therefore the study posed no actual harm to participants. All data that were collected were de-identified and study numbers were assigned to ensure delinking of hospital records from data collected. All data that were collected were restricted to the investigators.

3. Results

A total of 21,883 deliveries were conducted at NTH during the period of 2019 to 2021. Of these, there was a total of 770 stillbirths, with the majority from the year 2020 (306, 39.7%). There were more women aged 25 - 34 years (n = 326), with the majority of the women being married (n = 246, 85.7%). Similarly, the majority of the women had no formal education (n = 339, 93.1%). Table 1 shows the demographic characteristics of women who were included in the study.

Table 1. Social demographic characteristics of women included in the study.

Characteristic	n	%
Year of Admission (n = 770)		
2019	195	25.3
2020	306	39.7
2021	269	34.9
Age (years) (n = 766)		
<25 years	297	38.8
25 - 34 years	326	42.6
≥35 years	143	18.7
Marital Status (n = 287)		
Married	246	85.7
Not Married	41	14.3
Education (n = 364)		
None	339	93.1
Primary	5	1.4
Secondary	13	3.6
Tertiary	7	1.9

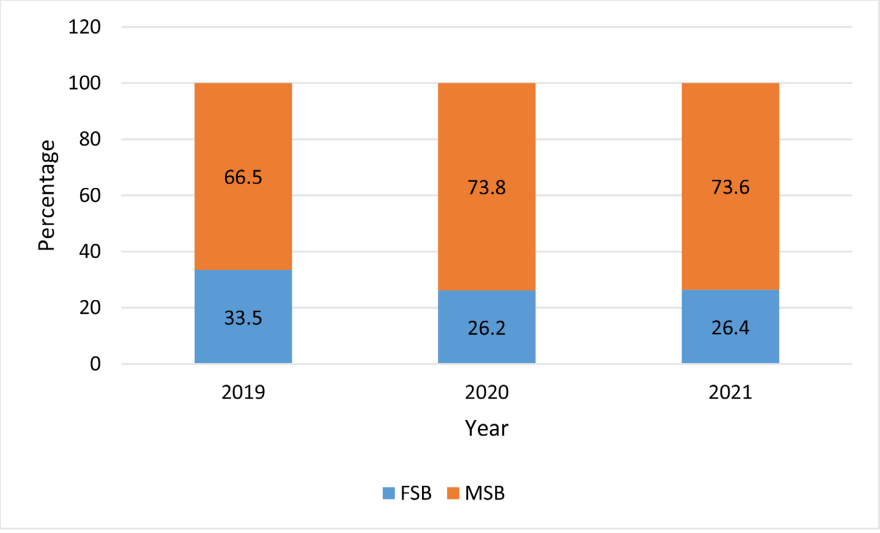

Figure 1. Percentage of fresh stillbirths and macerated stillbirths by year.

The overall prevalence of stillbirths at NTH from 2019 to 2021 was 3.52% (95% CI: 3.28% - 3.77%). The prevalence of stillbirths over the study years slightly increased from 2.92% (95% CI: 2.55% - 3.34%) in 2019, to 3.28% (95% CI: 2.89% - 3.72%) in 2020 and then 4.08% (95% CI: 3.64% - 4.56%). This study showed that macerated stillbirths (MSB) were more common, with 546/770 (71.0%), while the rest were fresh stillbirths (FSB), 223/770 (29.0%). Over the years, the percentage of MSB slightly increased while that of FSB slightly reduced, see Figure 1.

Table 2 presents the obstetric and antenatal characteristics of the participants. The majority of women were multigravida (543/762; 71.3%). Regarding parity, 249/741 (33.6%) were nulliparous, while 289/741 (39.0%) were multiparous. Most participants were in the third trimester (382/420; 91.0%) and were aware of their HIV status (402/420; 91.0%). Over three-quarters (187/360; 79.8%) had fewer than five antenatal care (ANC) visits. The majority (148/161; 91.9%) preferred attending ANC at clinics rather than hospitals. Two-thirds (249/358; 69.6%) reported prior ultrasound use. Regarding past medical history, 75.2% had no significant medical conditions. Among those admitted to Ndola Teaching Hospital (NTH), most were referred from another health facility (285/349; 81.7%), while 51/349 (14.6%) were self-referrals.

Table 2. Maternal characteristics of stillbirths.

Characteristic	n	%
Gravidity (n = 762)		
Primigravida	219	28.7
Multigravida	543	71.3
Parity (n = 741)		
Nullipara	249	33.6
Primipara	163	22.0
Multipara (2 - 4)	289	39.0
Grand Multipara (5 - 9)	40	5.4
Gestation Age (n =420)		
14 - 27 Weeks (2nd Trimester)	20	4.8
28 - 40 Weeks (3rd Trimester)	382	91.0
≥41 Weeks (Post-Term/Postdates)	18	4.2
HIV Status (n = 765)		
Known Non-Reactive	590	77.1
Known Reactive	138	18.0
Unknown	37	4.8
Number of ANC Visits (n = 360)		
0	123	34.2
1 - 4	164	45.6
5 - 8	69	19.2
≥9	4	1.1

Continued

Place of ANC Visit (n = 161)		
Clinic	148	91.9
Hospital	13	8.1
Ultrasound Use (n = 358)		
Yes	249	69.6
No	109	30.4
Past Medical History (n = 371)		
No Significant Conditions	279	75.2
Communicable (CD)	61	16.4
Non-Communicable (NCD)	28	7.5
CD + NCD	3	0.9
Referral (n = 349)		
No	13	3.7
Yes—Health Facility	285	81.7
Yes—Self	51	14.6

Table 3. Fetal characteristics of stillbirths.

Characteristic	Stillbirth	
	Yes	%
Mode of Delivery (n = 770)		
Spontaneous Vaginal Delivery	562	73.0
Assisted Delivery	208	27.0
Birth Weight (n = 762)		
<1.5 kg	188	24.7
1.5 - 2.4 kg	284	37.3
2.5 - 3.9 kg	278	36.5
≥4.0 kg	12	1.5
Gender (n = 758)		
Female	382	50.4
Male	376	49.6
Partograph Use (n = 763)		
Yes	380	49.8
No	383	50.2
Birth Attendant (n = 769)		
Medical Officer	214	27.8
Midwife	555	72.2

Table 3 shows the fetal characteristics of stillbirths. Most women delivered stillbirths via spontaneous vaginal delivery, 562/770 (73.0%). Partographs were used by less than half of the women, 380/763 (49.8%), during delivery. Slightly more babies delivered, 284/762 (37.3%), had birth weight between 2.5 - 3.9 kg, while slightly more than half of the babies were of female gender, 382/758 (50.4%). Midwives conducted the largest proportion of deliveries, 555/769 (72.2%).

4. Discussion

This study investigated stillbirths at Ndola Teaching Hospital (NTH) from 2019 to 2021, revealing an overall prevalence of 3.52% (95% CI: 3.28% - 3.77%), with a gradual increase from 2.92% in 2019 to 4.08% in 2021. Most stillbirths were macerated (71.0%), and affected women were predominantly aged 25 - 34 years (42.6%), married (85.7%), and without formal education (93.1%). The majority were multigravida (71.3%), multiparous (39.0%), and in their third trimester (91.0%) at presentation. Although most women were aware of their HIV status (91.0%) and two-thirds had prior ultrasound use, antenatal care attendance was generally low, with nearly 80% reporting fewer than five visits, and most preferring clinics over hospitals (91.9%). Most stillbirths were delivered via spontaneous vaginal delivery (73.0%), with partograph use in less than half of cases (49.8%), and midwives conducted the majority of deliveries (72.2%). These findings underscore the persistent burden of stillbirths at NTH and highlight the urgent need to improve maternal health education, antenatal care utilization, and intrapartum monitoring to reduce preventable perinatal deaths.

The findings from our study resonate with another study conducted in Lusaka of 39 stillbirths per 100 births, with slightly higher rates reported at another facility in Lusaka and Zimba Mission Hospital in the Southern part of Zambia [7] [9] [10]. Varying rates have also been reported in Africa, ranging from 15 to 146 stillbirths per 1000 births [11], with East Africa averaging 8.6 stillbirths per 1000 birthday and Sub-Saharan Africa at 61 stillbirths per 1000 births. These variations indicate differences in health systems and methodological approaches that were employed in the different regions. The rate of stillbirths in our study was nearly three times higher than the SDG 3.2 target of fewer than 12 stillbirths per 1000 births by 2030, as well as Zambia's Ministry of Health Legacy Goal No. 1. This underscores a major public health challenge and highlights the urgent need to reduce neonatal mortality from 35 to 12 per 1000 births by 2030. Achieving this will contribute not only to SDG 3.2 but also to Zambia's Health Strategic Plan, the 8th National Development Plan, and ultimately Vision 2030.

If the current trajectory continues, preventable stillbirths will remain a major contributor to perinatal mortality in Zambia, undermining national efforts to reduce the maternal mortality ratio. However, strengthening health systems to address the gaps identified could have a transformative effect. Interventions such as enhancing maternal health literacy, expanding ANC coverage, improving referral networks, ensuring consistent use of tools like partographs, and equipping lower-

level health facilities to manage obstetric complications would reduce the burden of stillbirths.

Macerated stillbirths were predominant, likely due to antepartum complications such as intrauterine infections, placental insufficiency, maternal malaria, and birth asphyxia, as suggested by the previous study in Zambia and this necessitates targeted interventions during antenatal care. The prevalence aligns with rates reported in South Asia [12]. Further, studies in low-resource settings reported a pooled rate of 28.9 per 1000 [4] [5].

In the current study, 73% of women delivered via Spontaneous Vaginal Delivery (SVD) compared to assisted deliveries. These findings concur with various studies favoring vaginal delivery, emphasizing instrumental or induced labour methods unless maternal complications necessitate a cesarean section [13]-[15]. Our study found that more than 5 to 8 visits increased the protective effect by 93%. These findings align with research from other low- and middle-income countries, highlighting the importance of attending antenatal care clinics in preventing stillbirths [4] [14] [15]. More ANC visits reduce macerated stillbirths because they prevent undetected intrauterine complications, ensure continuous fetal surveillance, and enable timely obstetric interventions before the fetus dies in utero [1]. The resemblance in findings is due to similarity in the coding for ANC visits or contacts that was modified by the World Health Organization in the number of visits or contacts a pregnant woman should have with a health care provider [16]. The opposite is also plausible that having no ANC visits is a modifiable factor contributing to stillbirths and this is supported by multiple studies [12] [17] [18].

The findings of this study have public health implications, as the high prevalence of stillbirths at NTH shows ongoing gaps in maternal health services, especially in antenatal care attendance, health literacy, and intrapartum monitoring. If these challenges are not attended to, preventable stillbirths will continue to impose emotional, social, and economic burden on mothers and families, strain healthcare resources, and hinder progress toward Zambia's maternal and child health targets. For example, Zambia set the target for neonatal mortality to decrease from 27 to less than 12 per 1000 live births by 2030. Conversely, implementing targeted interventions—such as improving access to quality antenatal care, promoting maternal education, strengthening referral systems, and ensuring consistent use of partographs and skilled birth attendance—could substantially reduce stillbirth rates, improve perinatal outcomes, and contribute to broader maternal and child health improvements in the region.

Practically, improving maternal health literacy could be achieved by incorporating culturally relevant messaging into outreach clinics and prenatal visits, as well as by implementing organized community-based health education programs run by midwives and community health workers. Establishing transparent communication guidelines between Ndola Teaching Hospital and other healthcare facilities, as well as funding dependable emergency transportation like ambulances or community-based transportation programs, could further improve the referral

system.

5. Study Limitations

There are various limitations to this study, considering its retrospective design. It depended on clinical records, which occasionally had inconsistent and insufficient documentation, leaving some maternal and fetal characteristics without data. This challenge raised the risk of information bias and could have impacted how accurate some of the relationships found were. Moreover, it is impossible to prove a causal link between the maternal variables found and stillbirth outcomes due to the retrospective methodology. Regardless of these limitations, the study offers insightful information about the prevalence and features of stillbirths at Ndola Teaching Hospital, offering proof from an area where such data are still hard to come by.

6. Conclusion

This study showed there was a high prevalence of stillbirths at NTH in the period under review and macerated stillbirths contributed more to the prevalence of stillbirths, which could have been due to pregnancy complications. Enhancing antenatal care, prompt referral and timely interventions for high-risk pregnancies, along with strengthening the healthcare system, are essential to reduce stillbirth rates effectively. Further research is warranted to explore the underlying causes of macerated stillbirths in this setting.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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