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Original Research Article

The Influence of Delayed Antenatal Care Attendance on the Risk of Macerated Stillbirths: A Retrospective Cross-Sectional Study

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Abstract: ***Background*:** Stillbirths, particularly macerated stillbirths linked to delayed antenatal care (ANC) and chronic placental insufficiency, remain a critical public health challenge in low-resource settings. In Tanzania, 34% of women initiate ANC after 16 weeks, exacerbating risks of undetected maternal-fetal complications. This study investigated the association between delayed ANC attendance and macerated stillbirths at Mwananyamala Regional Referral Hospital in Dar es Salaam, Tanzania. ***Methods*:** A retrospective cross-sectional study analyzed medical records of women with stillbirths (≥28 weeks) from January- December 2024. Data on ANC timing, maternal demographics, comorbidities, and pregnancy outcomes were collected. Logistic regression and ANOVA were used to assess associations, adjusting for confounders (e.g., age, parity, HIV). ***Results*:** Among 199 participants (57.6% response rate), 73.9% initiated ANC after 12 weeks and 94.5% attended fewer than the recommended 8 visits. Macerated stillbirths accounted for 74.9% of cases, with 42.2% of women reporting prior stillbirths. Late ANC initiation independently increased macerated stillbirth risk (AOR=3.46, 95% CI:0.182-0.742). Grand multiparity (≥5 births) was strongly associated with fresh stillbirths (OR=164.5, 95% CI:13.1-206.7), while multiparity (2-4 births) predicted macerated stillbirths (AOR=2.69, P=0.008). Hypertensive disorders (41.2% prevalence), particularly preeclampsia (OR=2.78, P=0.017), and HIV (43.2% prevalence) were linked to adverse outcomes. Higher education showed a protective trend (OR=0.39, P=0.089). ***Conclusion*:** Delayed ANC initiation, multiparity, and hypertensive disorders are critical, modifiable risk factors for macerated stillbirths in urban Tanzania. Community-driven ANC promotion and targeted prenatal monitoring for high-parity women are urgently needed to reduce preventable stillbirths.

Keywords: Antenatal Care, Delayed ANC initiation, Macerated stillbirth, hypertensive disorders in pregnancy, multiparity, HIV in pregnancy, preterm birth.

INTRODUCTION

Background

Stillbirths remain a devastating public health challenge globally, with an estimated 2 million births occurring annually, 98% of which are in low- and middle-income countries (LMI. Stillbirths are babies who die after 28 weeks of pregnancy, before or during delivery (WHO, 2018) (Bamber, 2022). Macerated stillbirths occur hours to days before delivery, and these babies are born with degenerative body changes that occur in a fetus remaining in the uterus after death (Moore, 2007). Macerated stillbirths are particularly concerning, as they often reflect chronic placental insufficiency or undetected maternal-fetal complications that could be mitigated through timely antenatal care (ANC) (Frøen *et al*., 2016). The World Health Organization (WHO) recommends initiating ANC within the first trimester (before 12 weeks of gestation) to enable early risk stratification, management of comorbidities, and fetal monitoring (WHO, 2018). However, in Tanzania, 34% of pregnant women attend their first ANC visit after 16 weeks of gestation, with even later initiation observed in urban centers (*Demographic and Health Survey and Malaria Indicator Survey*, n.d.).

In Dar es Salaam, Tanzania's largest city and economic center, Mwananyamala Regional Referral Hospital serves a diverse, large population, including many low-income women facing barriers to early healthcare access. Despite being a regional hospital classified under Comprehensive Emergency Obstetric

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and Neonatal Care (CEmONC), there are still reports of a significant burden of macerated stillbirths (Kidanto & Msemo, 2024). Late ANC attendance in this setting may be driven by factors such as limited health literacy, competition for socioeconomic priorities, and cultural misconceptions regarding pregnancy care (Manzi *et al*., 2014). Delayed ANC limits the detection and management of conditions such as preeclampsia, fetal growth restriction, and placental abnormalities, which are key contributors to macerated stillbirths (Haddrill *et al*., 2014) (Chuwa *et al*., 2017).

Studies from Tanzania have focused broadly on ANC utilization and maternal outcomes (Mwilike *et al*., 2018); however, none have specifically examined the relationship between ANC timing and macerated stillbirth risk. By analyzing retrospective maternal health records, this study explored how delayed ANC initiation interacts with the occurrence of macerated stillbirth, adjusting for confounders such as maternal age, parity, and comorbidities. Hence, this study aimed to investigate the influence of delayed antenatal care attendance and the risk of macerated stillbirths among women delivered at the Mwananyamala Regional Referral Hospital in Dar es Salaam.

Problem Statement

Despite advancements in maternal healthcare worldwide, stillbirths remain a significant public health burden (WHO, 2016), with macerated stillbirths being overlooked, while representing a critical outcome that has been heavily linked with delayed detection and management of pregnancy complications. Antenatal care (ANC) serves as a pillar in identifying risks associated with intrauterine fetal demise, such as fetal growth restriction, preeclampsia, and placental insufficiency (Lawn *et al*., 2016). Nevertheless, in most low-and middle-income countries, a significant percentage of pregnant women initiate ANC late (after 12 weeks of gestation) (Tesfaye *et al*., 2017) (Alamneh *et al*., 2022), missing opportunities for early and timely interventions (Wolde *et al*., 2019). In Tanzania, 66% of women start ANC clinic visits after 12 weeks of gestation (*Demographic and Health Survey and Malaria Indicator Survey*, n.d.). Although studies have established an association between ANC attendance and reduced stillbirth rates (McClure *et al*., 2015), the specific influence of delayed ANC initiation on the risk of macerated stillbirths remains poorly understood (McClure *et al*., 2006). The existing literature lacks particular data on how the timing of ANC enrollment interacts with preventable fetal deaths, particularly in contexts where delayed care is prevalent.

This study addresses this knowledge gap by examining the relationship between delayed ANC attendance and incidence of macerated stillbirths. Using a retrospective cross-sectional design, maternal health records were analyzed to determine whether late initiation of ANC is independently associated with an increased risk of macerated stillbirth. Findings from this research will provide evidence to strengthen ANC promotion strategies, inform clinical guidelines for high-risk monitoring, and ultimately contribute to reducing preventable fetal mortality in settings where delayed care seeking remains a persistent challenge.

MATERIALS AND METHODS

Study Design

This retrospective cross-sectional study assessed the influence of delayed antenatal care (ANC) attendance on the risk of macerated stillbirths. We reviewed the existing medical records of women who delivered at Mwananyamala Regional Referral Hospital from January 2024 to December 2024, focusing on cases of stillbirths and their ANC history.

Study Population

The study included all women who had a stillbirth at Mwananyamala Regional Referral Hospital from January 2024 to December 2024.

Inclusion Criteria

- Women who delivered a stillbirth at ≥28weeks of gestation
- Women with documented ANC attendance records

Exclusion Criteria

- Women with missing or incomplete ANC records.
- Women with congenital fetal anomalies incompatible with life
- Multiple gestations (i.e. twins or triplets)

Sample size and sampling technique

The study employed a simple random sampling technique, where all records of women who delivered stillbirths from January to December 2024 had an equal chance of being selected for this study to avoid sampling bias and ensure that a representative dataset was captured.

Sample size was calculated using the cross-sectional study formular by Kish Leslie (Kish, 1965)

$$n = \frac{p(1-p)Z^2}{e^2}$$

Where:

- n - is the sample size estimated
- p - is the estimated proportion of women with delayed antenatal visits in Tanzania p=66% (*Demographic and Health Survey and Malaria Indicator Survey*, n.d.)
- Z - is the Standard normal deviation set at 1.96 which corresponds with 95% confidence interval
- e - is the standard error set at 5% marginal error

then

$$n = \frac{0.66(1-0.66)1.96^2}{0.05^2}$$

n=345

So, the minimum sample size for this study was estimated at 345 participants
Study variables

Dependent variables
Macerated stillbirths, Fresh stillbirths

Independent variables
Delayed ANC attendance: Defined as the initiation of the first ANC visit beyond 12 weeks of gestation.

Potential confounders

- Maternal age
- Parity
- History of obstetric complications (i.e. preeclampsia, gestational diabetes)
- Hypertensive disorders in pregnancy
- Diabetes in pregnancy
- HIV status
- Mode of delivery

Data collection

Data were obtained through a structured data collection tool, which was tested for validity and reliability, with Cronbach's alpha of 0.82 through a pilot study, and was hence validated and used for this study. It includes the following key elements.

- Demographic information (Age, Parity)
- Antenatal Care details (Gestational age at first ANC visit, Number of visits)
- Pregnancy outcomes (stillbirth classification, gestational age at delivery, birth weight)
- Maternal Health status (preexisting conditions, pregnancy complications)

Data Analysis

After data were collected and entered into an Excel sheet, they were cleaned and analyzed using STATA version 15. The following analyses were performed.

- Descriptive analysis:
  - Categorical variables were summarized using frequencies and percentages
  - Continuous variables were summarized using means and standard deviations

- Bivariate analysis:
  - We used the logistic regression (for categorical variables) and t-test (for continuous variables) to assess differences between women with early and delayed ANC attendance.

- Multivariate logistic regression Analysis
  - It was used to determine the factors associated with delayed ANC attendance after adjusting for confounders.
  - One way ANOVA was run to explore the mean difference between the outcomes and the maternal age groups.

Ethical Consideration

Ethical approval was obtained from the Mwananyamala Regional Referral Hospital Ethics Committee. Permission to access patient records was sought from the hospital's administration. Patient confidentiality was maintained by excluding identifiers such as patient names and assigning numbers, and the data obtained were stored in a password-protected database.

RESULTS AND DISCUSSION

Demographic Information

The study enrolled 199 participants from an initial pool of 345 participants, achieving a 57.6% response rate, primarily attributed to incomplete data in patient records. The mean age of the participants was 27.75 ± 5.83 SD. Regarding other demographic characteristics, 43.72% (n=87) were single, while the largest population (37.69%) held a college degree or higher. More than half of the participants resided in the Kinondoni district, with 25.13% employed in petty businesses. Referrals from external facilities accounted for approximately one-third (33.17%) of participants (Table 1).

Table 1: A table showing the demographic information of the participants

Variable	Category	Frequency(*n=199*)	Percentage (%)
Maternal age group	17-22	43	21.61
	23-28	64	32.16
	29-34	65	32.66
	35-40	22	11.06
	41-46	5	2.51
Marital status	Single	87	43.72
	Cohabiting	23	11.56
	Married	80	40.20
	Widow/widower	9	4.52
Educational level	Non formal	18	9.05

	Primary school	25	12.58
	Ordinary level	61	30.65
	Advanced level	20	10.05
	College	75	37.69
Residence	Ilala	22	11.06
	Kigamboni	14	7.04
	Kinondoni	110	55.28
	Temeke	11	5.53
	Ubungo	42	21.11
Occupation	Employed	45	22.61
	Petty business	50	25.13
	Peasant	33	16.58
	Self-employed	27	13.57
	Housewife	44	22.11
Referral	Yes	66	33.17
	No	133	66.83

Obstetrics characteristics of the participants

Most participants (74.87%) were multigravidas, with 36.68% classified as multiparous. Macerated stillbirths were reported in 74.87% of the cases, and 42.21% had experienced a prior stillbirth. Late antenatal care (ANC) initiation (after 12 weeks of gestation) was observed in 73.87% of participants, with over half (52.76%) booking their index pregnancy during the second trimester. Nearly all participants (94.47%) attended fewer ANC visits than were recommended. Hypertensive disorders were absent in 58.78% of the cases, while diabetes was rare (4.5%). Anemia and preterm premature rupture of membranes (PPROM) affected 25% of the participants. The prevalence of HIV infection was 43.22%, and preterm deliveries accounted for 62.31% of the births (Table 2). More than two-thirds of the participants had a macerated stillbirth (Fig 1) and had delivered preterm (Fig 2).

Table 2: A table showing the obstetric characteristics of the participants

Variable	Category	Frequency(*n=199*)	Percentage (%)
Parity	Primiparous	48	24.12
	Multiparous	142	71.36
	Grand multipara	9	4.52
Gravidity	Primigravida	50	25.13
	Multigravida	149	74.87
Previous stillbirth(s)	Yes	84	42.21
	No	115	57.79
ANC attendance	None	8	4.02
	Early before 12 weeks	44	22.11
	Late after 12 weeks	147	73.87
Booking Gestation age(weeks)	Never	8	4.02
	1st trimester (5-13)	46	23.12
	2nd trimester (14-27)	105	52.76
	3rd trimester (≥28)	40	20.10
Contacts	Recommended (≥ 8)	11	5.53
	Poor (<8)	188	94.47
Hypertensive disorders	None	111	58.78
	PIH	41	20.60
	Chronic hypertension	14	7.04
	Preeclampsia	33	16.58
Diabetes in Pregnancy	Yes	9	4.52
	No	190	95.48
Anemia in Pregnancy	Yes	50	25.13
	No	149	74.87
PMTCT	1	86	43.22
	2	113	56.78

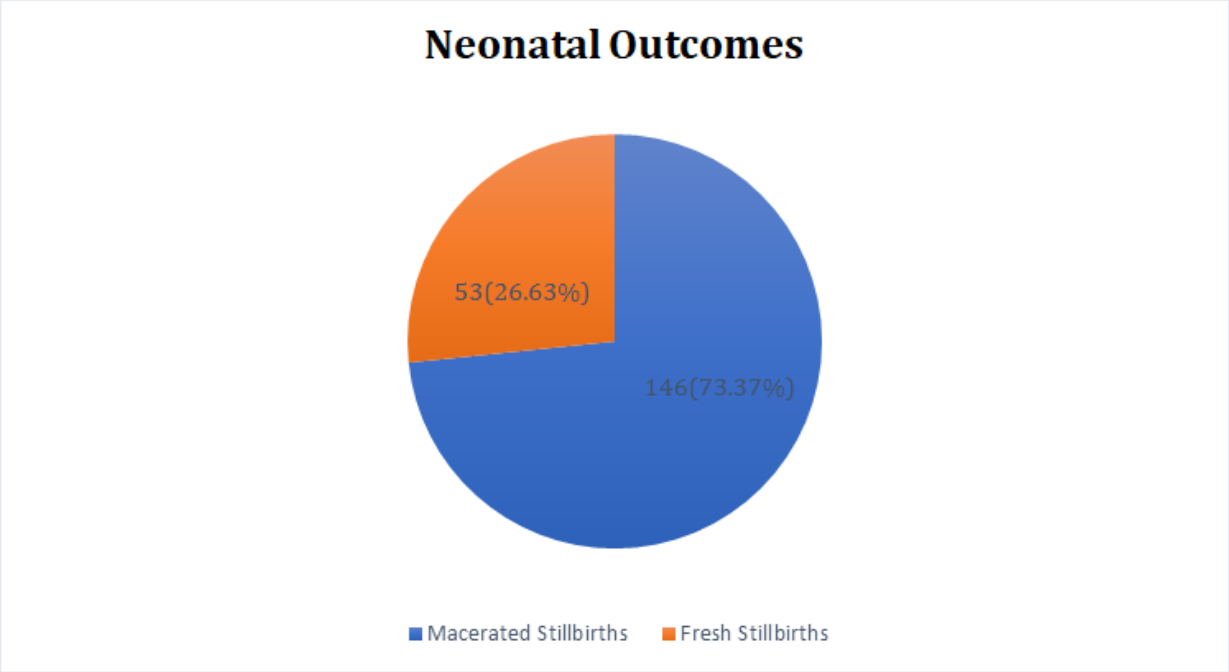

Figure 1: Showing Neonatal Outcomes

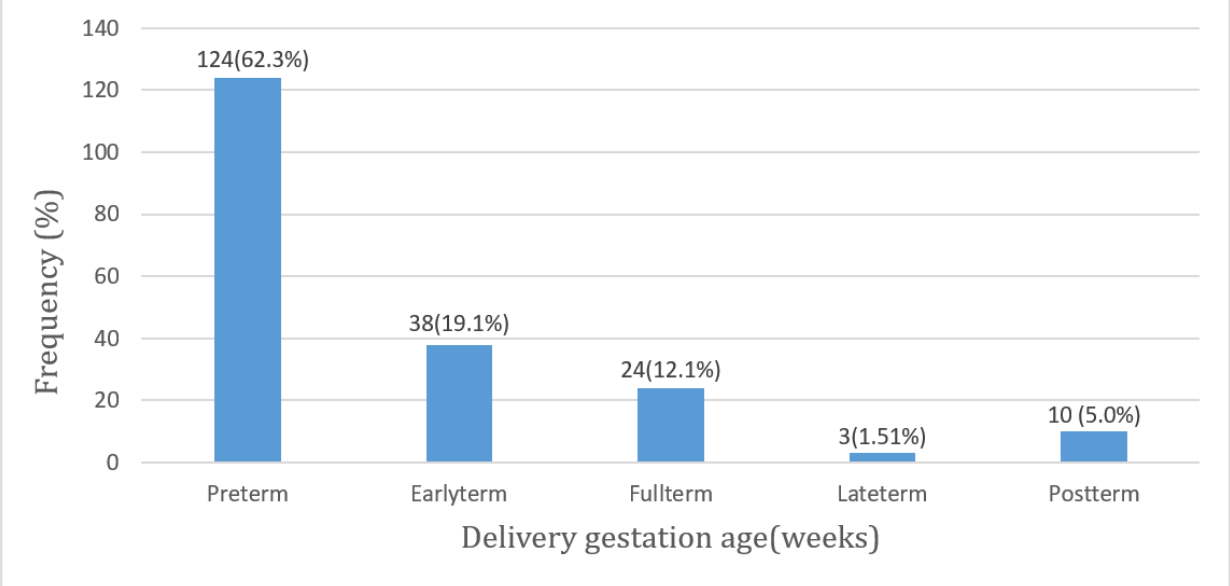

Figure 2: Illustrating Gestation age (weeks) at delivery

Neonatal Characteristics

Almost half (45.23%) of the neonates were born with normal birth weight. Only five (2.51%) of the participants showed signs of congenital anomalies (Table 3).

Table 3: A table showing the neonatal characteristics of the participants

Variable	Category	Frequency(*n=199*)	Percentage (%)
Birth weight	ELBW	2	1.01
	VLBW	28	14.07
	LBW	75	37.69
	NBW	90	45.23
	Macrosomia	4	2.01
Congenital anomalies	Yes	5	2.51
	No	194	97.49

Factors associated with stillbirths

In Univariate analysis, women in age groups 17-22 (OR=1.62, 95%CI:1.179-2.232) and 29-34 (OR=3.89, 95% CI: 1.340-11.27) had higher odds of macerated stillbirth. Women with grand multipara had 164.5 times likelihood of a fresh stillbirth (OR=164.50, 95% CI:13.125-206.704). Women who initiated ANC late, had a 9 times likelihood for macerated stillbirth (OR=9.56, 95% CI:6.236-12.342). Those with chronic hypertension (OR=3.21, 95% CI:1.007-10.256) and preeclampsia (OR=2.78, 95% CI:1.197-6.481) were highly linked to fresh stillbirth. Marital status, educational level, occupation, and HIV status (PMTCT) showed no significant associations (Table 4).

Table 4: A table showing the univariate regression analysis

Variable	Outcome				
	MSB (%)	FSB (%)	Crude OR	95% CI	P-Value
Age group					
17-22	38(88.37)	5(11.63)	1.62	1.179-2.232	0.003*
23-28	49(76.56)	15(23.44)	2.33	0.777-6.970	0.131
29-34	43(66.15)	22(33.85)	3.89	1.340-11.275	0.012*
35-40	13(57.14)	9(42.86)	5.26	1.490-18.579	0.010*
41-46	3(60.00)	2(40.00)	5.07	0.674-38.102	0.115
Marital status					
Single	65(74.71)	22(25.29)	1.01	0.690-1.477	0.961
Married	56(70.00)	24(30.00)	1.27	0.642-2.499	0.496
Others#	25(72.00)	7(28.00)	2.10	0.531-8.440	0.431
Education level					
Non formal	10(55.56)	8(44.44)	0.89	0.706-1.126	0.338
Primary	21(84.00)	4(16.00)	0.24	0.058-0.982	0.047*
Ordinary	43(70.49)	18(29.51)	0.52	0.178-1.541	0.240
Advanced	15(75.00)	5(25.00)	0.42	0.105-1.647	0.212
College	57(76.00)	18(24.00)	0.39	0.135-1.151	0.089
Occupation					
Employed	33(73.33)	12(26.67)	1.00	0.796-1.256	0.999
Housewife	34(73.27)	10(22.73)	0.81	0.308-2.126	0.667
Peasant	24(72.73)	9(27.27)	1.03	0.375-2.836	0.952
Petty business	32(64.00)	18(36.00)	1.55	0.643-3.720	0.330
Self-employed	23(85.19)	4(14.81)	0.478	0.137-1.670	0.248
Residence					
Ilala	18(81.82)	4(18.18)	1.12	0.857-1.468	0.402
Kigamboni	12(85.71)	2(14.29)	0.75	0.118-4.760	0.760
Kinondoni	78(70.91)	32(29.09)	1.85	0.579-5.883	0.300
Temeke	7(63.64)	4(36.36)	2.57	0.500-13.229	0.258
Ubungo	31(73.81)	11(26.19)	1.60	0.442-5.762	0.475
Referral					
Yes	46(69.70)	20(30.30)	1.32	0.684-2.539	0.410
No	100(75.19)	33(24.81)	1.32	0.684-2.539	0.410
Parity					
Primipara	47(97.92)	1(2.08)	12.60	3.849-41.232	0.000*
Multipara	97(68.31)	45(31.69)	21.80	2.916-163.060	0.003*
Grand multipara	2(22.22)	7(77.78)	164.50	13.125-206.704	0.000*
Gravidity					
Primigravida	50(100.00)	0(0.00)	1		
Multigravida	96(44.79)	53(55.21)			
Previous SB					
Yes	57(67.86)	27(32.14)	1.62	0.861-3.053	0.134
No	89(69.05)	26(30.95)	1.62	0.861-3.053	0.134
ANC attendance					
None	8(100.00)	0(0.00)	2.46	0.112-2.456	0.002*
Early	13(29.55)	31(70.45)	4.11	0.332-4.564	0.090
Late	124(84.35)	23(15.65)	9.56	6.236-12.342	0.042*

Booking GA (weeks)					
Never	7(87.5)	1(12.5)	0.75	0.559-43.400	0.157
1st trimester	27(58.70)	19(41.30)	4.92	0.504-1.116	0.151
2nd trimester	75(76.53)	23(23.47)	2.15	0.250-18.369	0.700
3rd trimester	37(78.72)	10(21.28)	1.89	0.018-1.161	0.572
Contacts					
Recommended	4(36.36)	7(63.64)	5.4	1.513-19.288	0.009*
Poor	142(75.53)	46(24.47)	5.4	1.513-19.288	0.009*
Hypertensive disorders					
None	90(81.08)	21(18.92)	1.44	1.105-1.888	0.007*
PIH	28(68.29)	13(31.71)	1.99	0.884-4.479	0.097
CH	8(57.14)	6(42.86)	3.21	1.007-10.256	0.049*
Pre-eclampsia	20(60.61)	13(39.39)	2.78	1.197-6.481	0.017*
Diabetes					
Yes	5(55.56)	4(44.44)	2.30	0.535-2.247	0.890
No	141(74.21)	49(25.79)	2.30	0.535-2.247	0.890
Anemia					
Yes	36(72)	14(28)	1.10	0.594-8.919	0.228
No	110(73.83)	39(26.17)	1.10	0.594-8.919	0.228
PMTCT					
1	66(76.74)	20(23.26)	1.36	0.714-2.591	0.348
2	80(70.80)	33(29.20)	1.36	0.714-2.591	0.348
Delivery GA (weeks)					
Preterm	86(69.35)	38(30.65)	0.66	0.450-0.962	0.031*
Early term	27(71.05)	11(28.95)	0.92	0.415-2.048	0.842
Full-term	21(87.50)	3(12.50)	0.32	0.091-1.150	0.081
Late term	3(100.00)	0(0.00)	1		
Post term	9(90.00)	1(10.00)	0.25	0.031-2.055	0.198
Birth weight(g)					
ELBW	2(100.00)	0(0.00)	0.79	0.531-1.180	0.251
VLBW	18(64.29)	10(35.71)	1		
LBW	54(72.00)	21(28.00	1.72	0.691-4.267	0.244
NBW	68(75.56)	22(24.44)	1.20	0.599-2.412	0.605
Macrosomia	4(100.00)	0(0.00)	1		
Congenital anomalies					
Yes	1(20.00)	4(80.00)	11.84	1.292-108.453	0.029*
No	145(74.74)	49(25.26)	11.84	1.292-108.453	0.029*
# (Cohabiting, widow & widower)					
***P value <0.05 (Statistically significant)**					

After adjusting for confounders, the multivariate analysis showed that Multiparas had 2.69 times odds of macerated stillbirth (AOR=2.69, 95% CI:0.089-0.580). Late initiation of ANC was also found to significantly increase the risk of macerated stillbirth (AOR=3.46, 95% CI:0.182-0.742). Preeclampsia still showed to put a woman at an increased risk of macerated stillbirth (AOR=1.87, 95% CI:0.003-0.108) (Table 5).

Table 5: A table showing the multivariate regression analysis

Variable	Outcome		Adjusted OR	95% CI	P-Value
	MSB (%)	FSB (%)			
Age group					
17-22	38(88.37)	5(11.63)	0.36	0.057-0.083	0.716
23-28	49(76.56)	15(23.44)			
29-34	43(66.15)	22(33.85)			
35-40	13(57.14)	9(42.86)			
41-46	3(60.00)	2(40.00)			
Marital status					
Single	65(74.71)	22(25.29)	0.10	0.024-0.129	0.181

Married	56(70.00)	24(30.00)			
Others#	25(72.00)	7(28.00)			
Education level					
Non formal	10(55.56)	8(44.44)	0.30	0.022-0.071	0.299
Primary	21(84.00)	4(16.00)			
Ordinary	43(70.49)	18(29.51)			
Advanced	15(75.00)	5(25.00)			
College	57(76.00)	18(24.00)			
Occupation					
Employed	33(73.33)	12(26.67)	0.46	0.027-0.059	0.458
Housewife	34(73.27)	10(22.73)			
Peasant	24(72.73)	9(27.27)			
Petty business	32(64.00)	18(36.00)			
Self-employed	23(85.19)	4(14.81)			
Residence					
Ilala	18(81.82)	4(18.18)	0.62	0.037-0.062	0.490
Kigamboni	12(85.71)	2(14.29)			
Kinondoni	78(70.91)	32(29.09)			
Temeke	7(63.64)	4(36.36)			
Ubungo	31(73.81)	11(26.19)			
Referral					
Yes	46(69.70)	20(30.30)	0.30	0.112-0.152	0.764
No	100(75.19)	33(24.81)			
Parity					
Primipara	47(97.92)	1(2.08)			
Multipara	97(68.31)	45(31.69)	2.69	0.089-0.580	0.008*
Grand multipara	2(22.22)	7(77.78)			
Gravidity					
Primigravida	50(100.00)	0(0.00)	0.02	0.270-0.274	0.987
Multigravida	96(44.79)	53(55.21)			
Previous SB					
Yes	57(67.86)	27(32.14) 0.91		0.071-0.194	0.362
No	89(69.05)	26(30.95)			
ANC attendance					
None	8(100.00)	0(0.00)			
Early	13(29.55)	31(70.45)			
Late	124(84.35)	23(15.65)	3.46	0.182-0.742	0.001*
Booking GA (weeks)					
Never	7(87.5)	1(12.5)			
1st trimester	27(58.70)	19(41.30)	0.48	0.071-0.194	0.632
2nd trimester	75(76.53)	23(23.47)			
3rd trimester	37(78.72)	10(21.28)			
Contacts					
Recommended	4(36.36)	7(63.64)			
Poor	142(75.53)	46(24.47)	2.59	0.085-0.635	0.010*
Hypertensive disorders					
None	90(81.08)	21(18.92)			
PIH	28(68.29)	13(31.71)	1.87	0.003-0.108	0.063
CH	8(57.14)	6(42.86)			
Pre-eclampsia	20(60.61)	13(39.39)			
Diabetes					
Yes	5(55.56)	4(44.44)	0.55	0.213-0.376	0.585
No	141(74.21)	49(25.79)			
Anemia					

Yes	36(72)	14(28)	0.20	0.122-0.838	0.838
No	110(73.83)	39(26.17)			
PMTCT					
1	66(76.74)	20(23.26)	0.10	0.112-0.125	0.920
2	80(70.80)	33(29.20)			
Delivery GA (weeks)					
Preterm	86(69.35)	38(30.65)	1.31	0.021-0.101	0.191
Early term	27(71.05)	11(28.95)			
Full-term	21(87.50)	3(12.50)			
Late term	3(100.00)	0(0.00)			
Post term	9(90.00)	1(10.00)			
Birth weight(g)					
ELBW	2(100.00)	0(0.00)	0.33	0.071-0.991	0.741
VLBW	18(64.29)	10(35.71)			
LBW	54(72.00)	21(28.00			
NBW					
Macrosomia					
Congenital anomalies					
Yes	1(20.00)	4(80.00)	3.07	0.218-1.00	0.002*
No	145(74.74)	49(25.26)			
# (Cohabiting, widow & widower)					
***P value < 0.05 (statistically significant)**					

One way ANOVA was also used to determine the influence of age groups on the outcome of the study and revealed that there's a statistical mean difference on the outcome among maternal age groups (P value <0.05) (Table 6).

Table 6: ANOVA for mean difference between outcome and age groups

Source	Sum of Squares	Degree of freedom	Mean Square	F statistic	P value
Between groups	1.909	4	0.477	2.50	0.0436
Within groups	36.975	194	0.191		
Total	38.884	198	0.196		

DISCUSSION

This study highlights critical gaps in antenatal care (ANC) utilization and adverse pregnancy outcomes among women at Mwananyamala Regional Referral Hospital. Our results show that late ANC and hypertensive disorders are critical, modifiable risk factors for stillbirths.

Late ANC initiation and suboptimal attendance

Notably, 73.9% of participants began antenatal care (ANC) after 12 weeks, while 94.5% attended fewer than the recommended eight visits. These findings are consistent with trends observed across sub-Saharan Africa, where structural challenges (e.g., financial constraints and transportation gaps) and cultural misconceptions about pregnancy often delay care-seeking (Adedokun & Yaya, 2020; Ahinkorah *et al.*, 2021; Pell *et al*., 2013). Delayed booking deprives women of early intervention such as HIV prophylaxis, anemia and hypertensive screening, congenital anomaly detection, and management of maternal comorbidities. Such gaps likely contribute to high rates of macerated stillbirth (74.9%). Multivariate analysis identified late ANC initiation as an independent risk factor for poor outcomes (AOR=3.46, P=0.001), highlighting the urgent need for community-based initiatives to improve early ANC engagement and education.

Parity and grand multiparity as risk factors

Grand multiparas (≥5 births) demonstrated a markedly elevated crude odds ratio of fresh stillbirth (FSB) in univariate analysis (OR=164.5, P=0.001). Consistent with existing evidence associating high parity with placental insufficiency and intrapartum complications due to uterine overdistension and reduced placental reserve (Aliyu *et al.*, 2005). However, multivariate analysis revealed multiparity (2-4 births) as a stronger independent predictor of macerated stillbirths (AOR=2.69, P=0.008), suggesting that chronic risks such as undiagnosed hypertensive disorders and sub-optimal inter-pregnancy care may explain this association. These findings highlight the need for targeted prenatal monitoring of multiparous women, emphasizing hypertension screening and postnatal follow-up to mitigate risks in subsequent pregnancies.

Hypertensive disorders and comorbidities

Hypertensive disorders were prevalent among 41.2% of participants, with preeclampsia demonstrating

a significant association with fresh stillbirth (FSB) (OR=2.78, P=0.017). Chronic hypertension further increases FSB risk (OR=3.21, P=0.049), aligning with global evidence implicating hypertensive disorders in placental dysfunction, impaired uteroplacental perfusion, and preterm birth (Agena & Modiba, 2019; Basta *et al*., 2022; Zile *et al*., 2019). However, the majority of women (58.85%) had no hypertensive disorders, suggesting that alternative pathways, such as late ANC initiation, undiagnosed HIV infection (43.2% prevalence), or systemic inflammation contributed to poor outcomes. This aligns with studies emphasizing HIV's role in maternal morbidities and stillbirths, particularly through immune dysregulation and intrauterine infection (Favarato *et al*., 2019; Odhiambo, 2022).

HIV prevalence and neonatal outcomes

The prevalence of HIV among participants (43.2%) was substantially higher than Tanzania's national average (4.7%), likely reflecting the hospital's specialized role as a referral center for high-risk pregnancies. Although prevention of mother-to-child transmission (PMTCT) showed no direct association with outcomes, the high preterm birth rate (62.3%) and low birth weight (LBW) incidence (37.7%) suggest that HIV-related systemic inflammation or adverse effects of ART may contribute indirectly to these complications. These findings align with global studies reporting higher rates of preterm birth, LBW, and small for gestational age infants among HIV-positive mothers compare to their HIV -negative counterparts, (Grignolo *et al*., 2017; Kim *et al.*, 2012; Stratton *et al.*, 1999) likely due to chronic immune activation and placental dysfunction.

Gestation age at delivery

Gestational age has shown a unique relationship with stillbirth risk, with heightened risks in both preterm and post-term pregnancies. In this study, 69.13% of stillbirths occurred in preterm deliveries (OR=0.66, p=0.031), aligning with global data where 75% of stillbirths are linked to preterm birth due to placental insufficiency, fetal immaturity, or intrauterine infection (Okwaraji *et al*., 2023). Post-term pregnancies face risks from placental aging and meconium aspiration. Critically, fetal growth restriction (FGR) highlights the need for early detection via ultrasound surveillance and serial monitoring to enable timely interventions, such as corticosteroid administration or elective delivery (Pels *et al*., 2020)These findings emphasize the urgency of standardized protocols for managing high-risk pregnancies (e.g., post-term induction) and expanding access to antenatal technologies (such as doppler ultrasound) in low-resource settings.

Age and socioeconomic factors

Univariate analysis revealed elevated macerated stillbirth risks among younger (17-22 years) and older (29- 40 years) women aligning with global evidence linking advanced maternal age to placental aging and stillbirth (Huang *et al*., 2008; Waldenström *et al.*, 2015). However, the rejection of these associations in multivariate models suggests that age-related risks are mediated by factors like parity or delayed ANC initiation rather than age itself. Notably, college-educated women exhibited a protective trend (OR=0.39, P=0.089), reinforcing the critical role of education in fostering health literacy and timely care-seeking (Adedokun & Yaya, 2020; Luque-Fernández *et al*., 2012). These findings highlight the need for interventions targeting ANC access and reproductive health education, particularly for high-parity and socioeconomically disadvantaged women, to reduce preventable stillbirths.

Limitations of the study

- Selection bias: The 57.6% response rate (due to incomplete records) may underrepresent marginalized groups.
- Retrospective design: Limits causal inference; unmeasured confounders (e.g., nutrition, income) could bias results
- Single-center data: findings may not generalize to rural or non-referral settings.

CONCLUSION

This study identifies late ANC initiation, hypertensive disorders, and high HIV prevalence as critical drivers of preventable stillbirths and adverse outcomes. Multiparity further exacerbates risks, while higher education demonstrates protective effects through improved health literacy. To combat these challenges, targeted interventions must prioritize community-based ANC promotion and expanded access to prenatal technologies. Also, more emphasis should be put on targeting high-parity women, especially enhanced monitoring on placental insufficiency and hypertension. Addressing these gaps is vital to advancing maternal health equity and reducing preventable stillbirths in urban Tanzania.

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