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Determinants of Stillbirth Among Women Who Gave Birth in Public Hospitals of West Gojjam Zone, Northwest Ethiopia, 2022. A Case-control Study

Ayal Gizachew Melaku[1], Moges Agazhe[2], Mulunesh Alemayehu[2], Tadesse Yirga Akalu[3], Gashaw Kerebeh[4], Roza Belayneh Dessalegn[5], Mulatu Mengaw Abetew[6] and Mengistu Abebe Messelu[7*]

[1]*Finote Selam General Hospital, Finote Selam, Ethiopia*
[2]*Department of Public Health, College of Medicine and Health Sciences, Debre Markos University, Debre Markos, Ethiopia*
[3]*Department of Pediatrics and Child Health Nursing, College of Medicine and Health Sciences, Debre Markos University, Debre Markos, Ethiopia*
[4]*Department of Pediatrics and Child Health Nursing, College of Medicine and Health Sciences, Debre Tabor University, Debre Tabor, Ethiopia*
[5]*Department Public health, College of Health Sciences, Injibara University, Injibara, Ethiopia*
[6]*Debre Markos Comprehensive Specialized Hospital, Debre Markos, Ethiopia*
[7]*Department of Nursing, College of Medicine and Health Sciences, Debre Markos University, Debre Markos, Ethiopia*

[*]Corresponding author: Mengistu Abebe Messelu, Department of Nursing, College of Medicine and Health Sciences, Debre Markos University, Debre Markos, Ethiopia.

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Abstract

Introduction: *Stillbirth is still a major public health problem in middle- and low-income countries. However, there has been limited research conducted to identify determinants of stillbirth in Ethiopia. Therefore, this study aimed to identify the determinants of stillbirth among women who gave birth in public hospitals in the West Gojjam Zone, Northwest Ethiopia.*

Methods: *Unmatched case-control study was conducted among 418 mothers who gave birth from March 1-30, 2022. Consecutive and systematic sampling techniques were used to select the cases and controls, respectively. The collected data were entered into Epidata and exported into SPSS version 16 for analysis. Numerical descriptive statistics were expressed by using the mean with standard deviation (SD) and/or median with interquartile range (IQR), whereas categorical variables were expressed by proportions. Bivariable and multivariable binary logistic regression analyses were used to identify determinants of stillbirth. The model goodness of fit test was checked using the Hosmer-Lemeshow test. Variables having a p-value < 0.25 in the bivariable analysis were entered into the multivariable analysis model. Adjusted odds ratio with 95% confidence intervals (CIs) was used to report the strength of association, and variables with a p-value < 0.05 were considered statistically significant.*

Results: *A total of 105 cases and 313 controls were included in this study. The odds of having stillbirth were higher among women who were illiterate (AOR: 1.6, 95% CI: 1.34, 7.55), had first ANC visit in the second trimester (AOR: 11.4, 95% CI: 2.99, 43.71), had an induced mode of delivery (AOR: 8.7, 95% CI: 2.10, 36.03), history of stillbirth (AOR: 1.5, 95% CI: 1.45, 4.90), bad obstetric history (AOR: 4.8 95% CI: 1.44, 15.89), history of preterm (AOR: 7.6, 95% CI: 1.57, 37.21), not vaccinated for TT (AOR: 8.8, 95% CI: 2.23, 35.17), labor not followed by using partograph (AOR: 3.1, 95% CI: 1.10, 8.42), and history of abortion (AOR: 11, 95% CI: 2.91, 41.31).*

Conclusion: *Women who were illiterate, started ANC visits in the second trimester, had an induced mode of delivery, history of stillbirth, bad obstetric history, history of preterm, history of abortion, not vaccinated for TT, and not followed by partograph were determinants of stillbirth.*

Keywords: Cases, Controls, Determinants, Ethiopia, Stillbirth

Introduction

Stillbirth is defined as a baby born without any signs of life at or after 28 weeks of gestation [1]. Stillbirth is a major public health issue in both developing and industrialized countries around the world [2]. Worldwide, it is estimated to be 2.6 million third-trimester pregnancy losses, and more than 98% occurred in low- and middle-income countries [3].

From 2010 to 2016, the average rate of stillbirth in Africa was 21.3 per 1000 births [4], with 0.86 percent in east Africa [5]. Several studies conducted in different regions of Ethiopia reported that the rate of stillbirth was 92 per 1000 births in Yirgalem Hospital, 6.8% in Ayder comprehensive specialized Hospital, North Ethiopia and 9.6% in Suhul Hospital Shire, Tigray, Ethiopia, and 85 per 1000 live births in the Amhara region [6-9].

Women who have stillbirth frequently express postpartum anxiety, depression, guilt, signs of grief, stigma, and loss of self-esteem [10, 11]. Women who repeatedly lose their neonates may be blamed, mistreated, and dishonored through a divorce, and an estimated 4.2 million women are living with depression [12].

According to studies conducted in the globe, early pregnancy; grand multiparity; poor maternal nutrition, such as severe anemia; maternal medical conditions during pregnancy; exposure to toxic substances, such as tobacco, or environmental toxins; and socioeconomic deprivation, i.e., limited access to healthcare services during pregnancy, either due to financial barriers or other factors, infection, prolonged labor, antepartum hemorrhage, preterm delivery, cord complications; and accidents are identified risk factors for stillbirth [13-15]. However, in most low-income nations, the true cause of stillbirths is unknown [16].

Even though stillbirth is still a major public health issue in both developing and industrialized countries, there is an inconsistency of results among prior studies on the determinants of stillbirth among women in Ethiopian. As far as the researchers' knowledge, there is no specific study conducted in the study area. Therefore, the findings of this study aimed to identify determinants associated with stillbirth among women attending delivery in Northwest Ethiopia.

Methods and Materials

Study Area and Period

A multi-center institutional-based, unmatched case-control study was conducted from March 1-30, 2022, in public hospitals in the West Gojjam Zone, Amhara region. The West Gojjam Zone is found in the Amhara region, 376 km from Addis Ababa and 185 km from Bahir Dar. West Gojjam Zone has seven public hospitals: Bure, Dega Damot, Merawi, Durbete, Adet, and Liben primary hospitals, and Finote Selam general hospital. In addition, there are 108 health centers and 441 health posts.

Study Design

An institutional-based unmatched case-control study was conducted.

Population

Source population

All mothers who gave birth at public hospitals in West Gojjam zone

Study Population

- **Cases:** All mothers who gave stillbirth and were attended by a skilled birth attendant at selected public hospitals in West Gojjam zone during the study period.
- **Controls:** All mothers who gave live birth and were attended by a skilled birth attendant at selected public hospitals in West Gojjam Zone during the study period.

Eligibility Criteria

Inclusion Criteria

All mothers who were delivered by a skilled birth attendant at the selected public hospitals in West Gojjam zone.

Exclusion Criteria

Mothers with multiple births were excluded from the study.

Sample Size Determination and Sampling Procedure

Sample Size Determination

The sample size for this study was calculated using power approach of two population formula using EPI info software by considering the following assumptions.

- Confidence level (CI) = 95%, margin of error (d2) = 0.05, and power (ZB) = 80%
- r = ratio of controls to cases
- p= average proportion of exposure among cases and controls,
- p1=the proportion of exposure among cases,
- p2=the proportion of exposure among controls,
- p1-p2, Minimum meaningful difference in proportions between case and control groups

$$n = \left(\frac{r+1}{r}\right)\frac{(p)(1-p)(Z_{\beta}+Z_{\alpha/2})^2}{(p_1-p_2)^2}$$

The largest sample size was 380, and after adding a 10% non-response rate, the final sample size was 418. Finally, about 105 cases and 313 controls were included with the case-to-control ratio of 1:3 (Table 1).

Table 1: Sample Size Determinants of Stillbirth Among Women Who Gave Girth at Selected Public Hospitals of West Gojjam Zone, Northwest Ethiopia 2022.

Variables	P1(percent of cases with exposure)	P2(percent of controls with exposure)	Power	95% CI	Control to cases ratio	Sample size			Refer.
						Cases	Controls	Total	
At least two doses of TT vaccine	48.8	68.8	0.84	1.96	3	68	204	272	(4)
Congenital anomaly	38.1	5.4	0.84	1.96	3	18	52	70	
Use of partograph	50	83	0.84	1.96	3	23	69	92	
STI	8.3	1.2	0.84	1.96	3	95	285	380	(3)

Sampling Procedure

Five public hospitals were randomly selected from the seven using a simple random sampling technique. From each hospital, all mothers who had encountered stillbirth were drawn consecutively as cases, and three controls per case were selected using a systematic random sampling technique until the required sample size had been reached (Figure 1).

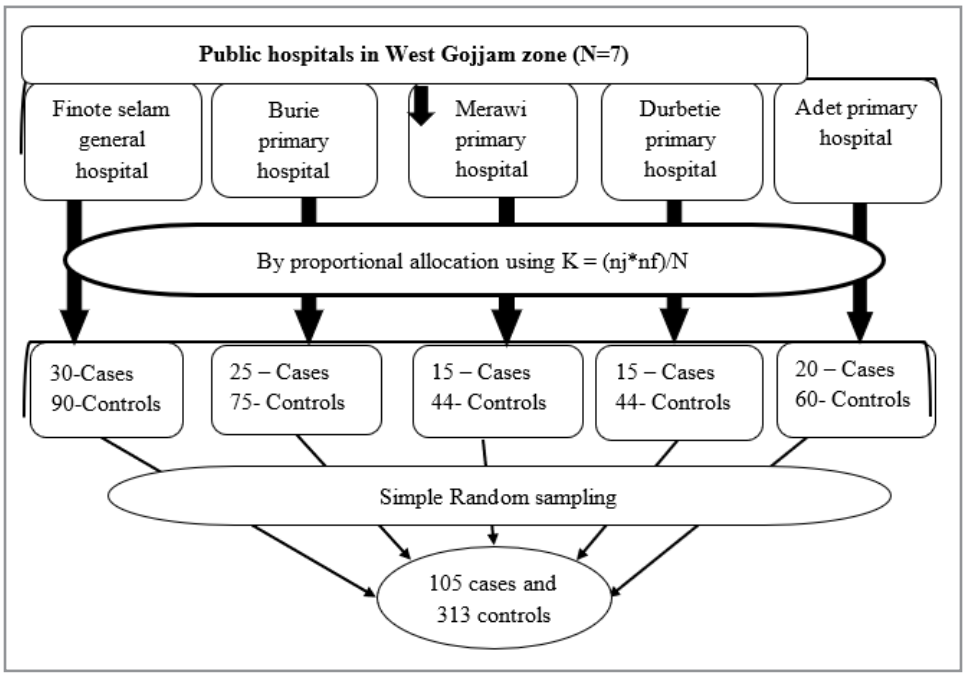

Figure 1: A Schematic Representation of The Sampling Procedure for The Study to Assess the Determinants of Stillbirth Among Women Who Gave Birth at Public Hospitals in West Gojjam Zone, Amhara Region, Ethi

Operational Definitions

Stillbirth: Is a fetal death at or after 28 weeks of pregnancy, and results in a baby born without any signs of life.

- **Cases:** Mothers who were given a stillbirth during labor
- **Controls:** Mothers who gave a live birth
- **Bad Obstetric History:** Had previous unfavorable fetal outcome in terms of two or more consecutive spontaneous abortion, early neonatal deaths, still births, intra uterine fetal death, intra uterine fetal retardation, and congenital anomalies.

Data Collection Tools

The data collection tool was developed by reviewing related literature with consideration of socio-demographic, obstetric, and medical characteristics.

A pre-tested structured face-to-face interviewer administrative questionnaire and checklist were used.

Data Collection Technique

Data collection was carried out by face-to-face interview and chart review.

Data Quality Control

The English version of questionnaire was translated into Amharic, and finally back into English to check its consistency. A one-day training was given for data collectors and supervisors. The overall data collection process was closely monitored by the principal investigator and supervisors. The questionnaires were pretested using 5% of the total sample size outside the study area. If any ambiguity or incompleteness is discovered during supervision, it was attempted to be resolved before moving to the next step. During the data collection phase, the obtained data were reviewed for completeness, accuracy, clarity, and consistency before being entered into data entry forms daily.

Data Management and Analysis

Collected data were coded, cleaned, entered into Epi Data 3.1, and exported to SPSS version 25 for further statistical analysis. Numerical descriptive statistics were expressed by using mean with standard deviation (SD) and/or median with interquartile range (IQR), whereas categorical variables were expressed by proportions. Tables and graphs were used to present the descriptive statistics. Both a bivariable and multivariable binary logistic regression analyses were used to identify the determinants of stillbirth. Variables having $p \leq 0.25$ in the bivariable analysis were candidates for multivariable logistic regression analysis. Finally, variables having a P-value <0.05 in the multivariable logistic regression analysis were declared to be statistically significant determinants of stillbirth. Adjusted odds ratio with 95% confidence intervals (CIs) was used to report the strength of association. The model goodness of fit test was checked using the Hosmer-Lemeshow test.

Results

Socio-demographic-related Characteristics of the Study Participants

A total of 418 (105 cases and 313 controls) were interviewed with a case-to-control ratio of 1:3. The mean age of the case group was 34.28 years with SD of 5.7, while the mean age of the mother who participated in the control group was 32 with SD of 4.8 (Table 2).

Table 2: Socio-demographic Characteristics Mothers who Attended Delivery Service in Public Hospitals at West Gojjam zone, Amhara Region, Ethiopia, 2022 (N=418)

Variables	Categories	Groups		
		Total (418)	Cases (n=105)	Controls (n=313)
Age	18-34 years	247 (59.1%)	54 (22.2%)	193(29.8%)
	> 35 years	171 (40.9%)	51 (29.8%)	120 (70.2%)
Residence	Urban	231(55.5%)	49(21.2%)	182(78.8%)
	Rural	187(44.7%)	56(29.9%)	131(70.0%)
Educational status	Illiterate	111 (26.6%)	40 (36.0%)	71 (64.0%)
	Primary	147 (35.2%)	38 (25.9%)	109 (74.1%)
	Secondary and above	160 (38.3%)	27 (16.9%)	133 (83.1%)
Occupation	Student or/ and Farmer	172(41%)	50 (47%)	122(38.9%)
	Governmental employers	122 (29.2%)	28 (23.0%)	94 (77.0%)
	Private employers	65 (15.6%)	11 (16.9%)	54 (83.1%)
	House wife	59 (14.1%)	16 (27.1%)	43 (72.9%)
Marital status	Married	391 (93.5%)	98 (25.1%)	293 (74.9%)
	Not married	27 (6.5%)	7 (25.9%)	10 37.0%)
Family size	< 5	247 (59.1%)	44 (41.9%)	203 (64.9%)
	> 5	171 (40.9%)	61 (58.1%)	110 (35.1%)

*Not married: single, windowed, and divorced

Obstetrics-related Characteristics of the Study Participants

All study participants had ANC visits in the previous pregnancy, of those, 20.8% had > 4 visits. Among the total of 418, 42.1% were attended their first ANC in the second trimester. The majority, (76.8%) of the study participants' labor was followed by using a partograph (Table 3).

Table 3: Obstetric-related Characteristics of Mothers who Attended Delivery Service in Public Hospitals at West Gojjam zone, Amhara Region, Ethiopia, 2022 (N=418).

Variable	Categories	Case (N=105)		Control (N=313)		Total(N=418)	
		Frequency	%	Frequency	%	Frequency	%
Number of ANC visit	<4	92	87.6	239	76.4	331	79.2
	> 4	13	12.4	74	23.6	87	20.8
Gestational age at the first visit	1st trimester	14	13.3	84	26.8	98	23.4

	2nd trimester	48	45.7	128	40.9	176	42.1
	3rd trimester	19	18.1	70	22.4	89	21.3
Use of modern contraceptive	Yes	64	61.0	245	78.3	309	75.9
	No	41	39.0	68	21.7	109	26.1
Gravidity	< 5	53	50.5	245	78.3	298	71.3
	> 5	52	49.5	68	21.7	120	28.7
Mode of delivery	Spontaneous	44	41.9	175	55.9	219	52.4
	Induced	24	22.9	32	10.2	56	13.4
	Instrumental	9	8.6	24	7.7	33	7.9
	Caesarean	28	26.7	82	26.2	110	26.3
Duration of labour	<24 hours	94	89.5	291	93.0	385	92.1
	>24 hours	11	10.5	22	7.0	33	7.9
Parity	< 5	69	65.7	256	81.8	327	77.8
	>5	36	34.3	52	16.6	88	21.1
Inter pregnancy interval	< 2 years	59	56.2	101	32.3	160	38.3
	2-4 years	34	32.6	147	46.9	182	43.3
	Not sure	12	11.4	65	20.8	77	18.4
Gestational age	Preterm	14	13.3	9	2.9	23	5.5
	Term	76	72.4	259	82.7	335	80.1
	Post-term	15	14.3	45	14.4	60	14.4
Pregnancy status	Un planned	32	8.2	57	81.8	389	6.9
	Planned	73	22.2	256	77.8	329	93.1
PROM	Yes	48	45.7	110	35.1	158	37.8
	No	57	54.3	203	64.9	260	62.2
History of preterm	Yes	16	15.2	12	3.8	28	6.7
	No	89	84.8	301	96.2	390	93.3
History of TT vaccination	Yes	54	51.5	261	83.4	315	75.3
	No	49	46.7	52	16.6	101	24.2
Presentation	Normal	82	78.1	266	85.0	348	83.3
	Mal-presentation	23	21.9	47	15.0	70	16.7
Presence of hemorrhage	Yes	35	33.3	40	12.8	75	17.9
	No	70	66.7	273	87.2	343	82.1
History of stillbirth	Yes	53	50.5	48	15.3	101	24.2
	No	52	49.5	263	84.0	317	75.8
History of APH	Yes	23	21.9	20	6.4	43	10.3
	No	82	78.1	293	93.6	375	89.7
History of PPH	Yes	8	7.6	7	2.2	15	3.6
	No	97	92.4	304	97.8	403	96.4

Medical-related Characteristics of the Study Participants

From the total of 105 cases, 7.6% were anemic, 8.6% had a urinary tract infection, 11.4% were hypertensive, and 18.2% had other health complications. Also, of 313 control subjects, 5.1% were anemic, 7.3% had a problem of urinary tract infections, 10.9% were hypertensive, and 8.3% had other health complications (Table 4).

Table 4: Medical Characteristics of Mothers who Attended Delivery Service in Public Hospitals at West Gojjam zone, Amhara Region, Ethiopia 2022 (N=418)

Variable	Category	Case (n=105)		Control (n=313)		Total (N=418)	
		Frequency	%	Frequency	%	Frequency	%
Illness during pregnancy.	Yes	48	45.8	99	31.6	147	35.2
	No	57	54.3	214	68.4	271	64.8

Clinical condition	Anemia	8	7.6	16	5.1	24	5.7
	UTI	9	8.6	23	7.3	32	7.7
	HTN	12	11.4	34	10.9	46	11.0
	Others	19	18.1	26	8.3	45	10.8
Tested for HIV	Yes	102	97.2	263	84	365	87.3
	No	3	2.9	50	16	53	12.7
HIV status	Positive	7	6.9	11	5.3	18	5.7
	Negative	95	93.1	252	94.7	347	94.3

Others: Gestational Diabetic Mellitus, Asthma, Heart failure

Determinants of Stillbirth

In the bi-variable analysis, maternal age, gestational age during pregnancy, mal-presentation, antenatal care, number of births, history of abortion, history of stillbirth, history of APH, hemorrhage during current pregnancy, UTI, HTN, bad obstetric history, TT vaccination, mode of delivery, pantograph utilization, use of contraceptive, educational status, residence, age and history of preterm were eligible for multivariable analysis (P-value< 0.25.

In multivariable logistic regression analysis, being illiterate (AOR: 1.6, 95% CI:1.34, 7.55), gestational age at the first ANC (AOR: 11.4, 95% CI: 2.99, 43.71), induction of labor (AOR: 8.7, 95% CI: 2.10, 36.03), history of stillbirth (AOR: 1.5, 95% CI: 1.45, 4.9), had a bad obstetric history (AOR: 4.8, 95% CI: 1.44, 15.89), having hemorrhage during current pregnancy (AOR: 1.9, 95% CI: 1.46, 6.81), having a history of preterm (AOR: 7.6, 95% CI: 1.57, 37.21), not taking TT vaccination (AOR: 8.8, 95% CI: 2.23, 35.17), not followed by partograph (AOR: 3.1, 95% CI:1.10, 8.42), and history of abortion (AOR: 11.0, 95% CI:2.91, 41.31) were found to be determinants of stillbirth (Table 5).

Table 5: Bi Variable and Multi-Variable Analysis of Determinants of Stillbirth Among Women Who Attended Delivery Service in Public Hospitals of West Gojjam Zone, Amhara Region, Ethiopia 2022 (n=418).

Variables	Category	Group		COR (95%) CI	AOR (95%, CI)
		Cases	Controls		
Educational status	Illiterate	41	70	2 (1.78- 5.62)	1.6(1.34-7.55) *
	Literate	64	243	1	1
Gestational age at the first visit	1st trimester	23	83	1	1
	2nd trimester	57	139	2.1 (1.06- 3.84)	11.4 (2.99-43.71) **
	3rd trimester	25	91	1.5 (0.69- 3.08)	4.5 (2.94-21.88) *
Mode of delivery	Spontaneous	44	175	1	1
	Induced	23	33	2.8 (1.48- 5.187)	8.71(2.10- 36.03) *
History of stillbirth	Yes	55	46	6.4 (3.89- 10.47)	1.5 (1.45-4.9) *
	No			1	1
Bad obstetric history	Yes	62	53	7.1 (4.34- 11.53)	4.8 (1.44-15.89) *

Discussion

Stillbirth is a major but neglected public health problem in resource-limited countries, specifically in Ethiopia. The current study aimed to assess the determinants of stillbirth among women who gave birth at the West Gojjam Zone, Northwest Ethiopia.

This study found that being illiterate was a 1.6 times higher risk for stillbirth (AOR: 1.6, 95% CI: 1.34, 7.55) compared with literate. This finding was supported by the previous studies conducted in Yemen, Nigeria, Ethiopia, Ethiopia [17-19). The possible explanation could be that illiteracy might compromise access to healthcare including birth spacing and financial status.

The findings of the current study also showed that mothers who started ANC visit during the second trimester had 11.4 times at risk for having stillbirth as compared with mothers who start their ANC visit during the first trimester. This finding was supported by previous studies conducted in England, Sweden, Nigeria, Bale Zone, Ethiopia, and another studies conducted in Ethiopia [20-22]. The possible reason might be due to they have started their ANC follow-up after having serious medical and obstetric complications, which is somewhat challenging and this affects the target of most treatment modalities and healthcare management systems. This implies that the fact early ANC follow-up helps a mother to be screened for certain risk factors and used to take appropriate measures(19). But, it was inconsistent with the findings of previous studies conducted in Yemen, Nepal, Mexico, and Bahir Dar, Ethiopia [23, 24].

The odds of having a stillbirth were 8.7-fold higher among mothers who induced their labor as compared to their counterparts. This finding was in line with the previous studies done

in United States, Romania, United Kingdom, Nigeria [25-28]. The possible reason could be that during induction of labor, there might be an exposure to an artificial uterotonic agent and this may result in uterine over stimulation which intern causes a non-reassuring fetal heart rate and may end up with stillbirth [29]. But, it was not supported by the studies conducted in Zambia and Southern Ethiopia, which revealed that cesarean mode of delivery increased the risk of stillbirth [30].

The current study revealed that mothers who had a bad obstetric history were 4.8 times higher risk of stillbirth as compared to their counterparts. This finding was supported by the studies conducted in Nepal, India, Jamaica, and Ethiopia [31, 32]. The possible explanation could be due to delay in visiting health facilities, the referral system, as well as failure to diagnose and poor emergency preparedness, which results in the rapture of the uterus and can be increased risk of stillbirth.

Preterm labour was one of the determinants of stillbirth in this study, mothers who encountered a preterm labour had 7.6 odds of stillbirth as compared to mothers who had no history of preterm labour. This finding was in line with the studies done in Nigeria and Jimma, Ethiopia [33]. The possible reason might be due to the fact that premature birth had immature lung, they are at risk of developing asphyxia and becoming distressed, having heart problems, underdeveloped immune systems, and developing an infection. This in turn causes stillbirth. Therefore, mothers who were diagnosed with preterm labour should be followed strictly to prevent the risk of stillbirths.

History of abortion was 11-fold risk of stillbirth compared with their counterparts. This finding was also in agreement with the findings of different previous studies conducted in the United States, Sweden, Nepal, Jimma, Ethiopia, Bahir Dar, Ethiopia, and Adigrat, Ethiopia [34, 35]. The possible reason might be related to the maternal Rh-factor, which leads to erythroblastosis fetalis, maternal chronic and repeated pregnancy-related comorbidities that result in pregnancy loss.

The current study also showed that pregnant mothers who had not taken the TT vaccine had 8.8-fold higher risk of stillbirth than their counterparts. This finding was supported by the studies done in Switzerland, Iran, and Bahir Dar, Ethiopia [36, 37]. The possible explanation might be that if the mother has not taken the TT vaccine, during or before conception, the fetus becomes susceptible to tetanus in the womb, and this might increase the chance of the fetus having a birth defect, miscarriage, and stillbirth.

The current finding also found that the odds of stillbirth were 3.1 times higher among mothers whose labor was not followed by using a partograph than labor followed by a partograph. This finding agreed with the findings of previous studies conducted in Bahir Dar, Ethiopia and Aksum, Ethiopia. The possible reason could be that if a partograph not utilized, obstructed labor, and prolonged labour, which lead to severe fetal compromise during the intrapartum period, is difficult to diagnose and may be end up in stillbirth.

According to this study, mothers who had hemorrhage during their current pregnancy had 1.9 times higher risk of stillbirth compared with mothers who had no history of hemorrhage. This finding was supported by a study conducted in Nepal. It might be due to hemorrhage during pregnancy decreased blood flow to the placenta, which results in decreased oxygen and nutritional supply to the fetus, and this can end up in stillbirth.

Mothers who had a history of the previous stillbirths were 1.5 times at risk for stillbirth than mothers who had no history of stillbirth. The finding was supported by the findings of studies conducted in Nepal, Mexico, Zambia, Nigeria, and Ethiopia. The possible reason might be that the mother has undiagnosed chromosomal abnormalities that cause intra-uterine fetal death.

Conclusion

This study concludes that independent variables such as being unable to read and write, having a delayed ANC visit, induction of labor, preterm labor, having history of stillbirth, having bad obstetric history, having a history of hemorrhage during pregnancy, not used pratograph during labour, didn't take TT vaccine, and having a history of abortion were found to be determinants of stillbirth. Therefore, it is better to improve partograph utilization during intrapartum care and screen mothers who had a higher risk of adverse birth outcomes during their pregnancy, such as those who had a bad obstetric history, history of preterm labour, history of stillbirth, and a history of hemorrhage during pregnancy.

Declarations

Ethical Approval and Consent to Participate

The ethical approval was obtained from Ethical Review Committee of Debre Markos University, and informed verbal consent was obtained from each study participant. Data was kept anonymously by coding to keep confidentiality. Information about specific personal identifiers like the patient's name were not collected, so it didn't inflict any harm on the patients. All the processes of the research were performed and secured in accordance with the relevant guidelines and regulations.

Consent for Publication

Not applicable

Conflict of Interest

The authors declared that there is no conflict of interest

Availability of Data and Materials

Data will be available upon request from the corresponding author.

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Authors' Contributions

AG: conceptualization, formal analysis, interpretation of the data, and original drafting of the paper; MA, MA, TY, GK, RB and MA editing and revising critically for important intellectual content, and manuscript preparation. Finally, all authors read and approved the final version of the submitted article.

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