



Modeling Stillbirth among Women Delivering at South west Ethiopia

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Summary

BACKGROUND

Stillbirth was defined as the birth of a baby with no signs of life at or after 28 weeks gestation. By 2015, there were 2.6 million stillbirths daily with more than 7178 mortalities globally. Majority of these deaths occurred in 60% of rural areas in developing countries. Three quarters of the stillbirths often occurred in south Asia and sub-Saharan Africa. Ethiopia was one of the Sub-Saharan African countries with high occurrence of stillbirth and ranked seven in the top ten.

AIM

This study took the initiative to identify and investigate the associated factors of stillbirths among women delivering at South West Ethiopia.

METHODOLOGY

This retrospective cohort study was done based on data from five hospitals in South West Ethiopia (Shenen Gibe, Bedele, Tercha, Bonga and Mizan-Aman) conducted from January to December 2017. Inclusive were 1000 women from these hospitals who met the criteria. 200 women randomly selected from each hospital were interviewed for their background and reproductive health history. Descriptive statistics, Chi square test of association and binary logistic regression statistical techniques were performed for socio-demographic factors, obstetrics related factors, medical and birth outcome assessment.

RESULTS

The descriptive analysis showed that the prevalence of still birth in south west Ethiopia was 11.7% and women who delivered at Shenene Gibe hospital were less likely to have a still birth compared to women who delivered at other hospitals. The findings of logistic regression also showed that place of residence, educational status, age at first marriage, family size, dietary counseling during pregnancy, gravidity, length of labor, bad obstetric history, pregnancy status, gestational age and weight of new born were a significant determinant factors of still birth in hospitals of south west Ethiopia.

CONCLUSION

Grouped as sociodemographic, obstetrics, medical history (Maternal diabetes mellitus, malaria, hypertension) and birth outcome related factors as well as living in rural areas was more Vulnerable. Most of those problems could be prevented if the causes and factors that are associated with the occurrence of stillbirth were systematically registered for management.

RECOMMENDATION

The government to give special attention to the existing rural health centers to improve their capacity for handling emergency obstetric care cases. Based on these findings, societal awareness should be improved on the risk of early marriage, unplanned and unwanted pregnancies.

Key words: Still birth, Chi square test, Binary logistic regression, South West Ethiopia.

[*Afr. J. Health Sci.* 2020 33(2) : 65 - 79]



Introduction

Stillbirth refers to the birth of a baby with no signs of life at or after 28 weeks gestation. Globally, there were 2.6 million stillbirths with more than 7178 deaths per day. Majority of these deaths occurred in developing countries. A quarter of the stillbirths occurred in South Asia and sub-Saharan Africa and 60% occurred in rural families of these areas [17].

Each year about 15 million babies in the world, more than one in ten (>10) births were born prematurely. More than one million of those babies die shortly after birth [3]. Global stillbirth rate had declined by 14%, from 22.1 stillbirths per 1000 births in 1995 to 18.9 stillbirths per 1000 births in 2009.

However, less than 1% decline was realized in the African region annually. The stillbirth rate for developed countries was estimated between 4.2 and 6.8 per 1000 births, whereas for the developing world, the estimate ranges from 20 to 32 per 1000 births [15]. 2.6 million third trimester stillbirths were estimated to occur annually with a rate of 18.4 per 1000 births in 2015 [4].

Although 98% occur in low and middle-income countries, it accounts for the largest proportion of perinatal deaths in high income countries [7]. Stillbirth rates vary within and between countries with economically disadvantaged communities having higher rates compared to their economically successful counterparts [10].

In 2015 Ethiopia was ranked seven among the world's top ten leading countries (India, Nigeria, Pakistan, China, Bangladesh, Democratic Republic Congo, Ethiopia, Indonesia, Tanzania, and Afghanistan) in stillbirth with;

- 66% (1.8 million) of the world's stillbirths
- 66% of neonatal deaths
- 60% of maternal deaths[11].

In sub-Saharan Africa, an estimated 900,000 babies born as stillbirths. The estimate that, babies who die before the onset of labor or ante partum stillbirths, account for two-thirds of all stillbirths in countries where the mortality rate is greater than 22 per 1,000 births [9]. World Bank health statistics 2013 revealed a stillbirth rate of 26 per 1000 deliveries which was the third highest in the East African countries next to Djibouti and Somalia with stillbirth rates of 34 & 30

per 1000 births, respectively [5]. There were several risk factors associated with antepartum stillbirth in studies from high-income countries;

1. Maternal age greater than 35 years
2. Parity higher than four
3. Low maternal educational status
4. Lack of antenatal care attendance
5. Chronic maternal medical conditions
6. Pre-eclampsia or placenta abruption during pregnancy
7. Intra-uterine growth restriction
8. Major congenital anomaly of the infant
9. Poor maternal nutritional status [6].

Similarly, risk factors for stillbirth in developing and developed countries were:

1. Maternal age (>35 years or <20 years)
2. Lack of education
3. Socioeconomic characteristics
4. Lack of antenatal care (ANC)
5. History of stillbirth
6. Hypertension, smoking, obesity

and diseases such as syphilis and malaria are some common factors associated with stillbirth [1].

A study conducted by [12] in Nepal reported that, maternal age, place of residence, education level and sub-region of residence were significantly related to the likelihood of experiencing a stillbirth. Stillbirth was found to be more common among older women. A study conducted in Southern Nigeria reported socio-demographic variables such as extremes of age and parity, unemployment, unmarried and primary level or no formal education were determinants of stillbirth. Others were maternal diabetes mellitus, malaria, hypertension, labor duration > 4 hours, instrumental or assisted vaginal delivery, gestational age at booking >12 weeks, low birth weight and preterm births [14].

An African woman living in a low-income country had a 24 times higher chances of having a stillbirth at the time of delivery than a woman in a high-income country [9]. She faces many challenges including lack of basic necessities, water sanitation proper nutrition, basic health services including poor communication.

In Gondar Hospital Ethiopia, risk factors like preterm birth, low birth weight, ante partum hemorrhage (APH), hypertension, history of perinatal death, lack of ANC follow up and large family size



(>5) were significantly and independently associated with stillbirth [2]. The study reported that, the five main causes of stillbirth were maternal infections in pregnancy, chronic illnesses such as hypertension and diabetes, childbirth complications, fetal growth restriction and congenital abnormalities [9].

Adolescent pregnancy was also dangerous for low- and middle-income countries (LMIC). Stillbirths and death in the first weeks and month of life were 50% higher among babies born to mothers younger than 20 years than those born to mothers aged 20–29 years. The younger the mother, the higher the risk [16].

Absence of ANC follow up and hypertension was associated with adverse birth outcomes. Further enhancements of antenatal / maternal care and early screening for hypertension was essential [2]. The GLOBAL stillbirth burden was higher in rural areas traditionally associated with socioeconomic disadvantaged populations [11]. Stillbirth was practically unrecognizable as a health problem either in global health metrics or within LMIC data reports [9].

Studies suggested that, most of those problems could be prevented [11]. It is crucial we understand the causes and factors that are associated with stillbirth. They were often not registered systematically in many low-income countries including Ethiopia. Reliable registers exist only in countries with minimal number of deaths. This lead to underestimation of stillbirths in these countries [13]. This study, aimed to determine the prevalence of stillbirth, identify risk factors and assess the effect of sociodemographic, obstetrics, medical history and birth outcome related factors associated with the occurrence of stillbirth in South west Ethiopia.

Methodology and Materials

Data Source and Sampling Procedure

This hospital-based retrospective cohort study design was conducted in hospitals in South West Ethiopia (Shenen Gibe, Bedele, Tercha, Bonga and Mizan-Aman) from January to December 2017. The data was collected using a structured questionnaire from the mothers who come to any of the hospitals for delivery by trained nurses and midwives during the study period. For every ANC visit or delivery during the study period, a questionnaire was filled for personal information of the mothers.

The questionnaire was structured into socio demographic, obstetrics, medical history and birth outcome related factors. The study population was all women who gave birth during the study period. A simple random sampling method was employed to select respondents from the population. Before data collection, ethical clearance was obtained from Ethical Clearance Review Committees (ECRCs) from the College of Natural Science, Jimma University, Ethiopia. Written permission letters were also obtained from the hospital's administrators.

Study Variables

The response variable for this study was the status of stillbirth and classified as "Yes" for an infant that had died in the womb or intra partum after 28 weeks of gestation and "No" for otherwise (WHO).

Independent variables

Predictor variables are variables which were presumed to affect a dependent variable. Since based on the reviewed literature, some of the common predictors that were expected to influence determinants of stillbirth among women delivering at Southwest Ethiopia were recorded as given below for the purpose of the analysis. In this study possible determinants of stillbirth were grouped as sociodemographic, obstetrics, medical history and birth outcome related factors.

1. Sociodemographic factors include place of residence, age, marital status, level of education, occupation, religion, age at 1st marriage, family size and average monthly income.
2. Obstetrics related factors include; antenatal care /number of ANC visits, time of 1st ANC visit, modern contraceptive use, types of contraceptive used, dietary counseling during pregnancy, gravidity, mode of delivery, labor status, length of labor, bad obstetrics history, PROM in this pregnancy, congenital malformation, pregnancy status and interpregnancy interval.
3. Medical history and birth outcomes assessment factors include; health status during pregnancy, fever, chronic illness, antepartum hemorrhage, postpartum hemorrhage, HIV status, ART status, physical harassment, time to reach nearby health facility, previous gestational age and birth weight other of babies.



Statistical Data Analysis

The analysis of this study was carried out in two parts. In the first part, results of descriptive statistics and Chi-square test of associations was presented. In the second part, it identified and examined the determinants of stillbirth using multiple logistic regression analysis with the help of SPSS software.

Results of Descriptive Statistics

A total of 1000 women were included in the study from five hospitals. 200 women selected from each hospital interviewed face to face by midwives and nurses on their background history as well as their reproductive health record. The prevalence of stillbirth was 11.7%. with highest occurrence recorded at Mizan-Aman (2.8%) followed by Bonga (2.6%), Bedele (2.5%), Tercha (2%) and Shenen-Gibe (1.8%) hospitals.

The major socio-demographic background records of the respondents were presented in **Table 1 below**. Among 1000 respondents 48.2% resided in rural areas and 51.8% resided in urban areas. The higher prevalence of still birth occurred with women who reside in rural areas (15.4%) as compared to women who reside in urban areas (8.3%).

Table 1 shows that, among the total respondents 32.6% of them were aged between 15-24 years, while 57.9% of the women were in the age range 25-34 years and the remaining 9.5% of them were 35 years and

above. The highest prevalence of stillbirth was observed from women whose age was 35 years and above (31.6%) followed by ranges between 25-34 years (12.8%).

Majority of respondents (41.9%) had no education. While only 9.7%, 30.3% and 18.1% of them had informal education; primary level, secondary and higher education level respectively. The highest prevalence was observed from women who had no education (16.9%).

Majority of women (66.4%) were first married at the age between 18-23 years, while 13% were first married the age between 12-17 years and about 20.6% were first married in the age between 24-29 years.

Furthermore occupation, family size and monthly income were found to be significant determinant predictors of stillbirth. The proportion of women with still births was considerably higher for women whose occupation was farming (16.7%) followed by housewife (12.5%). The proportion of women who had stillbirth was also highest among those whose family size was 7 and more (11.7%) compared to those whose family size was 3 and less.

Similarly, the socio-demographic determinant factors; residential place, age, educational status, occupation, age at first marriage and family size were found to have a significant effect on the association of stillbirth at 5%. **Table 1**.

Table 1: Distribution of Sociodemographic Related Determinant Factors of Stillbirth

Risk factors	Categories	Counts (%)	History of Still birth		d.f	Chi-Square	P-Value
			Yes	No			
Residence	Urban	518 (51.8%)	8.3%	91.7%	1	11.94	0.001*
	Rural	482 (48.2%)	15.4%	84.6%			
Age	15-24 years	326 (32.6%)	4.0%	96.0%	2	55.761	0.000*
	25-34 years	579 (57.9%)	12.8%	87.2%			
	35 years and above	95 (9.5%)	31.6%	68.4%			
Educational Status	Illiterate	419 (41.9%)	16.9%	83.1%	3	28.121	0.000*



Risk factors	Categories	Counts (%)	History of Still birth		d.f	Chi-Square	P-Value
			Yes	No			
Educational Status	Informal Education	97(9.7)	15.5%	84.5%	3	28.121	0.000*
	Primary Level	303(30.3)	4.6%	95.4%			
	Secondary and above	181(18.1)	9.4%	90.6%			
	Single	60(6)	5.0%	95.0%			
Marital Status	Married	893(89.3)	11.9%	88.1%	3	6.438	0.092
	Widowed	22(2.2)	9.1%	90.9%			
	Divorced	25(2.5)	24.0%	76.0%			
	Farmer	216(21.6)	16.7%	83.3%			
	Housewife	472(47.2)	12.5%	87.5%			
Occupation	Merchant	147(14.7)	6.1%	93.9%	4	13.341	0.010*
	Employee	88(8.8)	10.2%	89.8%			
	Housemaid and others	77(7.7)	5.2%	94.8%			
Religion	Orthodox	456(45.6)	11.4%	88.6%	3	3.099	0.377
	Muslim	320(32)	11.2%	88.8%			
	Protestant	208(20.8)	13.9%	86.1%			
	Others	15(1.5)	0.0%	100%			
Age at first Marriage	12-17 years	130(13.0)	18.5%	81.5%	2	6.942	0.031*
	18-23 years	664(66.4)	12.3%	87.7%			
	24-29 years	206(20.6)	8.7%	91.3%			
	3 and less	449(44.9)	6.7%	93.3%			
Family Size	Between 4 and 6	358(35.8)	10.1%	89.9%	2	52.388	0.000*
	7 and more	193(19.3)	11.7%	88.3%			
	2500 birr and less	824(82.4)	11.8%	88.2%			
Monthly Income	2501 - 5000 birr	141(14.1)	11.3%	88.7%	3	0.337	0.953
	5001 – 7500 birr	22(2.2)	15.4%	84.6%			
	7501 birr and more	13(1.3)	8.7%	91.3%			

*significant at 5%



Obstetric characteristics of the respondents is presented in **Table 2**. Among the total respondents, 62% of them visited antenatal care for two and three clinic days during their pregnancy. Contrary, the lowest proportion (16.1%) who recorded visiting antenatal care clinics, was only once during their pregnancy term. The highest proportion (17.1%) of stillbirths was observed in women who only made one antenatal clinic visit compared to those who visited more than once.

Table 2 shows that, out of the total 74.5% nutritional status (dietary counseling) during pregnancy was good and 52.8% of the total improved their diet then. Similarly, about 34.4%, 50.9% and 14.7% were pregnant for the first time (Primigravida). Pregnant for 2-4 times (Gravida 2-4) and pregnant for 5 and more times (Gravida 5 and above) respectively. The highest incidence of still birth occurred among women who were pregnant for 5 and more times (30.6%) relative to those pregnant for fewer times.

Accordingly, the proportions of women who suffered a stillbirth varied by length of labor. The proportion of women who suffered a stillbirth is highest among those with lengthy labor between 1 and 4 hours (20.8%) relative to women with length of labor between 5 and 11 hours (10.6%) and women with length of labor greater than 12 hours (11.2%).

Similarly, the results show that, majority of the respondents were not exposed to bad obstetric histories (84.4%). However, about 7.1% of them had previously experienced perinatal death recording the highest prevalence (67.6%) as compared to the other bad obstetric histories. Pregnancy status of women had a significant association with the incidence of still birth ($p=0.000$). Approximately 55.1%, of the respondents' pregnancy status was planned and wanted. 36.6% unplanned but wanted and 8.3% unplanned and unwanted respectively.

Out of the 304 respondents who provided information on their background characteristics in regard to interpregnancy intervals, 63.8% of them had an interval of zero, while the remaining 36.2% had gone through between 1 and 4 among whom the highest prevalence of (58.2%) was recorded.

Among the obstetrics related determining factors, frequency of antenatal care visits, times of the first antenatal care visit, dietary counseling during pregnancy, gravidity, length of labor, bad obstetric history, PROM in this pregnancy, congenital malformation, pregnancy status and interpregnancy interval were found to be of important effect on the incidence of still birth at 5% levels of significance.

Table 2: Distribution of Obstetrics Related Determinant Factors of Stillbirth

Risk factors	Categories	Counts (%)	History of Still birth		d.f	Chi-Square	p-Value
			Yes	No			
Antenatal care Visit	Yes	868 (86.8%)	11.2%	88.8%	1	1.754	0.185
	No	132 (13.2%)	15.2%	84.8%			
Frequency of Antenatal care visit	1 time	140 (16.1%)	17.1%	82.9%	2	7.167	0.028*
	2-3 times	538 (62%)	10.8%	89.2%			
	4 and more times	190 (21.9%)	7.9%	92.1%			
Times of first Antenatal care visit	1st Trimester	264 (30.4%)	5.7%	94.3%	2	12.914	0.002*
	2nd Trimester	497 (57.3%)	12.9%	87.1%			
	3rd Trimester	107 (12.3%)	16.8%	83.2%			
Use of modern Contraceptive	Yes	625 (62.5%)	10.4%	89.6%	1	2.726	0.099
	No	375 (37.5%)	13.9%	86.1%			
	Injectable	359 (57.4%)	11.7%	88.3%			



Types of	Pills	137(21.9)	5.1%	94.9%			
Contraceptive used	Implanon	101(16.2)	11.9%	88.1%	4	5.981	0.201
	IUD	17(2.7)	17.6%	82.4%			
	Condom	11(1.8)	9.1%	90.9%			
Dietary counseling During pregnancy	Yes	745(74.5)	10.2%	89.8%	1	6.351	0.012*
	No	255(25.5)	16.1%	83.9%			
	Primigravida	344(34.4)	2.6%	97.4%			
Gravidity	Gravida 2-4	509(50.9)	12.4%	87.6%	2	78.594	0.000*
	Gravida 5 and above	147(14.7)	30.6%	69.4%			
	SVD	757(75.7)	11.0%	89.0%			
Mode of Delivery	Instrumental delivery	88(8.8)	11.4%	88.6%	2	2.554	0.279
	Caesarean	155(15.5)	15.5%	84.5%			
Labor status	Spontaneous	840(84)	11.3%	88.7%	1	0.775	0.379
	Induced	160(16)	13.8%	86.2%			
	1-4 hours	77(7.7)	20.8%	79.2%			
Length of Labor	5-11 hours	359(35.9)	10.6%	89.4%	2	6.729	0.035*
	12 hours and above	564(56.4)	11.2%	88.8%			
	None	844(84.4)	15.6%	84.4%			
Bad obstetric History	Abortion	85(8.5)	28.2%	71.8%	2	112.4	0.000*
	Perinatal death	71(7.1)	67.6%	32.4%			
PROM in this Pregnancy	Yes	111(11.1)	20.7%	79.3%	1	9.835	0.002*
	No	889(88.9)	10.6%	89.4%			
Congenital Malformation	Yes	19(1.9)	42.1%	57.9%	1	17.331	0.000*
	No	981(98.1)	11.1%	88.9%			
	Unplanned and unwanted	83(8.3)	21.7%	78.3%			
Pregnancy Status	Unplanned but wanted	366(36.6)	18.6%	81.4%	2	44.454	0.000*
	Planned and Wanted	551(55.1)	5.6%	94.4%			
Interpregnancy Interval	0	194(63.8)	3.6%	96.4%	1	116.8	0.000*
	1-4	110(36.2)	58.2%	41.8%			

*significant at 5%



The major medical history and birth outcomes assessment related factors of incidence of stillbirth are presented in **Table 3** below. Among all the respondents, 21% of them recorded their health status as ‘sick’ during the pregnancy. Among them the highest incidence of still birth recorded was (27.1%) compared to women with ‘healthy’ status during the pregnancy recording (7.6%). Fever for more than two weeks had a significant association with still birth ($p=0.000$). Out of the total number of respondents, only 7% of them experienced fever for more than two weeks and recorded the highest prevalence of (22.9%) compared to those who were not exposed to fever for more than two weeks (10.9%).

Table 3 shows that, medical illness after pregnancy was an sensitive factor that affected the incidence of still birth ($P<0.000$). Majority of the respondents were healthy during their gestation period (53%) having the lowest prevalence of still birth occurring (7.5%). Despite those who experienced anemia and malaria during pregnancy, recording a high prevalence (22.4%), hypertension followed by (18.8%). Out of the total respondents 3.9% of them had Antepartum Hemorrhage with the highest distribution of still births recorded at (41%). Furthermore, 9% of them had Postpartum Hemorrhage with a high distribution of still birth (27.8%).

Incidentally, the results show that gestational age and birth weight of newborns had a significant association with still birth. Out of the total number of respondents:

1. Majority (85.3%) delivered during the gestational period (between 37 and 42 weeks (term)).
2. 4.7% delivered after more than 42 weeks (post-term).
3. Approximately 10% of them delivered during pregnancy period of less than 37 weeks (preterm) with the highest distribution of still births at (27%).

Most birth weights of the infants were between 2.51 kg and 4.0 kg (71.6%). However, 10.9% and 17.5% of birth weights of the newborn infants were more than 4 kg and less than 2.5 kg, respectively. The highest proportion of stillbirth prevalence occurred among women with newborn's birth weights less than 2.5 kg (17.7%).

Among medical history and birth outcome related determining factors, health status during pregnancy, fever more than two weeks, medical illness during pregnancy, status of Antepartum Hemorrhage, Status of Postpartum Hemorrhage, gestational age and birth weight of newborn were significantly associated with the incidence of still birth at 5% level of significance.

Table 3: Distribution of Medical History and Birth Outcome Related Factors of Stillbirth

Majority (85.3%) delivered	Categories	Counts (%)	History of Still birth		d.f	Chi-Square	P-Value
			Yes	No			
Health status during pregnancy	Sick	210 (21%)	27.1%	72.9%	1	61.362	0.000*
	Healthy	790 (79%)	7.6%	92.4%			
Fever more than Two weeks	Yes	70 (7%)	22.9%	77.1%	1	9.069	0.003*
	No	930 (8.5%)	10.9%	89.1%			
Type of illness During pregnancy	Anemia	85 (8.5%)	22.4%	77.6%	7	29.606	0.000*
	UTI	176 (17.6%)	14.2%	85.8%			
	Malaria	76 (7.6%)	22.4%	77.6%			
	DM	8 (0.8%)	12.5%	87.5%			
	HIV/AIDS	8 (0.8%)	12.5%	87.5%			
	Hypertension	32 (3.2%)	18.8%	81.2%			



Majority (85.3%) delivered	Categories	Counts (%)	History of Still birth		d.f	Chi-Square	P-Value
			Yes	No			
Type of illness During pregnancy	Others	85 (8.5%)	9.4%	90.6%			
	Healthy	530 (53%)	7.5%	92.5%			
Status of Antepartum Hemorrhage	Yes	39 (3.9%)	41.0%	59.0%	1	33.782	0.000*
	No	961 (96.1%)	10.5%	89.5%			
Status of Postpartum Hemorrhage	Yes	90 (9%)	27.8%	72.2%	1	24.746	0.000*
	No	910 (91%)	10.1%	89.9%			
HIV Screening Status	Yes	856 (85.6%)	12.4%	87.6%	1	2.686	0.101
	No	144 (14.4%)	7.6%	92.4%			
HIV test result	Positive	27 (2.7%)	7.4%	92.6%	1	.495	0.482
	Negative	972 (97.2%)	11.8%	88.2%			
ART Status	Started	24 (2.4%)	4.2%	95.8%	1	1.351	0.245
	None	976 (97.6%)	11.9%	88.1%			
Physical Harassment	Yes	28 (2.8%)	21.4%	78.6%	1	2.630	0.105
	No	971 (97.1%)	11.4%	88.6%			
Time to reach near- by health facility	30 minutes and less	358 (35.8%)	9.2%	90.8%	1	3.325	0.068
	More than 30 minutes	642 (64.2%)	13.1%	86.9%			
Gestational Age	Preterm(<37 weeks)	100(10%)	27.0%	73.0%	2	25.196	0.000*
	Term(37-42 weeks)	853 (85.3%)	10.0%	90.0%			
	Post-term(>42 weeks)	47 (4.7%)	10.6%	89.4%			
Birth weight of new born	<2.5 kg	175 (17.5%)	17.7%	82.3%	2	11.569	0.003*
	2.51-4.0 kg	716 (71.6%)	11.3%	88.7%			
	>4 kg	109 (10.9%)	4.6%	95.4%			

*Significant at 5%



Results of Binary Logistic Regression Analysis

Multiple logistic regressions were fitted based on Chi-square test results of bivariate analysis. Based on results presented in *Table 1, Table 2 and Table 3*, those predictor variables that are associated with stillbirth at 5% level of significance were selected for multiple logistic regression analysis. Those models were fitted using these predictor variables from forward selection (Likelihood ratio) method. The result presented in *Table 6* shows that twelve of the predictor variables were significantly associated with the occurrence of stillbirths in South West of Ethiopia.

Assessment of Goodness of Fit of the Model

For categorical data, after a logistic regression model has been fitted, a global test of goodness fit of the resulting model should be performed. It is necessary to see the appropriateness, adequacy and usefulness of the fitted model. The most commonly used techniques are Likelihood-Ratio test, Hosmer and Lemeshow test, R-Square and the Wald goodness of fit test.

Table 4: Model Summary of Binary Logistic Regression Model

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
734.157a	.242	.381

The two descriptive measures of Goodness of Fit presented in the above *Table 4* are R^2 indices defined by Cox and Snell (1989) and Nagelkerke (1991). These indices are variations of the R^2 concept defined for the ordinary least square regression model. The Nagelkerke R^2 was 38.1% indicating that the explanatory variables were useful in predicting the presence or absence of still birth in South West Ethiopia.

Hosmer and Lemeshow Test

A non-significant Chi-square indicated that there was no difference between the observed and the model predicted values. Hence, estimates of the model adequately fit the data [8]. Since *Table 5* shows the p-value is 0.054 and it is greater than 0.05 then, we don't reject the null hypothesis that there was no difference between observed and model predicted values, confirming that the model fitted the data well.

Table 5: Hosmer and Lemeshow Test

Chi-square	Df	Sig.
15.248	8	.054

Results of Multiple Logistic Regression Analysis

Multiple logistic regressions were used to analyze the effect of each independent variable on

women's status of stillbirth, while controlling the other independent variables. Accordingly residence, place of delivery hospitals, educational status, age at first marriage, number in a family, dietary counseling, gravidity, length of labor, bad obstetric history,



pregnancy status, gestational age and weight of new born were found to be significant predictors for prevalence of still birth at 5% level of significance (*see Table 6*)

The logistic model showed that the likelihood of having stillbirth was significantly associated with delivery hospitals. Women who delivered at Mizan Aman hospital were 1.646 times more likely to have an of stillbirth than Shenen Gibe hospital, controlling for other variables in the model. Similarly, women who delivered at Bedele hospital were 1.566 times more likely to have an experience a of stillbirth than Shenen Gibe hospital controlling for other variables in the model.

Moreover, women who delivered at Bonga hospital were more likely to deliver stillbirth than Shenen Gibe hospital controlling for other variables in the model. The odds of having stillbirth among women who delivered in Tercha were not significantly different from those who delivered at Shenen Gibe hospital.

Table 6 also shows that place of residence had a significant association with the incidence of still birth. A woman who resides in a rural area was 1.568 times more likely to experience a still birth than a woman who reside in an urban area, controlling for other variables in the model.

The model showed that women educational status is significantly associated with the incidence of still birth ($p=0.032$). According to results in *Table 4*, we observed that the log of the odds of respondents experiencing a stillbirth was positively related to age at first marriage. Respondents whose first marriage was in the age range between 12-17 years were 2.552 times more likely to deliver stillbirth than those whose age at first marriage was in the age range between 24-29 years.

Additionally, the model reported that, family size also has a significant association with the incidence of still birth ($p=0.005$). Respondents who had family members of between 4 and 6 were 46.1% less likely to suffer a still birth than respondents who had families with 7 or more members, controlling for other variables in the model.

Similarly, the model shows pregnancy status was a significant effect on the incidence of still birth. Women with pregnancy status being ‘unplanned’ and ‘unwanted’ were 2.938 times more likely to suffer a stillbirth than women whose pregnancy status was ‘planned’ and ‘wanted’, controlling for the other variables in the model. The odds of women with pregnancy status as ‘unplanned’ but ‘wanted’ was 1.842 times more likely to suffer a still birth than women whose pregnancies were ‘planned’ and ‘wanted’, controlling for the other variables in the model.

The model showed that women’s dietary counseling during pregnancy is a significant predictor of the incidence of still birth. A woman whose dietary counseling during pregnancy was poor is 1.636 times more likely to have still birth than women who had good dietary counseling during pregnancy controlling for other variables in the model.

The analysis also showed gravidity, length of labor and bad obstetric history to have a statistically significant association with the incidence of still birth. Women who experienced an abortion as a bad obstetric history were 93.5% less likely to suffer a still birth as compared to women with a perinatal death as a bad obstetric history, controlling for other variables in the model.

Furthermore, gestational age and weight of the newborn also had a significant association with the incidence of still birth. Women with gestational period less than 37 weeks (Preterm) were 3.253 times more likely experience a still birth than women with gestational period of more than 42 weeks (post-term), controlling for the other variables in the model.

Similarly, the odds of respondents having a newborn child with less than 2.5 kg birth weight was 9.727 times more likely to deliver a stillbirth than those having a newborn child with more than 4 kg birth weight. The odds of women with a newborn child having birth weight of between 2.5-4.0 kg was 4.322 times more likely to suffer a still birth than that of women having a newborn child with birth weight of more than 4 kg, controlling for the other variables in the model.



Table 6: Maximum Likelihood Estimates of Predicting the Incidence of Still Birth

Risk factors	B	S.E.	Wald	Df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							Lower	Upper
Residence								
Rural	.450	.207	4.738	1	.030	1.568	1.046	2.352
Urban (Ref)								
Delivery Hospitals			10.490	4	.033			
Bedele	.449	.204	4.819	1	.028	1.566	1.049	2.338
Mizan Aman	.498	.215	5.361	1	.021	1.646	1.080	2.510
Bonga	.479	.208	5.284	1	.022	1.614	1.073	2.429
Tercha	.373	.208	3.206	1	.073	1.453	.965	2.186
Shenen Gibe (Ref)								
Educational status			8.774	3	.032			
Illiterate	-.098	.303	.105	1	.746	.907	.501	1.641
Informal Education	-.016	.385	.002	1	.967	.984	.463	2.095
Primary Level	.616	.323	3.637	1	.057	1.852	.983	3.487
Secondary and above (Ref)								
Age at First Marriage			6.675	2	.036			
12-17 years	.937	.367	6.523	1	.011	2.552	1.243	5.238
18-23 years	.437	.284	2.360	1	.124	1.548	.887	2.702
24-29 years (Ref)								
Families			10.539	2	.005			
3 and less	.471	.327	2.074	1	.150	1.602	.844	3.043
Between 4 and 6	-.618	.292	4.488	1	.034	.539	.304	.955
7 and more (Ref)								
Dietary Counseling								
No	.492	.219	5.044	1	.025	1.636	1.065	2.515



Cont: Table 6: Maximum Likelihood Estimates of Predicting the Incidence of Still Birth

Risk factors	B	S.E.	Wald	Df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							Lower	Upper
Gravidity			9.618	2	.008			
Primigravida	.496	.376	1.737	1	.188	1.641	.786	3.430
Gravida 2-4	-.296	.294	1.014	1	.314	.744	.418	1.323
Gravida 5 and above (Ref)								
Length of Labor			10.159	2	.006			
1-4 hours	-.566	.307	3.389	1	.066	.568	.311	1.037
5-11 hours	.433	.222	3.820	1	.051	1.542	.999	2.381
12 hours and above (Ref)								
Bad Obstetric History			39.452	2	.000			
None	.332	.312	1.137	1	.286	1.394	.757	2.569
Abortion	-1.774	.419	17.889	1	.000	.170	.075	.386
Prenatal death (Ref)								
Pregnancy Status			11.026	2	.004			
Unplanned and unwanted	1.078	.345	9.735	1	.002	2.938	1.493	5.783
Unplanned but wanted	.611	.334	3.350	1	.067	1.842	.958	3.542
Planned and Wanted (Ref)								
Gestational age			6.789	2	.034			
Preterm (<37 weeks)	1.180	.453	6.789	1	.009	3.253	1.339	7.899
Term (37-42 weeks)	.646	.350	3.414	1	.065	1.908	.962	3.788
Post-term (>42 weeks) (Ref)								
Weight of Newborn			44.718	2	.000			
<2.5 kg	2.275	.448	25.819	1	.000	9.727	4.045	23.393
2.51-4.0 kg	1.464	.245	35.567	1	.000	4.322	2.672	6.992
>4 kg (Ref)								
Constant	-2.963	.768	14.874	1	.000	.052		



Discussion

This study aimed to identify determinants of still birth among women based on five hospitals in South West Ethiopia. Accordingly descriptive analysis, chi-square test and binary logistic regression techniques were used. In general, the results from this study were consistent with most previous studies in terms of the risk factors of still birth. The results obtained are discussed as follows:

The descriptive analysis of this study shows that the prevalence of still birth in South West Ethiopia was 11.7% and women who delivered at Shenene Gibe hospital were less likely suffer a still birth than women who delivered in other hospitals.

This study found that place of residence had a significant association with still birth. The results showed that women who reside in rural areas were 1.568 times more likely to suffer a still birth than women who reside in urban areas. This finding is consistent with (Lawn et al, 2016) and (Mahesh et al, 2019), who revealed that the stillbirth burden worldwide is higher in rural areas.

The findings revealed that age at first marriage was significantly associated with the incidence of still birth. Women whose age at first marriage is in the age range between 12-17 years were 2.552 times more likely to suffer a still birth than those whose age at first marriage is in the age range between 24-29 years. The result is agreement with (WHO, 2011), which showed that early age (<20 years) at pregnancy as one of the factors leading to increased risk of still birth with particular reference to mothers aged 20-29 years and the younger the mother, the higher the risk of still birth. The finding shows that there is a direct relationship between age at first marriage and risk of still birth.

Moreover, the study showed that women's dietary counseling during pregnancy is a significant predictor of the incidence of still birth. A woman whose dietary counseling during pregnancy was poor is 1.636 times more likely to suffer a still birth than a woman whose dietary counseling during the pregnancy was good. This finding is consistent with a study done by (Ali and Adam, 2011) which revealed that nutritional status is a risk factor associated with higher stillborn rates. The finding is also in agreement with [6] who showed that poor maternal nutritional status was one of the risk factors of still birth.

Moreover, the study found that gestational period was a significantly associated determinant of

still birth. Women with gestational period less than 37 weeks (Preterm) were 3.253 times more likely to suffer a still birth than those with gestational period of more than 12 weeks (post-term). The results are consistent with [14] who revealed that gestational age at booking of >12 weeks was determinant of stillbirth. Women who had experienced an abortion as a obstetric history were 93.5% less likely to suffer a still birth compared to women who had a Perinatal death history, controlling for other variables in the model. The result is also in agreement with [2]

The model of this study revealed that the likelihood of having still birth among women with a birth weight of newborn child less than 2.5 kg was 9.727 times than women having a newborn child with birth weight of more than 4 kg. The odds of women with a newborn child with birth weight between 2.5-4.0 kg was 4.322 times more likely to suffer a still birth than those with newborns with birth weight of more than 4 kg. The finding is consistent with a study done by [14] and [2], which showed that low birth weight is one of the determinant factors of still birth.

Conclusion

The study revealed that, living in rural areas, early marriage, having bad obstetric history, poor dietary counseling during pregnancy, gestational period less than 37 weeks, unplanned and unwanted pregnancy, perinatal death history and low birth weight were more likely to lead to stillbirth in South West Ethiopia

Recommendations

Based on the findings of this study, the following recommendations are forwarded:

1. Awareness to be given created in the society on the risk of early marriage, unplanned and unwanted pregnancy.
2. The government of Ethiopia should give special attention to the existing rural health centers to empower them for handling emergency obstetric care cases.
3. The health office of the South West Ethiopia should work hard on awareness of the community to improve dietary counseling during pregnancy.

Abbreviations

ANC: Antenatal Care

APH: Ante Partum Hemorrhage



ART: Anti-Retroviral Treatment
HIV/AIDS: Human Immune Virus/ Acquired Immune Deficiency Syndrome
PROM: Premature Rupture of Membranes
SPSS: Statistical Package for Social Sciences
WHO: World Health Organization

Conflict of Interest

The author has no conflicts of interest associated with the material presented in this study.

Acknowledgments

The author of this article would like to thank Shenen Gibe, Bedele, Tercha, Bonga and Mizan-Aman hospital administrators and staff members who were involved in providing the data. Research leading to this paper was supported by Jimma University. The author would like to appreciate Jimma University for funding of this study.

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