Determinants of Perinatal Mortality in Tercha General Hospital, Southern Ethiopia; Facility Based Case Control Study.

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Abstract

Background: Ethiopia meets the target millennium development goal 4 on child survival three years ahead of time. However, there were high perinatal deaths in the country and the reduction was not impressive. Identifying determinants and implement evidence based interventions is crucial to reduce perinatal death. However, there were no clear evidences on determinants of perinatal mortality in Tercha General Hospital.

Objective: To assess determinants of perinatal mortality in Tercha general hospital, Southern Ethiopia, January 1, 2014 and December 30, 2017.

Method: An unmatched case control study using secondary data as a source of information was conducted in Tercha general hospital. Cases were stillbirths and early neonatal deaths. Controls were those newborns live till 7th days. Randomly selected 366 (183 cases and 183 controls) study subjects were constituted for this study. The data were collected from March 1-20/2018. Epi-Data version 3.1 and SPSS Version 23 were used for data entry and analysis, respectively. Descriptive statistics were used to describe the study population in relation to study variables. Logistic regressions were employed to identify determinants of perinatal death.

Results: In multivariable logistic analysis, rural in residence of the mother [AOR=1.82; 95%CI:(1.04-3.19)], ANC booking [AOR=0.47; 95%CI:(0.27,0.83)], prolonged labour [AOR=2.75; 95%CI: (1.58-4.78)], low birth weight [AOR=1.78; 95%CI (1.06-2.97)], presence of obstetrics complication [AOR=2.15; 95%CI: (1.28-3.62)], using partograph [AOR=0.5; 95%CI: 0.25-0.9]. Using safe child birth checklist [AOR=0.52; 95%CI: 0.30-0.91], and coming with referral [(AOR=2.69; 95% CI: (1.51-4.8)] were significantly associated with perinatal mortality.

Conclusion and Recommendation: Being rural in residence, coming with referral, low birth weight, prolonged labour and presence of obstetric complication were associated with elevated the risk of perinatal mortality, and antenatal care booking, using partograph and using safe childbirthchecklist were associated with reduced risk of perinatal mortality. We therefore, recommend strengthening maternal health and newborn care servicesby taking into account these factors to reduce perinatal death.

Introduction

Perinatal mortality, as defined by World Health Organization (WHO), is total number of deaths in the perinatal period. This includes still birth (death of fetus after 28 weeks of gestation or above 1000gram birth weight) and early neonatal death (END) i.e. death of live new-born before the age of 7 completed days (1,2). While the WHO, the International Stillbirth Alliance and some developed countries utilize 22 weeks as their age of viability and a loss at that gestational age reported as perinatal mortality(3). In countries like Ethiopia, viability age greater than 28 week is considered for the report (4).

Newborns are at most risk of dying in their first week of birth, and globally three-quarters of neonatal deaths occur in the first week of life (5). Stillbirths account for over half of all perinatal deaths. One third of stillbirths takes place during delivery, and is largely avoidable. Intra-partum deaths (i.e. those occurring during delivery) are closely linked to place of care at delivery (3,6).

Every year, nearly 7 million perinatal deaths occur across the globe (3.5 million stillbirths and 4 million neonatal deaths), which is higher than the combined annual all age level deaths due to Acquired Immune Deficiencies Syndrome(AIDS) (2.1 million), tuberculosis (1.6 million) and malaria (1.3 million) (3,7,8).

Perinatal mortality is at an unacceptably high level in low and middle income countries, about 99% of these perinatal deaths occur in this country (9). In addition to this, the true mortality rate is under estimated in low and middle income countries where vital registration is not available(10).In Sub Saharan Africa approximately 30 million women become pregnant in a year. Of those, about 1 million deliveries are still birth; at least 1million babies die in their first month of life and 0.5 million die on the first day of life (11).

Ethiopia like other sub-Saharan countries has a high perinatal mortality. According to WHO report, PMR of Ethiopia in 2004 was 128,000 total deaths (34,000 still births and 94,000 early neonatal deaths)(12). According to Ethiopian Demographic and Health survey (EDHS–2016) perinatal mortality rate was 33 deaths per 1,000 pregnancies (13,14). The overall perinatal mortality reported from ten hospital based studies in Ethiopia was in the range of 66 to 124 per 1000 births. The report of the large scale community based perinatal mortality was also in the range of 37 to 52 per 1000 births (7).

Studies conducted in Ethiopia showed that perinatal mortality was associated with maternal socio demographic status like maternal age, occupation, birth interval, occupation (13,15,16). Maternal obstetrics and medical factors history such as Antenatal Care (ANC), Human immune deficiency Virus (HIV) status, history of obstetrics complications, parity, mode of delivery and neonatal related factors like fetal presentation, birth weight, and sex were variables which associated with perinatal mortality (27–31).

Southern Nations Nationalities Peoples and Representative (SNNPR), region is one of the regional states in Ethiopia which had perinatal mortality rate of 26 deaths per 1,000 pregnancies in EDHS 2016 report(13). Dawro zone is one of the largest populated zones in the region, with low health services coverage, institutional delivery and antenatal coverage (19). A study conducted at Tercha General Hospital (TGH) showed, perinatal mortality among the group of mothers undergone a major obstetrics intervention (Cesarean section(C/S),laparotomy for repair of uterus,hysterectomy, and destructive operation) were 258 per 1,000 live births (20).

Identifying determinants and implement evidence based interventions is crucial to reduce perinatal death. However, up to the knowledge of principal investigator while searching different literatures, there was no study done to assess determinants of perinatal mortality in TGH. Therefore, this study helps to assess determinants of perinatal mortality among hospital deliveries that will help to improve all concerned

bodies understanding on the factors associated to perinatal mortality and serves as an important tool for planning and resource allocation that aimed to improving newborns survival.

Materials And Methods

Study setting and Period

The study was conducted at Tercah General Hospital which is found Tarcha town, SNNPR. Tercha town is located at south west of Ethiopia, 517Kms away from Addis Ababa and 285Kms away from Hawassa (the capital city of SNNPR). The Hospital have 120 beds. There are 40 beds in the maternity ward, 4 labor beds and 3 delivery Koch. There is also neonatal intensive care unit with kangaroo mother care room (equipped with 4 beds). There are 150 clinical 87 supportive staff members (19). The study was conducted from March 1–20/2018

Study Design: Hospital based unmatched Case Control Study Design was employed.

Population:Cases were *r*andomly selected perinatal deaths that were attended in TGH from January 1, 2014 and December 30, 2017 and controls were randomly selected live births that were attended in TGH and alive up to 7 days in the same year with cases.

Sample size determination and Sampling technique

The required sample size was calculated by the statistical program of Epi-info stat Calc tool by considering different factors strongly associated with perinatal mortality from previous study conducted in Addis Ababa:birth interval <2 years, congenital anomalies, C/S delivery, Hg level<11gm/dl and partograph use (12). Based on the assumption of case to control ratio of 1:1, 95% confidence level, Power of 80% percentage of controls exposed (Hemoglobin level<11gm/dl) 8% and odds ratio of 2.6, the total sample size for this study became 366 (183 case and 183 controls).All perinatal cases and controls identification number (card number) in between January 1, 2014 and December 30, 2017 were taken from delivery room and neonatal intensive care unit registration log book then the required sample size were selected by using simple random sampling technique with computer generated random number.

Variables:

Dependent Variable; Perinatal Mortality

Independent variables

Maternal Socio demographic factors: Age, marital status, residency, occupational status, and educational status

Maternal obstetrics history related factors: Parity, birth interval, ANC booking, Tetanus Toxoid(TT) vaccination status, gestational age, mode of delivery, history of abortion, history of previous perinatal mortality, duration of labour, and history of obstetrics complications

Maternal medical illness Factors: HIV status, Venereal Disease Research Laboratory (VDRL) test result, hepatitis B test result, hemoglobin level (gm/dl), history of chronic Disease.

Newborn related factors: presentation, sex, weight, congenital anomaly.

Health care related factors: partograph use, use safe child birth checklist, and coming with referral

Data collection tool

The tools were developed from different literatures (17,22,26,27)and contained five different Section. Section one: maternal Socio demographic factors; it contains five items, Section two: maternal obstetrics factors: it contains eight items, Section three: maternal medical Factors: it contains six items, Section four: Newborn related factors: it contains seven items, Section five: Health care related factors: it contains three items

Data Collection Procedures

During data collection, delivery registry books were reviewed and selection of cases and controls was done from the registration books then the cards of both the selected cases and controls were traced from the archive (card room) using card numbers found in the registration book. For stillbirths and live births maternal cards were reviewed; and for early neonates death neonates card were assessed, if missing data in the early neonates card happened, their maternal cards were trace from the card room and complete it.

Data quality Assurance

Prior to data collection careful modification of the data collection tool were made. The tool was pre-tested (using 5% of sample size = 18) at TGH by using the source population (November- December 2013). Data collectors and supervisors were trained for 3 days. The tool also commented by two Epidemiology experts. Daily supervision of the data collection procedure was made.

Data processing and analysis

Before data entry data were cheeked for completeness, then data were coded and entered into Epi-Data version 3.1 then data were exported to Statistical package for social science (SPSS) Version 23 for checking the missing values, outliers, and analysis. Descriptive analysis was made to describe the study populations in relation to study variables.

First, bivariate logistic regression was done to select candidate variables for multi variable logistic regression. All variables having P-value ≤0.25 during bivariate analysis were considered as candidates for the multi variable logistic regression. After the multi variable logistic regression analysis variables having p-values <0.05 was considered as having statistical significant association with prenatal mortality. Model fitness was checked by Hosmer & Lemeshow goodness of test (p-value = 0.542). The degree of association between independent and dependent variables was assessed by using Adjusted Odds Ratio (AOR) with 95% CI. Finally, the data were presented by tables and frequencies.

Ethical Clearance

Ethical clearance was obtained from Institutional Review Board (IRB) of Jimma University, Faculty of Public Health. Permission was obtained from Tercha General Hospital and consent was taken from the manager. Names and other personal information which can violate the confidentiality of the study subjects were not taken. Any information have been kept confidentially.

Results

Socio-demographic characteristics of the respondents

The total of 366 study subjects (183 cases and 183 controls) were included in this study with 100% response rate. The mean age of mothers for cases and controls was 27.7± 6.2 and 26.4±5.9 years, respectively. The highest proportion of mothers of cases 135(73.7%) were in the age group 20–35 years. Majority of cases 153 (83.6%) were born from married mother. One third of mother of controls 66(36.07%) were at primary school level while 21(11.48%) of the controls were diploma and above. Most of mothers of cases (79.2%), were from rural area while 106 (57.9%) of the controls were from rural areas *(Table 1).*

Maternal Obstetrics Characteristics

Primipara mothers were higher in the control group than the cases. The proportion of mothers had antenatal care follow up at least one times in the current pregnancy in cases were 118(64.48%) and in controls were 146(79.78%). The proportion of mothers who received at least two doses of TT vaccination in cases were 117(63.93%) and in controls were 143(78.14%). Regarding mode of delivery, 58 (31.69%) of

the cases and 30(16.39%) of the controls were delivered by cesarean section. Thirty three (18.03%) of cases and 17 (9.29%) of controls had previous history perinatal mortality. With regard to the durations of labor, relatively long duration of labor was observed among cases. The median duration of labour in the cases and the controls group was 12 and 9 hours, respectively. One hundred three (56.28%) of the cases were born from mothers having at least one type of obstetric complication while it was only 51(27.87%) in the control group. Among obstetrics complications, newborn with antepartum hemorrhage responsible for 28(15.3%) of perinatal death, PROM responsible for 24(13.1%) of perinatal deaths *(Table 2).*

Maternal medical and Neonatal related factors

Regarding to maternal medical factors, 345 screened for HIV of which 340 (92.8%) were non-reactive and 4 (1.09%) were reactive among reactive mothers four of them were mothers of cases. Ninety seven percent of mothers were non-reactive for VDRL test. Majority of participants (84.6%) were none reactive and 0.8% were positive for hepatitis B surface antigen testing. Forty-three mothers of (23.5%) cases and 16(8.7%) controls hemoglobin level were less than 11gm/dl. Thirty one (16.9%) of cases and 14(7.65%) of controls of were born from mothers who were diagnosed at least one type of medical illnesses in the current pregnancy. Concerning to neonatal related factors, One hundred seven (58.47%) cases and 136(74.3%) controls mode of delivery were vertex in fetal presentation. The proportion of congenital anomaly in was higher in cases (3.83%) than controls (1.69%). The proportion of low birth weight (Wt <2500gm) cases and controls were 78(42.62%) and 55(30.05%), respectively *(Table 3).*

Organizational related factors

The proportion of partograph use was high in controls (88.5%) than cases (69.9%). Safe childhood checklist was used in 138(75.4%) controls and 102(55.7%) cases. Among those 51(58%) of mothers had at least one obstetrics complication. Seventy two (39.3%) of mothers of cases were referred from other health institution with referral paper *(Table 4)*

Determinants of perinatal mortality.

Binary logistic regression was done to assess the association of perinatal mortality with different characteristics. After multi variable analysis; place of residence [AOR = 1.82; 95%CI:(1.04–3.19); p-value = 0.035],ANC booking[AOR = 0.47; 95%CI: (0.27, 0.83); p-value<0.001],prolonged labor [AOR = 2.75;95%CI: (1.58–4.78), obstetrics complication [AOR = 2.15; 95%CI: (1.28–3.62); p-value = 0.004], birth weight [AOR = 1.78; 95%CI (1.06–2.97) p-value = 0.029]. Similarly, use of partograph [AOR = 0.5; 95%CI: (0.25–0.9); p-value = 0.025] use of safe childbirth checklist [AOR = 0.52; 95%CI:(0.30–0.91); p-value = 0.024] and coming with referral [(AOR = 2.69; 95% CI: (1.51–4.8); p-value = 0.001] were found to be independent determinants of perinatal mortality *(Table 5).*

Discussion

Mothers who were rural in residence were two times more likely to have perinatal mortality compared to those mother who were urban in residence [AOR = 1.82; 95%CI: (1.04–3.19), p = 0.035]. This finding is consistent with the study conducted in Jimma university referral hospital and showed that mothers who live outside Jimma is more likely to have perinatal death [AOR = 2.861; 95%CI:1.99–3.33] (21). This might be due to the fact that mothers live in rural area have exposure to lack of awareness, inaccessible healthy facility, poor transport access, or probably due to their big delay in health care seeking behavior; this all lead to obstetrics complications and increase the risk of perinatal loss.

In the present study, among socio demographic variables maternal level of education, age, occupational status, and marital status were not associated with perinatal mortality. This finding is similar with the results of other studies in Ethiopia (22,27) and study in Sudan (23).

Mothers with ANC booked were 53% less likely to have perinatal death than those who were un-booked [(AOR = 0.47; 95%CI: (0.27, 0.83)), p<0.001]. Our finding is comparable with the result of other studies in Ethiopia (25,27,28) and developing countries in Africa [AOR = 0.3; 95% CI:(0.1–0.6); p = 0.002] (23) that showed that having ANC follow up is a protective factor for perinatal mortality. This might be due those women's who attended ANC had more opportunity to prevent, identify, and treat pregnancy related conditions as well as help a woman approach pregnancy and birth as a positive experiences. However, the study is not consistence with the study conducted in Addis Ababa public hospitals; which shows there is no statistical significant association between perinatal mortality and ANC booking [AOR = 6.15; 95%CI:0.31–122.04] (12) The difference might be due to difference in study setting.

With regard to duration of labour, mothers with prolonged labour (labour took > = 8hr) were 2.75 times more likely for perinatal death than mothers had normal duration of labour (<labour took <8hr) [AOR = 2.75; 95%CI: (1.58–4.78), p-value<0.001]. The present finding is similar with the study conducted in Kenya that found prolonged labour was the main risk factor for perinatal mortality [AOR = 7.9; 95%CI: 3.92–15.94] (25). The result also supported by one study done in Ethiopia [(AOR = 8.79,95%CI (2.25–34.38)] (17). This might be due to prolonged labour increased risk of birth Aspasia, birth trauma, umbilical cord prolapse, PROM; which results increased perinatal mortality and morbidity (26)

Mothers who gave birth to low birth weight were 1.78 times more likely to have perinatal death as compared to those who gave birth to a normal birth weight baby [AOR = 1.78; 95%CI (1.06–2.97), p-value = 0.029]. This finding is consistence with the result of other studies in Ethiopia and developing countries (17,22,27) and showed that newborns who were low birth weight (<2500gm) were more likely for death compared to newborns with normal birth weight. This is due to the fact that being low birth weight is at high risk for hypothermia, which is one the cause PM.

Mothers who had complication during delivery were 2.15 times more likely of having perinatal mortality compared to those who had no complication [AOR = 2.15;95%CI:(1.28–3.62), p-value = 0.004]. This result

is in line with the result of other studies in Ethiopia and developing countries (15,22,25) that showed obstetric complications were strongly associated with perinatal mortality.

The odds of perinatal mortality were 50% less likely among mothers whose labor was followed using partograph compared to their counter parts [AOR = 0.5; 95%CI: 0.25–0.9, P-value = 0.025]. This finding is consistence with the study conducted in public hospitals of Addis Ababa [AOR = 0.35; 95%CI: (0.18–0.66)] (12). This implies that using WHO recommended partograph is a protective factor for perinatal mortality. This might be due to use of partograph can help alert health care providers to pick any abnormalities during the course of labor. Therefore, it can prevent perinatal loss with early diagnosis and management of labor complications.

The odds of perinatal mortality were 48% less likely among mothers whose labor was followed using safe childhood checklist compared to their counter parts [AOR = 0.52; 95%CI: 0.30–0.91, P-value = 0.024]. This might be due to the WHO safe childbirth checklist helps health-care workers ensure that essential birth practices are performed at critical moments during childbirth for every delivery, every time (27).

And mothers who came with referral to the hospital were 2.69 times more likely to end up in perinatal death as compared to mothers who came to hospital by themselves [(AOR = 2.69; 95% CI:(1.51–4.8); p-value = 0.001]. This might be related with coming with referral lead to delay on delivery care, miss's early C/S. Similarly, information obtained may have not been enough to assess due to the effect of this delay. This finding is consistence with other study conducted in Wolyta Sodo referral hospital [(AOR = 7.32; 95%CI (2.47, 21.63)] (17).

Limitation of the Study

Since this study was conducted based on secondary data that was gathered for other purpose, it was difficult to gather all necessary variables. The confounding effect of unmeasured variables could not be controlled.

Conclusion

In conclusion, being rural in mother's place of residence, presence of obstetrics complication during delivery, duration of labour, low birth weight and coming with referral were positively associated with perinatal mortality; whereas antenatal care booking, using partograph, and using safe childbirth checklist were negatively associated with perinatal mortality. Therefore, managers should strictly monitor ambulance service utilization for minimizing delay during referral. Health care providers should give special attention for early recognition of abnormalities and manage accordingly while doing ANC and labor follow up. Similarly, they should do immediate newborn care with special attention to newborns with low birth weight. It will better if researchers conduct further longitudinal community based study to get other unmeasured risk factors.

Abbreviations

ANC: Antenatal Care; AIDS: Acquired Immune Deficiencies Syndrome; C/S: Cesarean Section; END: Early Neonatal Death; EDHS: Ethiopian Demographic Health Survey; SNNPR: South Nations Nationality Population Representative; TGH: Tercha General Hospital; VDRL: Venereal Disease Research Laboratory; WHO: World Health Organization

Declarations

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Availability of data and materials

The data supporting our findings are found at, kept in confidential and stored at the correspondent author both in hard and soft copies. If someone wants our data, we are voluntary to share it and the correspondent author should be contacted through the email address under the author's information

Authors' Contributions

FTD, developed the proposal, carried out data collection, conducted the analysis, involved in reviewing the manuscript and had full access to all the data in the study and had final responsibility for the decision to submit for publication. CH and MB provided general guidance in overall study progress and participated in reviewing the proposal, reviewing the analysis and participated in final study document development. AA participate in reviewing the whole document and guide the preparation of manuscript.All authors read and approved the final manuscript and accountable for all aspects of the work.

Ethics approval and consent to participate

Ethical clearance was obtained from Institutional Review Board (IRB) of Jimma University, Faculty of Public Health. Following the endorsement by the IRB, a written permission obtained from Tercha general hospital. Furthermore, confidentiality was assured throughout the process.

Consent for publication

Not applicable.

Competing interests

I declare that the study has no competing of interests.

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Tables

Table 1: Socio demographic characteristics of mothers of perinatal deaths (cases) and controls among deliveries in Tercha general hospital, SNNPS, 2014-2017.

Variables	Cases		Controls	
	№=183	%	№=183	%
Age				
< 20 years	30	16.3	43	23.46
20-35 years	135	73.7	121	66.2
>35 years	18	10.0	19	10.3
Marital status(Mother)				
Married	153	83.6	153	83.6
Single	16	8.74	15	8.74
Widowed	8	4.37	8	4.3
Divorced	6	6.28	7	3.83
Residency				
Rural	145	79.2	106	57.9
Urban	38	20.8	77	42.1
Occupational Status				
Housewife	99	54.1	102	55.74
Gov’t employed	26	14.2	23	12.57
Student	6	3.28	14	7.65
Self-employed	52	28.4	44	24.04
Educational Status				
No formal education	87	47.54	64	34.97
Primary school	43	23.50	66	36.07
Secondary school	34	18.58	32	17.49
Diploma and above	19	10.38	21	11.48

Table 2: Obstetrics characteristics of mothers of perinatal deaths (cases) and controls among deliveries in Tercha general hospital, SNNPS, 2014-2017.

Variables	Case		Control	
	№=183	%	№=183	%
Parity				
Primipara	62	33.88	87	48
Multipara	121	62.12	96	62
Birth Interval				
>=2 year	67	36.6	62	78.14
<2 year	52	28.41	47	21.86
TT vaccination				
>=2times	117	63.93	143	78.14
<2times	66	36.07	40	21.86
ANC booking				
Yes	118	64.48	146	79.78
No	65	35.52	37	20.22
Mode of Delivery				
SVD	95	51.91	122	66.67
Instrumental	30	16.39	31	16.94
C/S	58	31.69	30	16.39
History of abortion				
Yes	28	15.3	16	8.74
No	155	84.7	167	91.26
History of previous perinatal mortality				

Yes	33	18.03	17	9.29
No	150	81.97	166	76.5
Duration of labour				
<8hr	43	23.5	86	46.99
>=8hr	140	76.5	97	53.01
Presence of obstetrics complication				
Yes	103	56.28	51	27.87
No	80	43.72	132	72.13
Preeclampsia				
Yes	10	5.5	11	6
No	173	94.5	172	94
Antepartum hemorrhage				
Yes	28	15.3	12	6.5
No	155	84.7	171	93.5
Uterine rupture				
Yes	10	5.5	2	1.1
No	173	94.5	181	98.9
PROM				
Yes	24	13.1	9	4.9
No	159	86.9	174	95.1
Obstructed labour				
Yes	18	9.8	13	7.1

No	165	90.2	170	92.9

Table 3: Maternal medical, neonatal and organizational related factors of perinatal deaths (cases) and controls among deliveries in Tercha general hospital, SNNPS, 2014-2017.

Variables	Cases		Controls	
	№=183	%	№=183	%
HIV test status				
Reactive	4	2.19	1	0.55
None reactive	162	88.5	180	83.1
Unknown	17	9.29	2	1.09
VDRL test status				
None reactive	177	96.7	181	98.9
Unknown	6	3.28	2	1.09
Hepatitis B test status				
Reactive	1	0.55	2	1.09
None reactive	150	82	160	87.4
Unknown	32	17.5	21	11.5
Hemoglobin level				
<11gm/dl	43	23.5	16	8.74
>=11gm/dl	140	76.5	167	91.3
History of chronic illness				
Yes	31	16.9	14	7.65
No	152	83.1	169	92.3
Fetal presentation				
Vertex presentation	107	58.47	136	74.32
Mal presentation	76	41.53	47	25.68
Sex of newborn				
Male	82	44.81	98	53.55
Female	101	55.19	85	46.45
Wight of newborn				
<2500gm	78	42.62	55	30.05
>=2500gm	105	57.38	128	69.95
Congenital anomaly				
Yes	7	3.825	3	1.639

No	176	96.17	180	98.36

Table 4: Organizational related factors of perinatal deaths (cases) and controls among deliveries in Tercha general hospital, SNNPS, 2014-2017

Variables	Cases		Controls	
	№=183	%	№=183	%
Use of Partograph				
Yes	128	69.9	162	88.5
No	55	30.1	21	11.5
Use of child birth checklist				
Yes	102	55.7	138	75.4
No	81	44.3	45	24.6
Coming with referral				
Yes	72	39.3	28	15.3
No	111	60.7	155	84.7

Table 5: The association between different factors and perinatal mortality in Tercha General Hospital, SNNPS, 2014-2017

Categories	Perinatal Outcome		COR(95%CI)	AOR(95%CI)
	Case № (%) (№=183)	Control № (%) (№=183)		
Residence				
Rural	145(79.2)	106(57.9)	2.77(1.74,4.4)**	1.8(1.4,3.19)**
Urban	38 (20.8)	77(42.1)	1	1
Hemoglobin level				
<11gm/dl	43(23.5)	16(8.74)	3.2(1.73, 5.9)**	1.62(0.79,3.33)
>11gm/dl	140(76.5)	167(91.3)	1	1
History of chronic illness				
Yes	31(16.9)	14(7.65)	2.46(1.26,4.8)*	1.19(0.52,2.75)
No	152(83.1)	169(92.3)	1	1
Presentation				
Vertex	107(58.47)	136(74.32)	1	1
Mal presentation	76(41.53)	47(25.68)	2(1.32,3.3)**	1.23(0.67,2.26)
Wight of newborn				
<2500gm	78(42.62)	55(30.05)	1.73(1.12, 2.6)*	1.7(1.06, 2.9)**
>=2500gm	105(57.38)	128(69.95)	1	1
Use of partograph				
Yes	128(69.9)	162(88.5)	0.3(0.17,0.52)**	0.5(0.25,0.9)**
No	55(30.1)	21(11.5)	1	1
Use of childbirth checklist				
Yes	102(55.7)	138(75.4)	0.41(0.26,0.64)*	0.52(0.3,0.9)**
No	81(44.3)	45(24.6)	1	1
Coming with referral				
Yes	72(39.3)	28(15.3)	3.59(2.18,5.92)*	2.69(1.5,4.8)**
No	111(60.7)	155(84.7)	1	1
TT vaccination				
>=2 times	117(63.93)	143(78.14)	0.49(0.31,0.78)*	0.86(0.35,2.125)
<2 times	66(36.07)	40(21.86)	1	1
ANC Booking				

Yes	118(64.48)	146(79.78)	0.46(0.29,0.73)**	0.47(0.27,0.83)**
No	65(35.52)	37(20.22)	1	1
Mode of delivery				
SVD	122(66.67)	95(51.91)	1	1
Instrumental	31(16.94)	30(16.39)	1.24(0.7,2.9)	0.94(0.42,2.11)
C/S	58(31.69)	30(16.39)	2.24(1.48,4.15)*	1.059(0.47,2.35)
History of Previous perinatal mortality				
Yes	33(18.03)	17(9.29)	2.1(1.15,4.02)*	1.28(0.62,2.63)
No	150(81.97)	166(76.5)	1	1
Duration of labour				
<8hr	43(23.5)	86(46.99)	1	1
>=8hr	140(76.5)	97(53.01)	2.89(1.8,4.5)**	2.75(1.6,4.78)**
Obstetrics complication				
Yes	103(56.28)	51(27.87)	3.3(2.16, 5.15)**	2.2(1.28,3.62)**
No	80(43.72)	132(72.13)	1	1

Note: *p<0.25, **p<0.05 (Indicates statistically significant)