Determinants of intrapartum and very early neonatal death among mothers who gave birth atDessie comprehensive specialized Hospital, south wollo, Dessie, Ethiopia 2021

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Abstract
Introduction: Intrapartum stillbirth and intrapartum-related neonatal deaths fatalities occur in great numbers all throughout the world. Neonatal mortality is unacceptably high in under developed nations during the first week of life, with nearly half of all deaths happening within the first 24 hours.The majority of the burden (90 percent) falls on low and middle-income countries, with South Asia and Sub-Saharan Africa accounting for more than three quarters. Ethiopia has one of the highest perinatal mortality rates in the world, according to a World Health Organization research. As a result, the goal of this research was to find out what factors contributed to intrapartum and very early neonatal fatalities among mothers who gave birth at the Dessie referral hospital.
Methods: An institution-based case-control study was conducted from January 2021 to May 2021 in Dessie Referral Hospital. The data were collected using a pre-tested questionnaire from 315 participants (105 cases and 210 controls). The data were analyzed using SPSS binary logistic regressions. A P-value of less than 0.05 at 95% CI in the multivariable analysis was considered a statistically significant variable.
Result: Ninety (85.7%) cases were from outside of Dessie town and 80 (82.9%) Cases were married. Ninety nine (94.3%) cases and 196 (93.3%) controls were referred from nearby facilities. Referred from nearby health facility (AOR 3.40 95% CI: 1.07, 10.82), Residence of Dessie town (AOR = .38; 95% CI .17, .83), occupation (AOR = 2.41 95%CI: 1.33, 4.37) ,onset of labor (AOR= 2.90; 95% CI: 1.19, 7.05),mode of delivery (AOR = 7:30, 95% CI: 2.6, 20.54), gestational age (AOR = 3.42 95%CI: 1.51, 7.73), and birth weight (AOR = 2.45 95%CI: 1.25, 4.80) were significantly associated with Intrapartum and very early neonatal death.
Conclusion: Intrapartum and very early neonatal death were highly associated with uneducated mothers, Employed women, mothers referred from nearby health facility, initiation of labor by induction, delivery by cesarean section, gestational age less than 37 wks, and birth weight less than 2500gm.
Keywords: Intrapartum fetal death, very early neonatal death, Dessie Comprehensive specialized Hospital.

Introduction

Deaths within the first 24 hours of a particular time are referred to as intrapartum and very early neonatal death rates. fants born dead after 28 weeks of pregnancy without skin degeneration or maceration are known as intrapartum or fresh stillbirths. Intrapartum death is assumed to have occurred less than 12 hours before delivery and it excludes infants with severe, lethal congenital abnormalities[1].
Mortality rates in the perinatal stage aid in determining the pregnancy's fate. It is also one of the markers of the quality of a ntenatal and perinatal health care offered. The perinatal phase is the most vulnerable time of a person's life. The death rate is higher during this time than at any other time in life [2].
The availability and quality of healthcare for both the mother and the newborn are reflected in the perinatal death rate. For millions of families in low and middleincome nations , perinatal mortality remains one of the most devastating pregnancy outcomes[3].In a single year, about 8,000,000 perinatal deaths are documented worldwide. Around 40–60% of this perinatal mortality occurs within the first 7 days of life, and nearly two million infants die each year around the time of delivery. Developing countries account for nearly all of this death [1].
Annually, an estimated 1.02 million stillbirths and 0.9 million neonatal deaths are caused by intrapartum complications. Th e majority of the burden (90%) falls on low and middle-income countries, with South Asia and sub-Saharan Africa accounting for more than three quarters [4].
Africa was responsible for one-third of the world's neonatal mortality. Approximately 75% of deathsin this region happened within the first week of life, with over half occurring withinthe first 24 hrs. Sub-Saharan Africa has the highest neonatalmortality rate among (Sustainable Developmental Goals(SDG) areas, in 2017 at 27 deaths per 1000 live births [4, 5].
Every year nearly, 30 million women In Sub-Saharan Africa become pregnant. Around one million of those are stillbirths; at least one million babies die in their first month, and 0.5 million die on the first day. Approximately 4 million low-birth-weight babies and those with neonatal complications may survive, but many will not realize their full potential [6].
The newborn mortality rate is 29 deaths per 1,000 live births, according to the Ethiopian Demographic Health Survey(EDHS) 2016. In other words, one out of every every 35 children in Ethiopia dies within the first month of life.

Since 2000, there has been a significant decrease in childhood mortality. Neonatal mortality has decreased by 41% in the last 16 years,from 49 deaths per 1,000 live births in 2000 to 29 deaths per 1,000 births in 2016. Neonatal mortality, on other hand has not changed as much as postnatal and child mortality[7].

The perinatal mortality rate in the Amhara regional state was 55 per thousand in 2011, the second highest perinatal mortality rate in the country. According to WHO estimates of perinatal death at the country, regional, and global levels, Ethiopia ranks is among the top countries in the world in terms of perinatal mortality [8].

Because of the large frequency of intrapartum and neonatal mortality in Ethiopia known about the determinant factors. Therefore, this study was conducted to assess determinant factors among mothers who deliver at DCSH (Dessie comprehensive specialized hospital], Dessie, Ethiopia, which was an input for the governmental and non-governmental stakeholders and the researchers as a baseline study.

Materials and Method

Study setting and design

Health facility-based case-control study design was conducted from January / 2021 to June /2021 at DCSH that is located in South Wollo Zone, Amhara National Regional State, Ethiopia. The total population of Dessie town was 198,801 and it serves 2.4 million people.

Study Participants and Sample Size Determination

The source populations of this study were all women, who gave birth during the data collection period from the DCSH. The study population for the cases was all perinatal deaths (fresh stillbirth plus very early neonatal death on the first day of life) happening during the study period in the study area. The source population for controls was all neonates who survived the first days of life in the same period and area. Mothers who give birth out of the DCSH and come for postpartum care were excluded from the study.

The sample size for this study was calculated by using Epi-info V.3.5.5 by considering an unmatched case-control study design based on the following assumptions. Adequate antenatal care (ANC4+) visits during pregnancy were taken as an exposure variable for perinatal mortality. Based on this, the proportion of exposure among controls (i.e., the percentage of pregnant women not having adequate ANC visits among those who survived the early neonatal period) was assumed to be 2.8% with an odds ratio (OR) of 4.25. 9 A 95% level of confidence, 80% power, and a case to control the ratio of 1: 2 were also achieved [9]. Based on these assumptions, the final sample size became 315 births (105 cases and 210 controls). Similarly, all mothers (105) who lost their babies during the intrapartum period and newborns during the first day were included in the study as cases. The controls were 210 mothers who gave birth to a live baby who at least survived the first day after birth. The controls were randomly selected from the list of mothers with a known pregnancy outcome that was registered, forming the sampling frame.

Data collection tools, procedure, quality control, and analysis

The questionnaires were developed by reviewing the result of different studies. The questionnaire was prepared in English, then translated to the local language (Amharic), and then back-translated to English by a language expert**.** Three BSc midwives in the obstetrics ward and two BSc Nurses in the NICU ward were employed as data collectors. One MSc MPH expert was assigned as a supervisor. A supervisor and data collectors were trained on the objectives of the study, how to approach participants, and take informed consent.The tool was pre-tested on 5% of samples in Woldia General Hospital coming for the same service before entering the actual data collection. The necessary modification was done according to the result of the pretest. The data were also continuously checked by the supervisor and principal investigator. Data cleaning and cross-checking were done before analysis. The data were coded and entered into Epi-Data version 3.1 and exported to the SPSS version 20.0 software package for further analysis. Descriptive analysis results were presented in the form of tables, and text using frequencies and percentages. Bivariableregression analysis was employed and variables that have a P-value of 0.25 & less were exported to the multivariable regression analysis. Multivariable regression analysis was employed to identify factors associated with Intrapartum and very early neonatal death. Finally, variables that have a P-value below 0.05 in the multivariable analysis were considered as a statistically significant.

Result

Socio-demographic characteristics of Respondent among Cases and Controls at DCSH

A total of 105 cases and 210 controls participated in the study, with a response rate of 100.0%. The majority, 268 (85.1%), were in the age range of 20-34 years, 80 (82.9%) among cases, and 188 (89.5%) among controls. The Majority, 286 (85.1%) were married, 80 (82.9%) among Cases, and 188 (89.5%) were among controls. Forty-three (41.0%) cases and 129 (61.4%) controls had secondary and above educational status. About 55 (52.4%) cases and 121 (57.6%) controls were orthodox followers by religion. Most, 212 (67.3%), of the mothers were from outside of Dessie town, 90 (85.7%) among cases and 122 (58.1%) among controls. Regarding their occupational status, 45(42.9%) cases, and 140 (66.7%) controls were employed. The majority 291 (92.4%) of the participants earn greater than 2000 Ethiopian Birr (ETB) per month (Table 1).

table 1 socio-demographic characteristics of mothers, among cases and controls atDessie comprehensive specialized hospital, north-central Ethiopia, 2021.

Variables		Cases n=105	Controls n=210	Total n=315
		Count (%)	Count (%)	Count (%)
Age	Less than 20	2 (1.9)	5 (2.4)	7(0.9%)
	From 20-34	80 (82.9)	188 (89.5)	268(85.1)
	More than 35	16 (15.2)	17 (8.1)	33(10.5)
Marital status	Married	94 (89.5)	192 (91.4)	286 (90.8)
	Unmarried	11 (10.5)	18 (8.6)	29(9.2)
Educational status	Unable to read and write	17 (16.2)	6 (2.9)	23(7.3)
	Elementary	45 (42.9)	75 (35.7)	120(38.1)
	Secondary and above	43 (41.0)	129 (61.4)	172(54.6)
Religion	Orthodox	55 (52.4)	121 (57.6)	176(55.9)
	Muslim	48 (45.7)	85 (40.5)	133(42.2)
	Others	2 (1.9)	4 (1.9)	6(1.9)
Ethnicity	Amhara	97 (92.4)	202 (96.2)	299(94.9)
	Others	8 (7.6)	8 (3.8)	16(5.1)
Occupation	Housewife	60 (57.1)	70 (33.3)	130(41.3)
	Employee	45 (42.9)	140 (66.7)	185(58.8)
Residence	Outside Dessie town	90 (85.7)	122 (58.1)	212(67.3)
	Dessie town	15 (14.3)	88 (41.9)	103(32.7)
Income	Less than 2000	11(10.5)	13 (6.2)	24(7.6)
	More than 2000	94 (89.5)	197 (93.8)	291(92.4)

Obstetrical characteristics of Respondent among Cases and Controls at DCSH

Most, 295 (93.7%), of the mothers had come witha referral, 99 (94.3%) among cases, and 196 (93.3%) among controls. The majority, 271 (86.0%), of their labor was initiated spontaneously, 75 (71.4%) among cases, and 196(93.3%) among controls. Seventy-one (67.6%) cases and 151 (71.9%) controls had an inter-pregnancy interval of fewer than 24 months. Ninety (85.7%) of cases and 142(67.6%) of controls were delivered spontaneously (Table 2).

table 2 obstetrical characteristics of respondent among cases and controls at Dessie comprehensive specialized hospital, north-central Ethiopia, 2021.

Variables		Cases (n=105)	Controls(n=210)	Total(n=315)
Come with a referral	Yes	99 (94.3)	196 (93.3)	295(93.7)
	No	6 (5.7)	14 (6.7)	20(6.3)
Onset of labor	Spontaneous	75 (71.4)	196 (93.3)	271(86.0)
	Induced	40 (28.6)	14 (6.7)	54(17.1)
Parity	Primipara	37 (35.2)	101(48.1)	138(43.8)
	Multipara	68 (64.8)	109(51.9)	177(56.2)
Interpregnancy interval	Less than 24 month	71 (67.6)	151(71.9)	222(70.5)
	More than 24 month	34 (32.4)	59 (28.1)	93(29.5)
Sexually transmitted infections	Yes	32(30.5)	50(23.8)	82(26.0)
	No	73(60.5)	160(76.2)	233(74)
Mode of delivery	SVD	90 (85.7)	142(67.6)	232(73.6)
	Operative vaginal delivery	8 (7.6)	18(8.6)	26(8.3)
	Cesarean section	7 (6.7)	50(23.8)	57(18.1)
Weight	<2500gm	44 (41.9)	45(21.4)	89(28.3)
	>2500gm	61 (58.1)	165(78.6)	226(71.7)

Factors associated with intrapartum and very early neonatal death Binary logistic analysis was done to assess the association between independent variables and the outcome variable. But after stepwise multivariable regression was made educational status, residence, occupation, comes with a referral, onset of labor, gestational age, mode of delivery, and weight were significantly associated with intrapartum and very early neonatal death (p-value <0.05).

Residence of Dessie town (AOR = .38; 95% CI .17, .83) was significantly associated with a reduction of intrapartum and very early neonatal death as compared with coming outside of Dessie town.

The risk of intrapartum and very early neonatal death was higher among women who were employed (AOR = 2.41 95%CI: 1.33, 4.37) than housewife women.

Mothers who were referred from nearby health facilities were 3.4 times more likely to develop intrapartum and very early neonatal death than women who come by themselves (AOR 3.40 95%CI: 1.07, 10.82).

Women who initiated labor by induction were nearly 3 times (AOR= 2.90; 95% CI: 1.19, 7.05) more likely to have intrapartum and very early neonatal death risk compared with their counterparts.
Women who delivered by cesarean section had more than seven times (AOR = 7:30, 95% CI: 2.6, 20.54) higher risk of intrapartum and very early neonatal death as compared with those who delivered by spontaneous vaginal delivery.
Women with a gestational age of fewer than 37 weeks (AOR = 3.42 95%CI: 1.51, 7.73) were 3.42 times more likely to have intrapartum and very early neonatal death than women who deliver after 37 complete weeks of gestational age.
Women who deliver neonates with a weight less than 2500gm (AOR = 2.45 95%CI: 1.25, 4.80) were 2.45 times more likely to have intrapartum and very early neonatal death than their counterparts (Table 3).

table 3 determinants of intrapartum and very early neonatal death at DCSH, north-central Ethiopia, 2021.

Variables	Cases (n = 105), n(%)	Controls (n = 210), n (%)	Total (315)	COR(CI)	AOR(CI)	P-value
educational status						
unable to read and write	17(16.2)	6 (2.9)	23 (7.3)	8.5(3.15-22.93)	8.19(2.24-29.94)	.001
Elementary	45(42.9)	75 (35.7)	120 (57.1)	4.7(1.73-12.85)	8.08(2.16-29.90)	.002
secondary and above	43 (40.9)	129 (61.4)	172(54.6)	1	1	
Residence						
outside Dessie town	90 (85.7)	122 (57.5)	212(67.3)	4.32(2.34-7.97)	.38(.17-.83)	<.016
Dessie town	15 (14.3)	88 (58.1)	103(32.7)	1	1	
Occupation						
housewife	60 (57.1)	70 (33.3)	130(41.3)	1	1	
Employee	45 (40.9)	140 (66.6)	185(58.7)	2.66(1.64-4.31)	2.41(1.33-4.37)	.004
come with a referral						
Yes	99 (94.3)	169 (80.5)	268(85.1)	4.00(1.64-9.76)	3.40(1.07-10.82)	.038
No	6 (5.7)	41 (19.5)	47(14.9)	1	1	
chronic disease						
Yes	17 (16.2)	18 (8.6)	35(11.1)	2.06(1.01-4.18)	2.39(.99-5.81)	.053
No	88 (83.8)	192 (91.4)	280(88.9)	1	1	
Parity						
Primipara	37 (35.2)	101 (48.1)	138(43.8)	1.70(1.05-2.76)	1.66(.90-3.06)	.10
Multipara	68 (64.8)	109 (51.9)	177(56.2)	1	1	
onset of labor						
Induced	30 (28.6)	14 (6.7)	44(14)	5.6(2.81-11.14)	2.9(1.19-7.05)	.019
Spontaneous	75 (71.4)	196 (93.3)	271(86)	1	1	
gestational age						
less than 37 wks	25 (23.8)	14 (6.7)	39(12.4)	4.37(2.16-8.84)	3.42(1.51-7.73)	.003
More than 37wks	80 (76.2)	196 (93.3)	276(87.6)	1	1	
Mode of delivery						
SVD	90(85.7)	142(67.6)	232(73.7)	1	1	
Assisted instrumental vaginal delivery	8(7.6)	18(8.6)	26(8.3)	1.4(.59-3.41)	2.44(.87-6.78)	.087
Cesarean section	7(6.7)	50(23.8)	57(18.1)	4.5(1.96-10.42)	7.3(2.6-20.54)	<0001
Weight of the newborn						
<2500gm	44(41.9)	45(21.4)	89(28.3)	2.64(1.59-4.39)	2.45(1.25-4.80)	.009
>2500gm	61(58.1)	165(78.6)	226(71.1)	1	1	

Discussion

According to the analysis educational status, residence, occupation, referred mothers from nearby health facilities, the onset of labor, gestational age, mode of delivery, and weight was significantly associated with intrapartum and very early neonatal death.

Educational status

This study indicated that the educational status of being unable to read and write and elementary is a risk factor for the development of intrapartum and very early neonatal death. A similar result was shown in a study done in Kenya in2007, Tanzania in 2006, in rural areas of Bangladesh,North Gondar Zone,the Marondera District, East of Zimbabwe, and the Tigray region of Ethiopia[10-15].Thus supporting therole of maternal education in reducing intrapartum and very early neonatal death.

Gestational age

This study showed a significant association between gestational age [<37 weeks] and the occurrence of intrapartum and very early neonatal death. This is in agreement with studies done at WolaitaSoddo referral hospital, Southern Ethiopia, Ayder Comprehensive Specialized Hospital, Northern Ethiopia, at the Marondera District, East of Zimbabwe,Jimma University Specialized Hospital, South West Ethiopia,and rural northern Ethiopia [12, 15-18]. This might be due to preterm birth is related with their anatomical structure immaturity and physiological adjustment of all the systems of the newborn which may increase the perinatal mortality risk. Respiratory system immaturity, respiratory distress syndrome (RDS), and susceptibility to certain infections due to the undeveloped immune system are the most common causes of preterm death.

Weight

In this study, it was found that birth weight [<2,500 gm.] was significantly associated with intrapartum and very early neonatal death. This result shows consistency with a study conducted atWolaitaSoddo referral hospital, Southern Ethiopia, at Jimma University medical center, South West Ethiopia, Public Hospitalsin Gamo Zone, and Jimma University Medical Center, Jimma, South West Ethiopia.Babies with low birth weight are vulnerable to the risk of death, especially early death, besides health problems, in comparison to newborns with adequate weight [16, 17, 19, 20].

Mode of delivery

Neonates who were delivered by assisted instrumental delivery and cesarean section had a significant association with intrapartum and very early neonatal death. This study finding is consistent with the study conducted by Public Hospitalsin Gamo Zone [19]. This might be due to the reason that a cesarean section is recommended to perform if the mother develops obstetric complications. In addition, this might be because instrumental delivery causing birth trauma leads to asphyxia. Instrumental deliveries may affect different locations of cranial hemorrhage; subdural, subarachnoid, intra-parenchyma or intra-ventricular due to exerting pressure of a vacuum and forceps extractors can cause brain bleeds on the cranium contributing to intracranial hemorrhage resulting birth asphyxia, bleeding diathesis, infection, and vascular anomalies.

Residency.

Regarding residency coming from outside of Dessie town was` associated with increased risk of intrapartum and very early neonatal death. This result is consistent with studies done at Jimma University medical center and in the Marondera District, East of Zimbabwe [15, 20],reported the association between place of residency and neonatal mortality. This may be related to delay in deciding to seek care and delay in reaching care due to the availability of and cost of transportation which would affect the on-time arrival of laboring mothers to the hospitals and lack of pre-hospital emergency care. Since most mothers and newborns are referred to the center after they had already developed complications, this could contribute significantly to the loss of life during neonatal periods.

Referred mothers from nearby health facility

This study showed a significant association between mothers who referred from nearby health facility and intrapartum and very early neonatal death. This might be due to the health institution-related factors, sub-optimal obstetric care during antepartum, intrapartum, postpartum period, and delayed visits of the client toward the health institution. Most commonly, laboring mothers who visit hospitals were referred from the nearby primary health care facilities for better care. This referral system may take a certain time until reaching the hospital, which increases the delay before reaching a hospital.

Limitation

The sample size is relatively small.

Due to the lack of literature on this topic, the discussion part is compared with works of literature done on perinatal and neonatal death.

Abbreviation

AOR, Adjusted Odds Ratio, CI, Confidence Interval; COR, Crude Odds Ratio; DCSH; Dessie Comprehensive Specialized Hospital, NICU, Neonatal Intensive Care Unit; OR, Odds Ratio; SDG, Sustainable Developmental Goals; SVD, Spontaneous Vaginal Delivery; WHO, World Health Organization

Data sharing statement

All data and material are available within the manuscript.

Ethics Approval and Consent to Participate

This study was conducted following the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board (IRB) Wollo University, with protocol number CMHS/34/13/13 Official letters were submitted to the DCSH. Written informed consent was obtained from each study participant before running the study. Participants were informed that they had the full right to withdraw from the study at any time without justifying their reason. The results of the study participants were kept confidential.

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Author Contributions
AW: Developed design, performed the statistical analysis and sequence alignment, and drafted the manuscript.
TD: Participated in Design development, performed the statistical analysis and participated in drafting the manuscript. ,
AS: participated in the development of design, statistical analysis, and manuscript draft development, all these authors read and approved the final manuscript. Funding we did not receive any grants from a funding agency.
Disclosure
The authors report no conflicts of interest for this work

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