

Analysis of Determinants of Neonatal Mortality in Afar and Somalia Regions, Ethiopia

Abstract

Background: Children face the highest risk of dying in their first month of life. Ethiopia is one of the sub-Saharan countries with highest newborn deaths. Afar and Somalia regions in Ethiopia are among the regions with high death rates of newborn children. This study aimed to analyse and identify determinants of neonatal mortality in Afar and Somalia regions, Ethiopia.

Methods: This study used 2016 Ethiopian Demographic and Health Survey data for the analysis. The multivariable logistic regression model was used to identify the significant determinants of neonatal mortality. Adjusted odds ratio with a 95% confidence interval and p-value < 0.05 in the multivariable logistic regression model was reported to declare the statistical significance and strength of association between neonatal mortality and determinants.

Results: A total of 2567 newborn children were included in this study. Mortality rate among newborns in the first month was 41 per 1000 live births in Afar and Somalia regions. Health facility delivery (AOR: 0.634; 95% CI: 0.409–0.982), being female (AOR: 0.206; 95% CI: 0.073–0.528), multiple births (AOR: 3.958; 95% CI: 2.293–11.208), small size at birth (AOR: 1.208; 95% CI: 1.003–1.728), secondary and above educational level of mothers (AOR: 0.484; 95% CI: 0.294–0.797) were statistically significant determinants neonatal mortality.

Conclusions: In this study, sex of child, place of delivery, birth type, size at birth, mother's educational level were found to be statistically significant determinants of neonatal death in Afar and Somalia regions, Ethiopia. Mothers with no education should be given health education and institutional delivery should be encouraged to improve the survival of the neonates in Afar and Somalia regions, Ethiopia.

Key words: Neonatal mortality, Afar and Somalia Regions, Ethiopia

Introduction

Neonatal mortality is defined as the death of a live-born infant within the first 28 days of life [1]. Children face the highest risk of dying in their first month of life, at a rate of 19 deaths per 1,000 live births globally [2].

Globally, 2.6 million new-borns died in 2016- approximately 7000 neonate deaths every day. Neonatal deaths accounted for 46 percent of all under-five deaths, increasing from 41 percent in 2000. The largest number of new-born deaths occurred in Southern Asia (39 percent), followed by sub-Saharan Africa (38 percent). Five countries accounted for half of all new-born deaths: India, Pakistan, Nigeria, the Democratic Republic of the Congo and Ethiopia [2].

In 2020 **alone**, globally, 2.4 million children died in the first month of life – approximately 6,500 neonatal deaths every day – with about a third of all neonatal deaths occurring within the first day after birth, and close to three-quarters occurring within the first week of life [<https://data.unicef.org/topic/child-survival/neonatal-mortality/>].

Annually, 1.12 million newborn deaths occur in **World Health Organization (WHO)** African Region. Main causes for this include prematurity and low-birth weight, lack of oxygen at birth, infections, and birth trauma [3]. In sub-Saharan Africa, the neonates face challenges in a diversity of lethal clinical conditions that seek serious interventions [4]. **World Health Organization (WHO)** and **United Nations Children's Fund (UNICEF)** recommend home visits by skilled health workers during a baby's first week of life to improve newborn survival [3].

According to 2016 Ethiopian Demographic Health Survey (2016 EDHS), neonatal mortality declined from 49 deaths per 1,000 live births in 2000 to 29 deaths per 1,000 births in 2016, a reduction of 41% over the past 16 years. However, there are some regions where still the neonatal mortality rate is high [5].

According to prior studies, neonatal mortality is determined by factors like **sex of child, birth type, size of child at birth, birth weight, child's birth order, preceding birth interval, region, place of residence, number of Antenatal(ANC) visit of mother during pregnancy, number of Postnatal Care (PNC) visit of mother, place of delivery, mode of delivery, age of mother, educational level of mother, educational level of father, religion of mother, family size, household wealth index, parity, maternal anaemia, and marital status of mother** [6-22].

Reduction in neonatal mortality rates were observed among all regions of Ethiopia except Afar and Somalia regions over the past five years. In Afar and Somalia regions, in 2011, the neonatal mortality rates were 33 deaths per 1000 births and 34 deaths per 1000 births respectively [23], and increased to 38 deaths per 1000 births and 41 deaths per 1000 births respectively in 2016 [5]. Moreover, Afar and Somalia regions are among the regions with high neonatal mortality rates in Ethiopia [5]. Neonatal mortality is a core indicator of neonatal health and wellbeing [1]. Hence, identifying the determinants of neonatal mortality is important to design intervention programmes which can increase the neonatal survival. Therefore, this study aimed to analyse and identify the determinants of neonatal mortality in Afar and Somalia regions based on the evidence from the 2016 Ethiopian Demographic and Health Survey.

Methods

Data source

The study used 2016 Ethiopia Demographic and Health Survey (EDHS) data which were collected from January 18, 2016 to June 27, 2016. The 2016 EDHS data is openly available from the measure DHS website (<https://dhsprogram.com>). The survey was implemented by the Central Statistical Agency (CSA) at the request of the Federal Ministry of Health. The primary objective of the 2016 EDHS was to provide up to date estimates of key demographic and health indicators.

Variables of the study

The response variable of this study was neonatal mortality. It is coded as 1 if the liveborn neonate died within 28 days of life and 0 if the newborn alive in the first month of life). The independent variables included in this study were sex of child, birth type, size of child at birth, birth order, place of residence, place of delivery, mode of delivery, age of mother, educational level of mother, marital status, maternal anaemia, religion, parity and household wealth index

Statistical data analysis

The data were analysed using SPSS version 25. The background characteristics of the respondents were described using frequency and percent. Both bivariate logistic regression and multivariable logistic regression analyses were conducted. Those variables found to be significant ($p < 0.05$) in bivariate logistic regression analysis were considered in the multivariable logistic regression analysis. Adjusted Odds Ratio with a 95% confidence interval in the multivariable logistic regression analysis was reported to declare the statistical significance and strength of association between neonatal mortality and determinants. The goodness of fit test was done using the Hosmer-lemeshow test. The multi-collinearity was checked using the variance inflation factor.

Results

A total of 2567 neonates were included in this study. Among 2567 neonates included in the study, 105 died in the first month of the life, which indicates 41 deaths per 1000 live births. Out of the total neonates included in the study, 1373(53.5%) of them were males. More than four-fifth (2182 (85.0%)) of them were born at home. Majority 2555 (99.5%) of them were born vaginally. 2507(97.7%) of them were singletons. 949 (37.0%) of them had size of below average at birth. Regarding birth order, 1048 (40.8%) of them had birth order of second to fourth. More than half (1615 (62.9%)) of them were born to families where the total number of ever born children were four or more. About half (1296 (50.5%)) of them were born to mothers who aged 25-34 years. Majority (2172 (84.6%)) of them were born to mothers living in rural areas. More than four-fifth (2193(85.4%)) of them were born to mothers with no education. 2446 (95.3%) of them were born to mothers who were married or living together with partners. More than nine-tenth (2521 (98.2)) of them were born to Muslim mothers. More than three-fourth (2082 (81.1%)) of mothers were with wealth index of poor (Table 1).

Table 1. Background characteristics of mothers and neonates in Afar and Somalia regions, Ethiopia

Sex of child	Frequency	Percent
Male	1373	53.5
Female	1194	46.5
Place of delivery		
Home	2182	85.0
Health facility	385	15.0
Mode of delivery		
Vaginal	2555	99.5

Caesarean	12	0.5
Birth type		
single	2507	97.7
Multiple	60	2.3
Size of child at birth		
Large	650	25.3
Average	968	37.7
Small	949	37.0
Birth order		
1	454	17.7
2-4	1048	40.8
5+	1065	41.5
Parity		
1	245	9.5
2-3	707	27.5
4+	1615	62.9
Age of mother		
15-24	725	28.2
25-34	1296	50.5
35+	546	21.3
Place of residence		
Urban	395	15.4
Rural	2172	84.6
Educational level of mother		
No education	2193	85.4
Primary	289	11.3
Secondary/higher	85	3.3
Anaemia status of mother		
Anaemic	1798	70.0
Non anaemic	769	30.0
Marital status		
Married/living together with partner		
Widowed/divorced/ separated		
Religion		
Orthodox	27	1.1
Catholic	5	0.2
Protestant	12	0.5
Muslim	2521	98.2
Traditional	2	0.1
Household wealth index		
Poor	2082	81.1
Middle	102	4.0
Rich	383	14.9

In this study, 60(4.4%) neonatal mortalities occurred among males. 92(4.2) neonatal mortalities occurred among neonates born at home. 8.3% of neonatal mortalities occurred among neonates delivered by caesarean. 11(18.3%) neonatal mortalities occurred among neonates with multiple births. 77(8%) neonatal mortalities occurred among neonates with size of average and below at birth. 26(5.7%) neonatal mortalities occurred among those whose birth order was first. 13(5.3%) neonatal mortalities occurred among those who born to the mothers with parity of one. 33(6.0%) neonatal mortalities occurred among those who born to the mothers aged 35 and above years. 98(4.5%) neonatal mortalities occurred among neonates residing in rural areas. 14(4.8%) neonatal mortalities occurred among neonates born to mothers with primary education. 98 (4.0%) neonatal mortalities occurred among neonates born to mothers who were married or living together with partners. 104 (4.1%) neonatal mortalities occurred among neonates born to Muslim mothers. 92(4.4%) neonatal mortalities occurred among neonates from poor families (Table 2).

Bivariate analysis revealed that sex of child, birth type, birth order, size at birth, educational level of mother, place of delivery and household wealth were associated with neonatal mortality. Multivariate logistic regression analysis revealed that sex of child, place of delivery, birth type, size at birth, and educational level of mother were significantly associated with neonatal mortality (Table 2).

The odds of neonatal death among females was lower than males (AOR: 0.206; 95% CI: 0.073–0.528). Neonates born at health facilities were 0.634 times less likely to die than those born at home (AOR: 0.634; 95% CI: 0.409–0.982). Neonates of multiple births were 3.958 times more likely to die than Neonates of single births (AOR: 3.958; 95% CI: 2.293–11.208). Neonates with small size at birth were 1.208 times more likely to die than those with large size at birth (AOR: 1.208; 95% CI: 1.003–1.728). Neonates born to mothers who had secondary and above education were 0.484 times less likely to die than those who were born to mothers with no formal education (AOR: 0.484; 95% CI: 0.294–0.797) (Table 2).

Table 2. Factors associated with neonatal mortality in Afar and Somalia regions, Ethiopia

Variable	Died within first month of life		COR (95% CI)	AOR (95% CI)	P-value of AOR
	Yes(%)	No(%)			
Sex of child					
Male	60(4.4)	1313(95.6)	Ref	Ref	
Female	45(3.8)	1149(96.2)	0.357(0.114, 0.790)	0.206(0.073, 0.528)	0.023
Place of delivery					
Home	92(4.2)	2090(95.8)	Ref	Ref	
Health facility	13(3.4)	372(96.6)	0.523(0.303, 0.805)	0.634(0.409, 0.982)	0.040
Mode of delivery					
Vaginal	104(4.1%)	2451(95.9)	Ref		
Caesarean	1(8.3)	11(91.7)	1.440(0.956, 2.176)		
Birth type					
single	94(3.7)	2413(96.3)	Ref	Ref	
Multiple	11(18.3)	49(81.7)	2.707(1.236, 10.064)	3.958(2.293, 1.208)	0.000
Size of child at birth					
Large	28(4.3)	622(95.7)	Ref	Ref	

Average	42(4.3)	926(95.7)	1.760(0.997, 2.912)	1.035(0.839, 1.994)	0.083
Small	35(3.7)	914(96.3)	1.614(1.483, 1.829)	1.208(1.003, 1.728)	0.009
Birth order					
1	26(5.7)	428(94.3)	Ref	Ref	
2-4	31(3.0)	1017(97.0)	0.642(0.433, 0.952)	0.884(0.729, 1.208)	0.829
5+	48(4.5)	1017(95.5)	0.701(0.497, 0.924)	0.526(0.394, 1.826)	0.305
Parity					
1	13(5.3)	232(94.7)	Ref		
2-3	24(3.4)	683(96.6)	0.615(0.342, 1.07)		
4+	68(4.2)	1547(95.8)	0.817(0.488, 1.367)		
Age of mother					
15-24	35(4.8)	690(95.2)	Ref		
25-34	37(2.9)	1259(97.1)	1.051(0.627, 1.761)		
35+	33(6.0)	513(94.0)	0.795(0.289, 2.185)		
Place of residence					
Urban	7(1.8)	388 (98.2)	Ref		
Rural	98(4.5)	2074 (95.5)	1.071(0.839,1.407)		
Educational level of mother					
No education	88 (4.0)	2105 (96.0)	Ref	Ref	
Primary	14(4.8)	275 (95.2)	0.630(0.422,0.939)	0.528(0.395, 1.829)	0.153
Secondary/higher	3(3.5)	82(96.5)	0.440(0.389, 0.752)	0.484(0.294,0.797)	0.004
Anaemia status of mother					
Anaemic	90(5.0)	1708 (95.0)	Ref		
Non anaemic	15(2.0)	754(98.0)	0.759(0.411, 1.906)		
Marital status					
Married/living together with partner	98 (4.0)	2348 (96.0)	Ref		
Widowed/divorced/separated	7(5.8)	114 (94.2)	1.342(0.672, 2.680)		
Religion					
Orthodox	1(3.7)	26 (96.3)	Ref		
Catholic	0(0.0)	5(100.0)	0.121(0.088, 1.250)		
Protestant	0(0.0)	12(100.0)	0.362(0.171, 1.234)		
Muslim	104 (4.1)	2417 (95.9)	1.682(0.230, 12.319)		
Traditional	0(0.0)	2(100.0)	0.068(0.042, 0.150)		
Household wealth index					
Poor	92(4.4)	1990 (95.6)	Ref	Ref	
Middle	4(3.9)	98(96.1)	0.454(0.248, 0.867)	0.732(0.618, 1.407)	0.827
Rich	9(2.3)	374 (97.7)	0.564(0.323, 0.987)	0.890(0.457,2.142)	0.539

COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, CI= Confidence interval, Ref= Reference category

Discussion

Ethiopia is a country among the five countries that accounted for half of all new-born deaths in the world [2]. Afar and Somalia regions are the regions among with high neonatal mortality in Ethiopia [5]. A total of 2567 newborn children were included in this study. Of

the total, 105 died in the first month of the life, which shows that the neonatal mortality rate in Afar and Somalia regions was 41 per 1000 live births. This result is consistent with result of prior study [17]. However, it is higher than the results of the studies [12, 24, 29]. This could be due to that Afar and Somalia regions of Ethiopia are underdeveloped regions where maternal and child health care services are relatively low compared to other regions of Ethiopia.

This study found that sex of child, birth type, size at birth, place of delivery and educational level of mother were statistically significant determinants of neonatal mortality.

Female neonates were less likely to die than male neonates. This is consistent with studies [13, 16, 19, 20, 22, 24]. This might be due to the fact that males being biologically weaker and more susceptible to diseases and mortality than the females.

Neonates born to mothers who attained secondary education and above were less likely to die than neonate born to mothers who did not have formal education. This result is consistent with studies [7, 16, 20, 22, 25-28]. This could be due to that educated mothers may more attend ANC and PNC, and deliver at health facilities compared to uneducated mothers.

Neonates with small size at birth were more likely to die than neonates with large size at birth. This is consistent with studies [25, 28, 29]. Multiple births were more likely to die in the first month of birth than singletons. This is consistent with studies [6, 13, 20, 22, 25]. Neonates born at health facilities were less likely to die than neonates born at home. This is consistent with the studies [25, 29, 30]. This could be due to that mothers who give birth at health facilities may be given health information regarding the care of the child.

Conclusion

The aim of this study was to analyse and identify determinants of neonatal mortality in Afar and Somalia regions, Ethiopia. Neonatal mortality was significantly associated with sex of child, birth type, size at birth, place of delivery and educational level of mother in Afar and Somalia regions, Ethiopia. Mothers with no education should be given health education and institutional delivery should be encouraged to improve the survival of the neonates in Afar and Somalia regions, Ethiopia.

Limitation

In this study, some of important factors like number of ANC visits during pregnancy, preceding birth interval, and others were not included in the analysis due to high missing values in the secondary data used for this study.

ABERRATIONS

ANC: Antenatal Care

AOR: Adjusted odds ratio

CSA: Central Statistical Agency

DHS: Demographic and Health Survey

EDHS: Ethiopian Demographic and Health Survey

PNC: Postnatal Care

UNICEF: United Nations Children's Fund

WHO: World Health Organization

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

As this study used publicly available Secondary data, the ethical approval was not necessary.

CONSENT FOR PUBLICATION

It is not applicable.

AVAILABILITY OF DATA

Data used for the analysis of this study are available from corresponding author upon reasonable request.

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This study did not receive any fund.

COMPETING INTERESTS

Authors declare that they have no competing interests

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