

Mortality among neonates admitted to Hawassa University comprehensive and specialized hospital, Hawassa, Southern Ethiopia.

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Abstract

Background Neonatal mortality is defined as all deaths occurring before the 28th day of life. Neonatal death less than 7 days in Ethiopia reduced much slower than under 5 mortality recently. The objective of the study was to identify proportion of neonatal mortality and associated factors among neonates admitted to neonatal intensive care unit over the past five years.

Methods Cross sectional study design with retrospective chart review was applied. Data entry was handled with EpiData 3.1 and exported to SPSS 22 for analysis. Bivariate and multivariate logistic regression analysis were applied to test factors associated with neonatal mortality.

Results From the admitted neonates, 34.2% (111) deaths were recorded in the hospital. Neonatal sepsis was the leading diagnosis (36.9%) on admission. Neonates who born to mothers who had previous history of abortion [P=0.003, AOR=4.227, 95%CI: 1.653, 10.810] had almost 4 times more probability of death than those born to mothers whose previous pregnancy outcome was life birth.

Conclusions Prevalence of neonatal mortality over the past five years was 34.2%. Previous pregnancy outcome, birth weight and 5th minute APGAR score had significant statistical association with neonatal mortality.

Background

Neonatal mortality is defined as all deaths occurring before the 28th day of life. This could be further subdivided into early (occurring before the seventh day of life) or late neonatal mortality (occurring after the seventh day). This subdivision is important since the causes of early and late neonatal mortality are distinct [1]. A country's level of neonatal mortality indirectly verifies whether the health system is functioning well, health institutions are well organized & equipped or there are competent providers [2].

Globally, the average neonatal mortality rate has fallen by more than a quarter over 20 years from 33.2 to 23.9 per 1,000 live births. However, reduction in neonatal mortality rate was slower in Africa [3].

Neonatal mortality accounts for approximately 40% of all childhood mortality in resource poor countries [4]. Fifty percent of neonatal deaths worldwide occur in just five countries: Nigeria, Congo, Ethiopia, Tanzania and Uganda [5]. In Uganda, Neonatal mortality was inversely proportional to birth weight and gestational age. [6].

According to 2016 EDHS report, the neonatal mortality rate (NMR) was 29/1000 live births, which has not revealed significant reduction from the 2000 EDHS report [7]. Still to the recent, neonatal death less than 7 days in Ethiopia, one of the highest in the world, reduced much slower than under five mortality [8]. As evidence indicated, the proportion of early and late neonatal death is 79% and 21% respectively. From these, 41% is died within 24 hours in Ethiopia [9]. In Gondar University hospital, death accounts for 23.1% from the final outcomes of the admitted neonates. The leading contributing factors for neonatal deaths

were home delivery, birth asphyxia, preterm delivery, neonatal Sepsis, meningitis, seizure and tetanus which are similar in other findings from other Sub-Saharan African countries [10]. In Jimma zone, Southwest Ethiopia, those born to mothers who had 1–3 ANC visits and 4 or more visits less likely died during neonatal period than those whose mothers had no ANC visit at all. Home birth, Preterm birth, and prolonged rupture of membrane had also increased the likelihood of neonatal death [11].

Maternal health status before and during pregnancy is a key predictor neonatal mortality, however, avoiding problems regarding on knowledge about common factors associated with neonatal mortality become essential existing gap [12, 13]. Neonatal mortality was also influenced by potential factors like: marital status of the mother, parity, birth weight, gestational age at birth, labor complications and previous unfavorable outcomes like still birth and neonatal deaths [14, 15]. The risk of death was increased with male sex and decreased when the neonate is born to those mother who taken at least two doses of tetanus toxoid vaccination [16]. As review of past studies evidenced, neonatal mortality was also associated with demographic factors including maternal age at birth, and obstetric factors such as birth order with intervals, birth weight, mode of delivery and delivery assistance [17–19].

Methods

Aim of the study

The study aimed to assess proportion of neonatal mortality and associated factors among neonates admitted to neonatal intensive care unit over 2013 –2017 at Hawassa University comprehensive and specialized hospital, Southern Ethiopia.

Study design and sampling

Institutional based cross sectional study design was applied to conduct the study. This study was conducted in Hawassa University Comprehensive Specialized Hospital NICU. Sample size was calculated with single population proportion formula and yielded 325. Medical charts (records) of neonates were selected using systematic sampling technique from the admission log book of neonatal intensive care unit (NICU) among neonates admitted from 1st January 2013 to 31st December 2017 to Hawassa University comprehensive and specialized hospital.

Data Management and Analysis

Data was collected using structured checklists. Data entry was handled with EpiData 3.1 and exported to SPSS 22 for analysis. Descriptive analysis was done to describe frequency of the variables. Bivariate and multivariable logistic regression analysis were done to identify significant association between neonatal death and independent variables. Using pretested structured checklist, providing training for data

collectors, daily supervision of data collection, checking completeness of the collected data and data cleaning were the main activities undertaken to ensure data quality.

Results

A total of 325 medical records were reviewed and all of them were analyzed. Among neonates admitted to neonatal intensive care unit (NICU) over 2013 to 2017, 34.2% (111) deaths were recorded.

Socio-demographic characteristics

Majority (59.7%) of the neonates admitted to NICU over the five years were male. The mean age of the neonates in days was 6 (+6.694 SD). The mean age of the neonates' mothers was 27.21 years (+4.982 SD) (*Table 1*).

Two hundred thirty nine (73.5%) of the mothers were multipara and 26.5% (86) were primipara. The report indicated as 7.4% (24) of the mothers had history of urinary tract infection (UTI) during their current pregnancy. Majority (87.7%) of the mothers had history of ANC and 12.3% (40) had no ANC for the current pregnancy. Similarly, the largest share (87.1%) of the mothers had history of immunization for tetanus toxoid. Almost all (95.1%) mothers had no history of fever attack during the recent pregnancy. Majority (72.9%) of the mothers gave the current birth through spontaneous vaginal delivery (SVD) (*Figure 1*).

More than half of the mothers (57.8%) gave birth in hospital followed by health center (31.1%), home (10.2%) and clinics (0.9%). Two hundred seventy (83.1%) of them had history of hypertension and only 0.6% (2) had history of malarial infection during pregnancy. Life birth was the leading (57.2%) immediate previous pregnancy outcome followed by still birth (8.3%) (*Figure 2*).

The mean birth weight of the neonates was 2591.78 grams (+788.51 SD) whereas 36.54 weeks (+3.339 SD) was the average gestational age on birth. The mean of the first minute APGAR score was 3.93 (+2.39 SD) and that of the fifth minute was 4.99 (+2.96SD). From the total neonates, 9.2% (30), 64.9% (211) and 25.8% (84) had normal, moderate and low APGAR score on the first minute. On the other hand, 33.2% (108), 43.1% (140) and 23.7% (77) had normal, moderate and low APGAR score on the fifth minute respectively. Majority (49.5%) of the neonates were term birth followed by preterm birth (40.6%) (*Figure 3*).

Majority of the neonates (56.9%) had normal birth weight followed by low birth weight (32.9%), very low birth weight (5.8%), macrosomia (3.7%) and extremely low birth weight (0.6%). More than half (70.5%) of the neonates were in early neonatal period on admission. Neonatal sepsis was the leading diagnosis (36.9%) on admission. The other diagnoses on admission were: low birth weight (21.8%), birth asphyxia (11.4%), congenital anomalies (8.3%), prematurity (4.6%) and others (16.9%) like hyperbilirubinemia, neonatal meningitis, hypoglycemia etc.

The most commonly given antibiotic as component of treatment after admission was ampicillin with gentamycin (72.6%). This is followed by ceftriaxone (16.6%), Cloxacillin (1.6%) and others (8.9%) such as Vancomycin, Ceftazidime, Azitromycin etc. Intranasal oxygen was administered for the majority (84.6%) of admitted neonates. The commonly reported immediate causes of death were sepsis, prematurity, respiratory failure, cardiac arrest and birth asphyxia.

Factors associated with neonatal mortality

In bivariate analysis, age of the neonate, previous pregnancy outcome, maternal history of hypertension during pregnancy, diagnoses on admission, birth weight and 5th minute APGAR score were significantly associated with neonatal mortality. However, age of the neonate, maternal history of hypertension during pregnancy and diagnosis on admission turned insignificant in multivariate analysis (*Table 2*).

Neonates who born to mothers who had history of previous pregnancy outcomes such as abortion and death after delivery had almost 4 [$P = 0.003$, AOR = 4.227, 95%CI: 1.653, 10.810] and 12 times [$P = 0.004$, AOR = 12.250, 95%CI: 2.230, 67.288] more probability of death than those born to mothers whose previous pregnancy outcome was life birth respectively. Neonates with very low birth weight had almost 25 more odds of death than neonates having normal birth weight [$P = 0.000$, AOR = 24.760, 95% CI: 4.859, 126.18]. In addition, those neonates who had moderate 5th minute APGAR score had approximately 3 times more probability of death than those who had normal APGAR score of the same minute [$P = 0.004$, AOR = 2.719, 95%CI: 1.368, 5.405].

Discussion

The prevalence of neonatal mortality in this study (34.2%) is higher than mortality Tanzanian tertiary referral hospital [20] and rural KwaZulu-Natal hospital in South Africa [21]. The reason behind of this variation may be the difference in study setting that these two hospitals might have advanced setting to give lifesaving care in neonatal unit than the current setting. The common diagnoses on admission, from which neonatal sepsis is the leading diagnosis in this study, are almost similar with admission diagnoses in Uganda [6] and referral hospital in Cameroon [22]. Similarly, the report from Gondar University hospital supports the current study. This verifies as neonatal sepsis, hypothermia, jaundice, hypoglycemia etc. need more attention in care (treatment) of neonates admitted to NICU. Moreover, the commonly reported immediate causes of death in the current study are in line with findings from different studies [10, 11]. From this, it can be thought that health professionals who care for the neonates admitted to NICU shall pay detail attention to neonates with neonatal sepsis, prematurity and birth asphyxia so as to decrease risk of death.

Sex of the neonate and maternal TT immunization status that had significant association with neonatal mortality in other studies [16, 23], had shown insignificant association in this study. Even though maternal TT immunization status can be risk for developing of neonatal tetanus; difference in sample

size, study population and the fact that almost all mothers in the current study are TT vaccinated can be the possible reasons for this variation. Unlike study in Jimma zone [11], history of ANC visits had no significant statistical association with neonatal mortality in the current study. Almost all mothers in the current study had ANC visits and this could be the possible reason for variation from that of study in Jimma zone. Previous unfavorable pregnancy outcomes like abortion and death after delivery that increased the likelihood of neonatal death in this study are supportable with report of different studies [24, 25]. Neonates with very low birth weight also had increased probability of death than neonates with normal birth weight in this study. This can be due to risk these very low birth neonates have to develop disorders like hypoglycemia, hypothermia and other medical complications which are the commonly reported causes of death in various studies including this study [10, 11, 14, and 15]. Moreover, the increased risk of death with low APGAR score and low birth weight is in line with report of various studies [10, 14–19].

Conclusion

Proportion of neonatal mortality among neonates admitted to NICU over the past five years was 34.2%. Neonatal sepsis, prematurity, respiratory failure, cardiac arrest and birth asphyxia were the commonly reported immediate causes of death. Previous pregnancy outcome, birth weight and 5th minute APGAR had significant statistical association with neonatal mortality.

List Of Abbreviations And Acronyms

ANC—Antenatal Care

AOR—Adjusted Odds ratio

APGAR—Appearance, Pulse, Grimace, Activity and Respiration score

CI—Confidence interval

EDHS—Ethiopian Demographic and Health survey

NICU—Neonatal intensive care unit

NMR—Neonatal mortality rate

SD—Standard deviation

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from Hawassa University College of medicine and health sciences institutional review board. Hawassa university school of nursing written permission request letter for the conduction of this study. Accordingly, Clinical and academic directorate of the hospital that taken letter of permission request wrote corresponding letter to NICU and medical record office after which medical chart (record) selection was undertaken with the assigned personnel to the end of respectful return of the chart. No personal identification data was misused and confidentiality was also respected.

Consent for publication

Not applicable

Availability of data and materials

All data generated or analyzed during this study are included in this published article

Competing interests

The authors had no personal or financial conflict of interest.

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Not applicable

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Authors' Contributions

All authors contributed to conception and design of the study, analysis and interpretation of data together. ATD mainly handled the manuscript preparation and the manuscript has been approved by all authors.

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Tables

Table1: Socio demographic features of the neonates and their mothers, April, 2018 (n=325)

Characteristics	FrequencyPercent (%)		
Age of neonate in days	≤7	229	70.5
	8-28	96	29.5
Sex of neonate	Male	194	59.7
	Female	131	40.3
Neonates' mothers age	≤18	11	3.4
	>18	314	96.6

Table 2: Multivariable analysis of factors associated with neonatal mortality, Hawassa University comprehensive and specialized hospital, April, 2018.

Characteristics	Neonatal death		P-value	AOR(95% C.I)
	Yes: # (%)	No: # (%)		
Age of the neonate on admission				
≤7 days	86 (77.5)	143 (66.8)	0.273	1.419(0.759, 2.656)
8-28 days *	25 (22.5)	71 (33.2)		1
Previous pregnancy outcome				
Still birth	12 (10.8)	15(7.0)	0.205	1.814 (0.722, 4.558)
Aborted	15 (13.5)	10 (4.7)	0.003**	4.227 (1.653, 10.810)
Died after delivery	10(9.0)	2 (0.9)	0.004**	12.250(2.230, 67.288)
Others*	23 (20.7)	52 (24.3)		1
Life birth	51 (45.9)	135 (63.1)	0.731	0.878 (0.418, 1.844)
History of hypertension during pregnancy				
Yes	27 (24.3)	28 (13.1)	0.074	1.872(0.941, 3.722)
No*	84 (75.7)	186 (86.9)		1
Diagnosis on admission				
Sepsis	29(26.1)	91 (42.5)	0.296	0.649 (0.288,1.462)
Birth asphyxia	12 (10.8)	25 (11.7)	0.854	1.10 (0.398, 3.042)
Low birth weight	35(31.5)	36 (16.8)	0.891	0.929 (0.326, 2.650)
Congenital anomaly	11 (9.9)	16 (7.5)	0.339	1.727 (0.564, 5.285)
Prematurity	9 (8.1)	6 (2.8)	0.504	1.608 (0.399, 6.478)
Others*	15 (13.5)	40 (18.7)		1
Birth weight				
Extremely LBW	2 (1.8)	0 (0.0)	0.999	54805 (0.0000, ...)
Very low birth weight	17 (15.3)	2 (0.9)	0.000**	24.760 (4.859, 126.18)

Low birth weight	47 (42.3)	60 (28.0)	0.158	1.759 (0.804, 3.851)
Macrosomia	41 (36.9)	144 (67.3)	0.112	3.063 (0.770, 12.184)
Normal birth weight *	4 (3.6)	8 (3.7)		1
5th minute APGAR score				
Low APGAR score	28 (25.2)	49 (22.9)	0.125	1.852 (0.842, 4.070)
Moderate APGAR score	63 (56.8)	77 (36.0)	0.004**	2.719 (1.368, 5.405)
Normal APGAR score*	20 (18.0)	88 (41.1)		1

#: frequency; *: reference category; **: Significant statistical association; LBW: Low birth weight

Figures

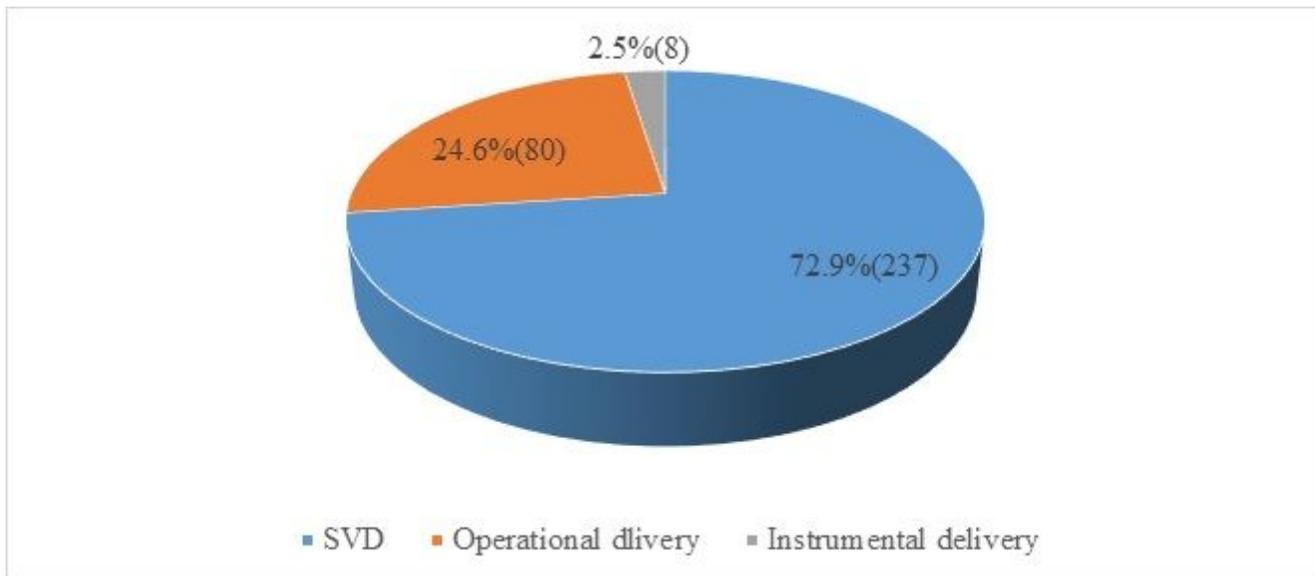


Figure 1

Mode of delivery for the index pregnancy, April, 2018

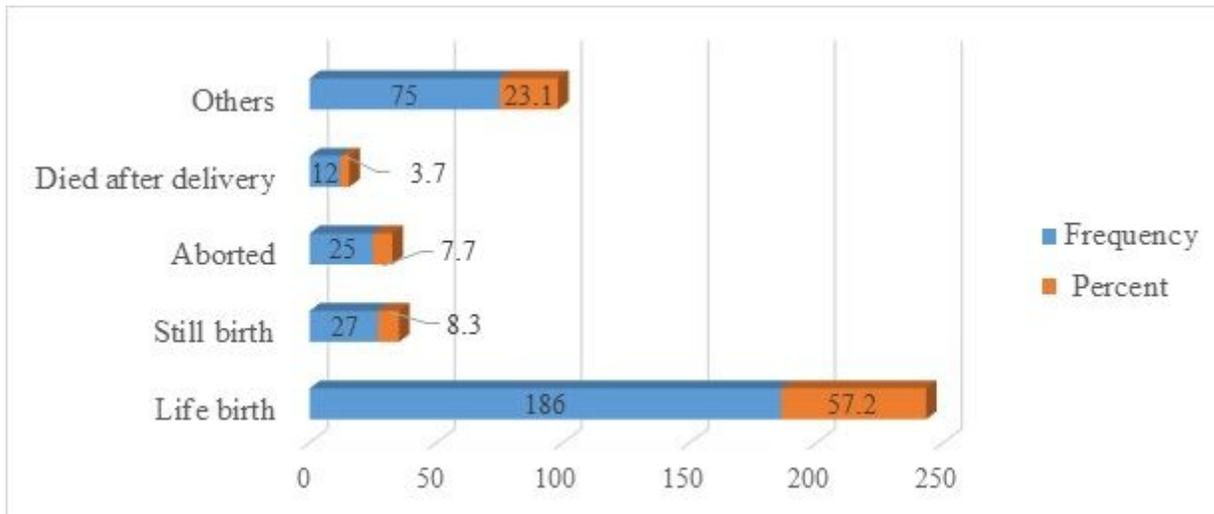


Figure 2

Immediate previous pregnancy outcome, April, 2018

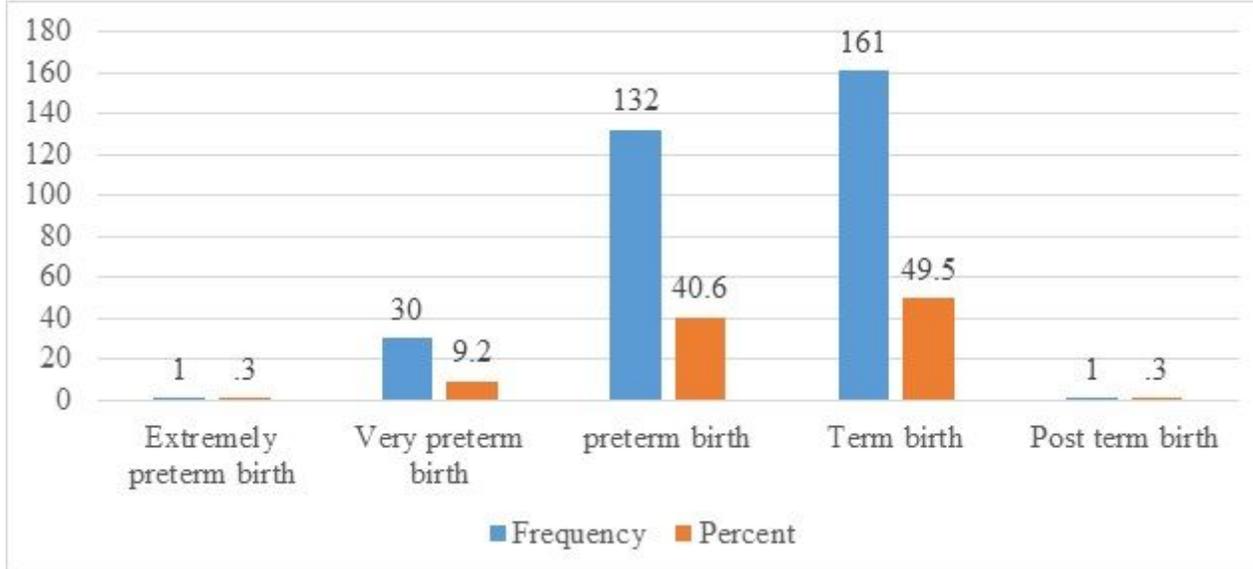


Figure 3

Classification of the neonates as per the gestational age at delivery, April, 2018