


Neonatal Mortality and Its Associated Factors among Neonates Admitted to Wollega University Referral Hospital Neonatal Intensive Care Unit, East Wollega, Ethiopia

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Abstract

Ethiopia has a high neonatal mortality rate in spite of dearth of study. Therefore we aimed to assess magnitude and associated factors of neonatal mortality among neonates admitted to neonatal intensive care units of Wollega University Referral Hospital. Accordingly, a facility based cross-sectional study was conducted on 289 by reviewing medical records of neonates admitted to neonatal intensive care unit. The collected data were entered in to Epi data version 3.1 and Stata version 14 used for analysis. Variables with P -value < 0.25 at with 95% confidence interval in binary logistic regression analysis were taken to the multiple logistic regression analysis. Finally, variables with Likewise, variable with P -value < 0.05 at 95% confidence interval in multiple logistic regression analysis were considered as statistically significant. Among 289 neonates admitted to neonatal intensive care unit, 53 (18.34 %) were died. Majority 42(79.25%) of those deaths occurred at ≤ 7 days of birth. Preterm [AOR 4.15, 95% CI (1.67-10.33)], neonates faced birth asphyxia [AOR 3.26, 95% CI (1.33-7.98)], neonates who developed sepsis [AOR 2.29 95% CI (1.01-5.20)] and neonates encountered with jaundice [(AOR 11.08, 95% CI (1.03-119.59))] were more at risk to die. In general, the magnitude of neonatal mortality among neonates admitted to neonatal intensive care unit was high. Gestational age (maturity of new born), birth asphyxia, neonatal sepsis and neonatal jaundice were predictors of neonatal mortality. Neonates admitted to neonatal intensive care unit with sepsis, jaundice, and birth asphyxia demand special attention to reduce neonatal mortality.

Keywords

neonates, mortality, intensive care unit, Wollega university referral hospital

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Introduction

The neonatal period is defined as the first 28 days after birth and it can be further subdivided into the very early (birth to less than 24 hours), early (birth to < 7 days), and late neonatal periods (7 days to < 28 days).¹ Neonatal mortality rate can also be defined as the number of resident newborns in a specified geographic area dying at less than 28 days of age divided by the number of resident live births for the same geographic area for a specified time period and multiplied by 1000.² Neonatal period is one of the greatest risky periods in human life associated with 3 to 4 million neonatal deaths per year worldwide and 99% of these deaths being in low to middle income countries.³⁻⁶

Among the 20 countries with the highest risk of neonatal death worldwide, 15(75%) are in Africa.⁷ Ethiopia is one of these countries experiencing high neonatal mortality rate of 30 per 1000 live births.^{5,8} In spite of hard works done by the government and other partners, inconsiderable decline was attained in the last 15 years

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and Ethiopia remained with high neonatal mortality rate.⁵ As the prevailing evidence on neonatal mortality was very few to initiate structured intervention, implementation of MDG-4 was unfortunately not effective as planned.^{9,10}

Subsequently, identifying the magnitude and determining the factors associated with neonatal death is an evidence for inventions and a fundamental to tackle the burden of neonatal deaths.^{11,12} However, there was a general shortage of studies on neonatal mortality in the study area.¹³ Therefore, the study aimed to assess the magnitude and associated factors of neonatal mortality among admitted neonate to Neonatal Intensive Care Unit (NICU) of Wollega University Referral Hospital (WURH). The finding of this study can be a baseline data for health professionals working in NICU. Moreover, it can be an input for systematic review to change policy makers and programmers.

Methods and Materials

Study Area and Period

The study was conducted in Nekemte town at NICU of WURH which is located at a distance of 331 km West of Addis Ababa, in Oromia Regional State. Data were collected from July 1-10, 2019.

Study Design

The study was conducted using a cross-sectional study design.

Source and Study Population

All medical charts of neonates admitted to WURH neonatal intensive care unit were considered as source of population while medical charts of all neonates admitted to WURH neonatal intensive care unit from July 2017-July, 2019 were considered as study population.

Inclusion Criteria and Exclusion Criteria

All selected medical charts of neonates admitted to NICU from July 2017 to July, 2019 with variables of interest were included in the study. All medical charts of neonates with incomplete or with no legible handwriting were excluded from the study.

Sample Size Determination and Sampling Procedure

The sample size was calculated using single population proportion formula. The proportion used was 22.8%

taken from the study done at Mizan-Tepi Teaching Hospital.¹⁴ The margin of error 5% with 95% level of confidence was used to calculate the required sample size. Adding 15% for non-response, the final sample size became 312.

By using NICU'S registration book, systematic sampling was used to select study unit for the specific study period. Consequently, all maternal, neonatal & facility related variables were collected.

Data Collection Instruments and Data Collectors

Data were collected by using pre-tested, structured check list. Data extraction check lists developed based on instruments applied in different related studies. Four medical interns were recruited to collect data.

Data Collection Procedure

Data was extracted by reviewing medical records of newborns using the data extraction checklist. The data extraction checklist contained variables related to socio-demographic characteristics, condition of the baby after birth, neonatal illness, maternal and delivery history.

Data Processing and Analysis

EPI data version 3.1 and Stata software version 14 were used for data entry and analysis. After data cleaning, frequencies and percentages were calculated to all variables. Variables with *P*-value of less than 0.25 in binary logistic regression analysis were entered into the multivariable logistic regression analysis. Odds ratio with 95% confidence interval was used to examine associations between dependent & independent variables. Variables with *P*-value < 0.05 were considered statistically significant.

Data Quality Control Measures

The quality of the data was assured by using validated and pre-tested data extraction checklist. The validity of the tool was checked by face validity. Data collectors were trained intensively for 1 day on data collection instruments. Furthermore, there was a close supervision throughout the data collection process.

Operational Definitions

Neonatal death: Death of a neonate that was born alive within the first 28 completed days of life

Early neonatal death: The death of neonate that occur during the first 7 days of life

Late neonatal death: Death of a neonate that occur between 7 and 28 completed days of life

Neonatal resuscitation: A rational lifesaving procedure at the time of birth to initiate and maintain breathing and circulation of the neonate.

Ethical Considerations

A permission letter was obtained from Wollega University Institutes of Health Science, and given to WURH.

Result

According to record from NICU, 1297 neonates were admitted in the last 2 years; we have planned to conduct the study on 312 samples, but 289 of neonatal card were reviewed, which give 92.6% response rate.

Magnitude of Neonatal Mortality

Among 289 neonates admitted to neonatal intensive care unit, 53 (18.34 %) were died at 95 CI (14.30-23.26%). Majority 42(79.25%) of the death occur ≤ 7 days of birth. There was no difference among sexes of died neonates [26(male) versus 27 (female)] (Table 2).

Maternal Related Factors

From the reviewed neonatal cards, 236 (81.66%) of maternal age were in range of 20 to 34 years. Majority 222 (76.82%) of the neonate were from rural residents and 247 (85.47%) of the mothers had antenatal care follow up. Around half 156(53.98%) of women had 2 and above parity, majority 198 (68.51%) of the mothers were gave birth through spontaneous vaginal delivery and 248(85.8%) of the labor lasted less than 24hours.

Only 54 (18.99%) of the women were faced complications during pregnancy and labor. Among complications, obstructed labor was the leading 1 followed by preeclampsia, Premature Rupture of Membrane (PROM), Ante Partum Hemorrhage (APH), twin pregnancy and eclampsia (Table 1).

Neonatal Related Factors

From the total neonates admitted to NICU during study period, 229 (79.24%) of neonates were delivered at term and around half of neonates were male. Out of the neonates admitted to NICU, 148(51.21%) of neonates' birth weight were in normal range (2.5-4 kg). Regarding APGAR score, 178 (61.59%) and 187 (64.71%) of APGAR score at first and fifth minutes were $\geq 7/10$ respectively.

Less than one fourth 59(20.42%) of neonates were resuscitated at birth and 18 (6.23%) of neonates were diagnosed as having congenital anomalies. Around half 130(44.98%) of neonates' body temperature were in normal range at admission. From the study participants, 53(18.34%) of neonates experienced birth asphyxia and around half 133(46.02%) of neonates diagnosed with neonatal sepsis. Among neonates admitted to NICU, 14(4.84%), 79(27.34%), 6(2.08%), 19(6.57%) and 17(5.88%) were faced hemorrhagic diseases of new born, hypothermia, neonatal jaundice, hypoglycemia and meconium aspiration syndrome respectively (Table 2).

Facility Related Factors

Regarding place of delivery, 193(66.78%) of neonates were delivered in the hospitals followed by health center 76(26.30%). Most 255 (88.24%) of the neonates were stayed in the NICU ≤ 7 days after admission (Table 3).

Factors Associated with Neonatal Death

Using multivariable logistic regression, contributing factors of neonatal death were identified. These contributing factors were gestational age, birth asphyxia, neonatal sepsis and neonatal jaundice. Preterm neonates were 4 times more likely die as compared to neonate delivered at term [AOR 4.15, at 95% CI (1.67-10.33)]. Neonates faced birth asphyxia were more likely die as compared to the counterpart [AOR 3.26 at 95% CI (1.33-7.98)].

A neonate who developed neonatal sepsis was 2.3 times more likely die as compared to normal neonates [AOR 2.29 95% CI (1.01-5.20)]. Neonates encountered with neonatal jaundice were eleven times more likely die as compared to their counterpart [(AOR 11.08, 95% CI (1.03-119.59)] (Table 4).

Discussion

Despite numerous innovations and interventions made to improve the survival of newborns, neonatal mortality remains a serious public health concern, particularly in low- and middle-income country.

Therefore, this study aimed to assess the magnitude and factors associated with of neonatal mortality admitted at NICU of WURH.

The magnitude of neonatal mortality among neonates admitted to neonatal intensive care unit was 18.34 % at 95 CI (14.30-23.26%). Majority 42(79.25%)

Table 1. Maternal Related Factors among Neonates Admitted to WURH NICU from July, 2017 to July, 2019.

Variable	Category	Frequency	Percentage
Maternal age in year	<20	26	9.00
	20-34	236	81.66
	≥35	27	9.34
Residence	Urban	67	23.18
	Rural	222	76.82
Antenatal care follows up	Yes	247	85.47
	No	42	14.53
Number of antenatal visits	First visit	11	4.51
	Second visit	39	15.98
	Third visit	141	57.79
	Fourth visit	53	21.72
Parity	One	133	46.02
	Two and above	156	53.98
Duration of labor	<24 hours	248	85.81
	≥24 hours	41	14.19
Duration of rupture of membrane	<8 hours	256	88.58
	≥8 hours	33	11.42
Mode of delivery	Spontaneous vaginal delivery	198	68.51
	Instrumental delivery	21	7.27
	Cesarean section	70	24.22
Complications during pregnancy and labor	Yes	54	18.69
	No	235	81.31
Type of pregnancy and labour complications	APH	5	7.55
	Pre-eclamsia	7	13.21
	Eclampsia	4	7.55
	PROM	7	13.21
	Obstructed labour	24	45.28
	Twin pregnancy	7	13.21

of the death occur before 7 days of birth. This finding is similar with the studies previously conducted in Ethiopia: Jigjiga- Sheik Hassan Yabare Referral Hospital (20.5%), Amhara regional state referral hospitals (15.06%), Debre Markos referral hospital (21.3), Eastern part of Ethiopia public hospitals (20%) and Mizan-Tepi University Teaching Hospital (22.8%).^{10,14-17} The similarity of magnitude might be explained by relative similarities in infrastructures, medical equipment and guidelines used in hospitals and also the skill of health professionals working in NICU of Hospitals in Ethiopia.

The magnitude of this study finding is higher than the study done in Libya (10.9%) and Addis Ababa Public hospitals (11.4%).^{18,19} The discrepancy might be due to study area in terms of infrastructure, and skill of health professionals working in NICU of Libya and Ethiopia may not be similar. In this study, gestational age, birth asphyxia, neonatal sepsis and neonatal jaundice were the identified as determinants. Accordingly, neonates delivered prematurely and admitted to

neonatal intensive care unit were 4 times more likely die as compared to neonate delivered at term and admitted to NICU due to different cases. This finding is supported with the studies done in Libya and in Ethiopia, Jigjiga- Sheik Hassan Yabare Referral Hospital, Dessie referral hospitals, Eastern part of Ethiopia public hospitals and Black lion hospital.^{10,15,20,21} In fact, prematurely delivered baby faced different complications as a result of difficulty in adapting to extra-uterine environment and consequently are at risk of different complications compared to term babies. Therefore, they need more special attention to reduce neonatal mortality.

Neonates admitted to neonatal intensive care unit with birth asphyxia were 3 times more likely to die as compared to counterpart. This finding is consistent with the studies done in Libya and Ethiopia: Debre Markos referral hospital, Dessie referral hospital, Black lion hospital and Adama hospital medical.^{8,17,20-22} Oxygen deficit at delivery (birth asphyxia) can lead to severe hypoxic ischemic organ damage in newborns followed by a fatal outcome or severe life-long pathologies.

Table 2. Neonatal Related Factors among Neonates Admitted to WURH NICU from July, 2017 to July, 2019.

Variable	Category	Frequency	Percentage
Gestational age	Pre term	56	19.38
	Term	229	79.24
	Post term	4	1.38
Sex of neonate	Male	149	51.56
	Female	140	48.44
Neonates died	Yes	53	18.34
	No	236	81.66
Neonates age at death	≤7 days	42	79.25
	>7 days	11	20.75
Birth weight	<1000 g	3	1.04
	1000-1499 g	21	7.27
	1500-2499 g	111	38.41
	2500-4000 g	148	51.21
	>4000 g	6	2.08
APGAR score at 1 minute	<3/10	22	7.61
	3-6/10	57	19.72
	≥7/10	178	61.59
	Not recorded	32	11.07
APGAR score at 5 minutes	<3/10	10	3.46
	3-6/10	45	15.57
	≥7/10	187	64.71
	Not recorded	47	16.26
Resuscitate	Yes	59	20.42
	No	230	79.58
Congenital anomalies	Yes	18	6.23
	No	271	93.77
Body temperature at admission	<36.5°C	113	39.10
	36.5-37.5°C	130	44.98
	>37.5°C	46	15.92
Birth asphyxia	Yes	53	18.34
	No	236	81.66
Neonatal sepsis	Yes	133	46.02
	No	156	53.98
Neonatal meningitis	Yes	21	7.27
	No	268	92.73
Acute respiratory distress syndrome	Yes	10	3.46
	No	279	96.54
Hemorrhagic disease of new born	Yes	14	4.84
	No	275	95.16
Hypothermia	Yes	79	27.34
	No	210	72.66
Neonatal jaundice	Yes	6	2.08
	No	283	97.92
Hypoglycemia	Yes	19	6.57
	No	270	93.43
Meconium aspiration syndrome	Yes	17	5.88
	No	272	94.12

Therefore, provisions of quality neonatal care including quality resuscitation, thermal care, and proper feeding are important to reduce adverse outcome of neonates

admitted with asphyxia. Furthermore, producing competent health providers through continuous professional development can reduce neonatal mortality.

Table 3. Neonatal Related Factors among Neonates Admitted to WURH NICU from July, 2017 to July, 2019.

Variable	Category	Frequency	Percentage
Place of delivery	Home	20	6.92
	Health center	76	26.30
	Hospital	193	66.78
Duration of stay in NICU	≤7 days	255	88.24
	>7 days	34	11.76

Table 4. Factors Associated with Neonatal Death among Neonates Admitted to NICU at WURH 2019.

Variable	Category	Neonatal mortality		COD/95%CI	AOD/95%CI
		Yes	No		
Residence	Urban	9	58		
	Rural	44	178	1.59 (0.73, 3.46)	1.13 (0.40, 3.13)
Antenatal care follow up	Yes	41	206		
	No	12	30	2.01 (0.95, 4.24)	1.81 (0.69, 4.71)
Gestational age	Pre term	28	28	8.54 (4.35, 16.74)	4.15 (1.67, 10.33)**
	Term	24	205		
	Post term	1	3	2.84 (0.28, 28.46)	3.87 (0.30, 49.04)
Duration of labor	<24	39	209		
	≥24 hours	14	27	2.77 (1.33, 5.76)	1.55 (0.49, 4.89)
Duration of rupture of membrane	<8 hours	41	215		
	≥8 hours	12	21	2.99 (1.36, 6.56)	2.60 (0.83, 8.15)
Mode of delivery	SVD	40	158		
	Instrumental	7	14	1.97 (0.74, 5.21)	0.69 (0.17, 2.78)
	C/S	6	64	0.37 (0.14, 0.91)	0.37 (0.11, 1.26)
Complications during pregnancy and labor	Yes	13	41	1.54 (0.75, 3.14)	2.07 (0.79, 5.36)
	No	40	195		
Resuscitate	Yes	20	39	3.06 (1.59, 5.88)	1.36 (0.55, 3.33)
	No	33	197		
Body temperature at admission	<36.5°C	32	81	3.88 (1.88, 7.99)	2.27 (0.91, 5.60)
	36.5-37.5°C	12	118		
	>37.5°C	9	37	2.39 (0.93, 6.12)	1.75 (0.56, 5.52)
Birth asphyxia	Yes	18	35	2.95 (1.50, 5.78)	3.26 (1.33, 7.98)**
	No	35	201		
Neonatal sepsis	Yes	28	105	1.39 (0.76, 2.53)	2.29 (1.01, 5.20)*
	No	25	131		
Neonatal meningitis	Yes	6	15	1.88 (0.69, 5.10)	3.76 (0.99, 14.28)
	No	47	221		
Acute respiratory distress syndrome	Yes	5	5	4.81 (1.34, 17.27)	3.74 (0.56, 24.79)
	No	48	231		
Neonatal jaundice	Yes	3	3	4.66 (0.91, 23.76)	11.08 (1.03, 119.59)*
	No	50	233		
Meconium aspiration syndrome	Yes	6	11	2.61 (0.91, 7.41)	2.05 (0.58, 7.21)
	No	47	225		

*P-value of ≤.05. **P-value of <.001.

The bold types implies AOR of significant variables.

The odds of neonatal death were 2 times more likely observed among neonates who had neonatal sepsis as compared to neonate with no sepsis. This finding is in concordance with previous studies

conducted in Ethiopia: Eastern part of Ethiopia public hospitals, Dessie referral hospital and Adama hospital medical college.^{10,20,22} If infection is not treated immediately, it can be complicated to septic shock

and multiple organ dysfunctions in which both are the most common causes of death in the neonatal period.

Furthermore, this study found that neonates admitted to the NICU due to neonatal jaundice were at higher risk of death as compared to neonates admitted due to other causes. High level bilirubin in neonate can damage the brain and spinal cord of neonate which can be life threatening and cause neonatal death.

Conclusion

In this study, the magnitude of neonatal mortality among neonates admitted to neonatal intensive care unit was high. Gestational age (maturity of new born), birth asphyxia, neonatal sepsis and neonatal jaundice were predictors of neonatal mortality. Therefore, neonates admitted to NICU with birth asphyxia, neonatal sepsis, neonatal jaundice, and prematurity need special consideration and follow up to reduce neonatal mortality. Due to a relative similarity of NICU's set up in Referral Hospital, relative similarity in skill and qualifications of health professionals working in NICU of Referral Hospital, similar infrastructure pertaining to Referral Hospital in Ethiopia, the finding can be cautiously inferred to different Referral Hospitals in Ethiopia.

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Authors' contributions

All authors participated on conception, study design, acquisition of data, software, analysis and interpretation, a critical review of the document and revision of the manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics approval statement

A written permission letter was obtained from Wollega University with Ref No.: WU/RD/78/19. Likewise, we got permission from WURH to access data pertaining admitted neonates to NICU. Moreover, no identifiable data were included in dataset and in the manuscript. However, consent to participate was not applicable because of the nature of data.

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Data sharing and data availability statement

Data used for this manuscript is available from corresponding author at lalisachewaka@gmail.com on a reasonable request.

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