Original article

Predictors of early neonatal mortality at a neonatal intensive care unit of a specialized referral teaching hospital in Ethiopia

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Abstract

Background: The larger fraction of infant mortality is that of neonatal; and early neonatal death is the most significant contributor of neonatal mortality as a whole. There are various factors which may be associated with early neonatal mortality and they have been the reasons for the wide variation in mortality rates among the health facilities reporting.

Objective: This study was made to assess the independent predictors of early neonatal mortality.

Methods: From 2001 through 2005, a total of 3789 live born neonates, who were admitted to the neonatal intensive care unit of Tikur Anbessa Hospital, were included in this study. Variables were classified into two: Socio economic/reproductive factors and maternal/newborn factors. Predictors were assessed using a multivariable binary logistic regression. Variables with a p-value of <0.05 were entered into a multivariable logistic model.

Results: From the socio-economic/reproductive variables: age less than one day (AOR=2.53 95% CI= (1.66, 3.85)), having three or more siblings (AOR=2.04, 95% CI= (1.15, 3.64)), second birth order (AOR=1.79, 95% CI= (1.28, 2.51)), absence of antenatal care (AOR=1.70, 95% CI= (1.28,2.26)), and being unmarried (AOR=1.55 95%CI=(1.20,2.00)) were independent predictors of increased mortality. On the other hand, singleton pregnancy was found to be protective by 30% against early neonatal mortality with an odds of 0.70, 95% CI of (0.54, 0.90). From the neonatal/ maternal variables: gestational age of <32 weeks (AOR= 10.46, 95% CI= (5.39, 20.31)), first minute APGAR of three or less (AOR=2.12, 95% CI= (1.39, 2.23)), presence of any congenital anomaly (AOR=2.02, 95% CI=(1.33,2.51)), presence of peri-natal asphyxia (AOR=1.82, 95% CI=(1.32,2.51)), any oxygen treatment (AOR=2.65, 95% CI=(1.89,3.72)), birth weight less than 1500 (AOR=9.64, 95%CI=(3.32,27.97)) were independent predictors of neonatal mortality. A normal weight at admission was protective of early neonatal mortality.

Conclusion: There are many factors that could have influenced neonatal mortality in the current study. Antenatal care follow up is the key point of contact for planning and managing labor and delivery; it should be improved to control most other variables. The care provided to these high risk babies should also be maximized to reduce mortality in these risk groups. [*Ethiop. J. Health Dev.* 2012;26(3):200-207]

Background

Despite a remarkable reduction in the under five mortality in the past few years following important interventions like immunization and diarrhea control programs, the neonatal mortality in resource poor countries is still alarmingly high. It accounts for over 40% of all deaths of children under the age of five years. It is estimated that 34 of every 1000 babies born in developing countries die in the first month of life. This happens primarily because of most child survival strategies being deigned bypassing the newborn. About two-third of infant deaths occur in the neonatal period, of which nearly two-thirds die during the first week and of these two thirds die during the first 24 hours (1, 2).

In Ethiopia, according to the recent demographic and health survey (EDHS, 2010), infant mortality rate has declined over the past five years giving the nation the hope of achieving the MDG in 2015. This success is due mainly to the various child survival strategies. However, there has been a very small decline in the neonatal mortality rate (NMR) during the same period (3).

A study in Indonesia about determinants of neonatal mortality showed a significant difference in neonatal mortality among different regions of the country. A decline in the odds of neonatal death was found as the percentage of deliveries assisted by trained delivery attendants increased whereas it was found to be high for infants born to working mothers and fathers and for infants born to fathers who were unemployed. More neonatal mortality was found for higher rank infants with a short birth interval, male infants, smaller than average-sized infants and infants of mothers with delivery complications. Infants receiving any postnatal care were significantly protected from neonatal death (4).

Another study in Burkina Faso showed an NMR of 46.3 per 1000 live births. Among 864 live births followed to day 28, there were a total of 40 neonatal deaths. The main predictors of neonatal mortality in this study were twin birth, having a nulliparous mother and birth into a polygynous household (5).

Other maternal including in-vitro fertilization, earlier still birth, higher maternal age, maternal diabetes and lower

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socioeconomic status, smoking during pregnancy and being a single mother were found to be associated with increased risk of peri-natal mortality (6).

The struggle towards having a better NMR is closely linked to identifying the factors associated with an increased mortality. There are few studies in Sub-Saharan Africa about predictors of neonatal mortality, and those which have been reported so far were done with a small sample size. In the current study, we analyzed a five year newborn data to describe the level of early neonatal mortality and factors associated with neonatal mortality rate.

Methods

Study Area:

The study was done at Addis Ababa University, College of Health Sciences, Department of Pediatrics and child Health, Tikur Anbessa Specialized Hospital (TASH), Neonatal Intensive Care Unit (NICU), in Addis Ababa, Ethiopia. The department has six major wings: Emergency admission services, Neonatal ICU (NICU), Pediatric ICU (PICU), under five admission unit, over five years admission unit and pediatric surgical admission unit. There are a total of 150 patient beds; the NICU has 50 beds for newborn infants. It is the largest ICU in the country with a very high patient admission. Most of the admissions are associated with prematurity. The KMC (Kangaroo Mother Care) wing has a total of five beds and is a place where preterm babies are given care in the Kangaroo position for thermal control.

About a third of newborn babies were in the hospital while the remaining two third were from other government, private health institutions in Addis Ababa. A significant number of newborn babies also came from home.

Study Design:

A historical cohort of 3789 newborns that were admitted to the NICU during the years 2001-2005.

Source Population:

All neonates admitted to the NICU of TASH.

***Study Subjects*:**

Newborns below the age of 7 days who were admitted to the NICU from 2001 to 2005. All newborns admitted to the NICU over the study period were recruited to the study and entered into a data-base of newborn records in the NICU.

Method of Data Analysis:

the data were exported to SPSS 20; after cleaning, descriptive and analytic analysis were done as applicable.

The level of significance was set at P<0.05. Binary logistic regression was used to produce a summary of statistics of proportions including crude odds ratio and 95% confidence intervals.

Screening of predictors of neonatal mortality was done using binary logistic regression for each variable one at a time. Then, those variables with a P-value<0.05 were collected and entered into logistic regression to control possible confounders.

Only covariates that were associated with the outcome (P<0.05), after controlling potential confounders, were retained.

Early Neonatal Mortality (ENM) was set as the dependent variable and tested for association with socio-demographic and maternal/newborn factors.

Results

Over the study period there were a total of 3789 (58.2% male and 41.8% female) newborn below the age of seven days admitted. Seventy five percent of the newborns were admitted at their first day of life and half of them were first born. Preterm neonates accounted for 45.7% while only 6% were post term. Fifty eight percent of the mothers were in the most productive age of 20-30 years and teen age pregnancies accounted for 17.4%. There were 881 deaths in the study period making an early NMR of 23.3% (233 per 1000 live births); 96.6% of the deaths occurred during the first three days of life and 60.7% of the infants were male. First born, preterm and low-birth weight infants accounted for 20.5%, 52.5% and 59.3% of neonatal deaths, respectively, from each group. It was also higher in those whose mothers had no antenatal care follow up (34%), and who had a congenital anomaly (34.4%), peri-natal asphyxia (PNA) (30.6%), respiratory distress (28.5%) and those who received oxygen treatment (31.6%). The percentage of early neonatal mortality was found to be rather lower in those who had jaundice at admission (16%) and in those with polycythemia (13.3%) (Table 1).

While testing for association of socio-demographic and reproductive variables with early neonatal mortality using binary regression : age at admission, source of referral, address, gestation, birth order, maternal occupation, maternal education, number of siblings and marital status were significantly associated (Table 2). The odds of ENM for babies who came at the age of less than one day (24 hours) was 2.77 (COR=2.77 CI= (1.88, 4.08), *P<0.0001*) and for those who came between the age of 1-3 days was 2.80 (COR=2.80 CI=(1.84,4.25), *P<0.0001*). Those who were referred from centers out of the city had the highest odds of mortality (COR=2.41 CI= (1.88, 3.09), *P<0.0001*). Singleton pregnancy had a 1.87 times increased risk of mortality (COR=1.87 CI= (1.51, 2.32) *P<0.0001*). The risk of mortality increased as the birth order increased and the highest risk was for those of fifth or higher (COR=1.61 CI= (1.19, 2.18)

P=0.002). Mothers being students and in elementary education were also associated with increased mortality (COR=1.45 CI= (1.12, 1.88) *P*= 0.005, COR=2.09 CI= (1.38, 3.15) P<*0.0001*, respectively) (Table 2 and Table 3).

Table 1: **Frequency distribution of Newborn and Maternal Characteristics, NICU of Tikur Anbessa Hospital, Addis Ababa, Ethiopia, 2001-2005**

Character	Died (%)	Survived (%)	Total	P-value
Age at admission				
≤1 day	693 (24.8)	2122 (75.2)	2815	
1-3 days	158 (24.6)	479 (75.8)	637	<0.0001
4-7 days	30 (10.6)	254 (89.4)	284	
Gender				
Male	530 (24.0)	1665 (76)	2205	0.099
Female	343 (21.7)	118 (78.3)	1584	
Birth Order				
First	387 (20.5)	1505 (79.5)	1892	
Second	229 (26.4)	640 (73.6)	869	
Third	109 (25.3)	322 (74.7)	431	<0.0001
Fourth	70 (27.1)	188 (72.9)	258	
Fifth and more	67 (29.3)	162 (70.7)	229	
Gestational age				
≤ 32 weeks	347 (52.5)	314 (47.5)	661	
32-37 weeks	227 (21.2)	843 (78.8)	1072	
37-42	248 (15.2)	1383 (84.8)	1631	<0.0001
≥ 42 weeks	19 (8.8)	198 (91.2)	217	
Birth weight				
≤ 1500	268 (50.3)	184 (40.7)	452	
1501-2449	281 (21.6)	1020 (78.4)	1301	
2500-3999	242 (15.6)	1309 (84.4)	1551	<0.0001
≥ 4000	5 (3.1)	157 (96.9)	162	
Maternal age				
≤ 20 years	201 (24.4)	624 (75.6)	825	
20-30 years	493 (23.4)	1611 (76.6)	2104	0.856
≥ 30 years	154 (23.4)	504 (76.6)	658	
Marital status (mother)				
In Marriage	574 (21.2)	2128 (78.8)	2702	<0.001
Not in Marriage	119 (29.2)	289 (70.8)	408	
Number of siblings				
None	393 (21.5)	1431 (78.5)	1824	
One	225 (24.2)	703 (75.8)	928	0.001
Two	108 (23.3)	356 (76.7)	464	
Three or More	155 (29.8)	365 (70.2)	520	
APGAR at 1st minute				
≤ 3	185 (39.7)	28 (60.3)	466	
4-6	388 (22.7)	1324 (76.3)	1712	<0.0001
7-10	113 (12.7)	780 (87.3)	893	
APGAR at 5th minutes				
≤ 3	29 (47.5)	32 (52.5)	61	
4-6	337 (32.7)	694 (67.3)	1031	<0.0001
7-10	314 (16)	1651 (84)	1965	
Antenatal care				
Yes	732 (22)	2556 (78)	3288	<0.0001
No	106 (34)	205 (66)	311	
Congenital anomaly				
Yes	108 (34.4)	206 (65.6)	314	<0.0001
None	760 (22.6)	2597 (77.4)	3357	
Perinatal asphyxia				
Yes	174 (30.6)	395 (69.4)	569	<0.0001
None	685 (22)	242 (78)	3106	
Polycythemia				
Yes	104 (16)	54 (84)	645	<0.0001
None	694 (23.6)	2250 (76.4)	2944	
Jaundice at admission				
Yes	132 (13.5)	847 (86.5)	979	<0.0001
None	745 (27.4)	1978 (72.6)	2723	
Oxygen treatment				
Yes	755 (31.6)	1634 (68.4)	2389	<0.0001
None	116 (9)	1177 (91)	1293	
Respiratory distress				
Yes	735 (28.5)	1846 (71.5)	2581	<0.0001
None	146 (12.8)	997 (87.2)	1143	

Table 2: **Socio-demographic Variables associated with Early Neonatal Mortality (ENM) in the NICU of TASH in Ethiopia from 2001-2005.******

Variable	Outcome		P-value	COR* 95%CI** for COR
	Dead	Survived		
Age at admission				
≤1 day	693	2122	<0.0001	2.77 (1.88, 4.08)
1-3 days	158	693	<0.0001	2.80 (1.84, 4.24)
4-7 days	30	158		1
Address				
Addis Ababa	689	2127	<0.0001	1.96 (1.50, 2.56)
Out of Addis	71	430		1
Transferred from				
TASH***	174	907		1
Gov't hospital	250	866	<0.0001	1.50 (1.21, 1.87)
HC*****, Addis Ababa	87	248	<0.0001	1.86 (1.36, 2.45)
Home Delivery	47	112	<0.0001	2.19 (1.50, 3.19)
Private institution	163	355	<0.0001	2.38 (1.87, 3.06)
Out of Addis Ababa	160	346	<0.0001	2.41 (1.88, 3.09)
Gestation				
Single	723	2557	<0.0001	1.87 (1.51, 2.32)
Multiple	151	285		1
Birth order				
First	387	1550		1
Second	229	640	0.001	1.39 (1.15, 1.68)
Third	109	322	0.027	1.32 (1.03, 1.68)
Forth	70	188	0.014	1.45 (1.08, 1.95)
Fifth and more	67	162	0.002	1.61 (1.19, 2.18)
Maternal Occupation				
House wife	401	1480		1
Gov't employee	61	248	0.520	0.91 (0.67, 1.22)
Self employee	59	213	0.890	
Daily Laborer	19	53	0.340	
Student	95	242	0.005	1.45 (1.12, 1.88)
Maternal Education				
Illiterate	105	316	0.002	1.96 (1.28, 2.98)
Read and write	12	41	0.148	
Elementary school	129	346	0.000	2.09 (1.38 3.15)
High school	216	699	0.003	1.82 (1.23, 2.69)
Higher education	35	206		1
In a marriage				
Yes	574	2128		1
No	119	289	<0.0001	1.53 (1.21, 1.93)
No. of siblings				
None	393	1431		1
One	225	703	0.109	1.17 (0.96, 1.41)
Two	108	356	0.421	1.11 (0.87, 1.41
Three and more	155	365	<0.0001	1.55 (1.24, 1.92)

* COR=Crude Odds Ratio, ** CI=Confidence Interval, *** TASH=Tikure Anbessa Specialized Hospital, **** Binary logistic regression, ***** =Health centre

Table 3: **Maternal and Neonatal Factors associated with Early Neonatal Mortality (ENM) in the NICU of Tikur Anbessa Specialized Hospital in Ethiopia from 2001-2005*****

Variable	Outcome		P-value	COR* 95%CI** for COR
	Dead	Survived		
Gestational age				
≤ 32 Weeks	347	314	<0.0001	11.52 (7.02, 18.89)
32-37 weeks	227	845	<0.0001	2.80 (1.71, 4.58)
37-42	248	1383	0.012	1.87 (1.15, 3.05)
≥ 42 weeks	19	198		1
Birth weight				
≤ 1500gm	268	184	<0.0001	15.74 (18.4, 113.6)
1501-244gm9	281	1020	<0.0001	8.65 (3.51, 21.28)
2500-3999gm	241	1309	<0.0001	5.81 (2.36, 14.29)
≥ 4000gm	5	157		1
Length				
≤ 45 cm	524	987	<0.0001	3.16 (2.45, 4.08)
45-51 cm	261	1350	0.301	1.15 (0.88, 1.50)
≥ 51 cm	84	500		1
APGAR at 1st Minute				
≤ 3	185	281	<0.0001	4.54 (3.47, 5.96)
4-6	388	1324	<0.0001	2.02 (1.61, 2.54)
7-10	466	1712		1
APGAR at 5th Minutes				
≤ 3	29	32	<0.0001	4.77 (2.84, 7.99)
4-6	377	694	<0.0001	2.55 (2.14, 2.54)
7-10	314	1651		1
Congenital Anomaly				
Yes	108	206	<0.0001	1.79 (1.40, 2.28)
No	760	2597		1
Perinatal Asphyxia				
Yes	174	395	<0.0001	1.56 (1.28, 1.90)
None	569	3106		1
Respiratory distress				
Yes	755	1634	<0.0001	4.69 (0.000)
None	116	1177		1
Oxygen Treatment				
Yes	755	1634	<0.0001	4.69 (0.000)
None	116	1177		1
Jaundice at Admission				
Yes	132	847	<0.0001	0.44 (0.34, 0.51)
None	745	1978		1
Hematocrite (HCT)				
35 – 65%	626	2184	0.002	1.45 (1.15, 1.83)
<=35%	55	55	<0.0001	5.07 (3.29, 7.81)
>=65%	99	502		1
Polycythemia				
Yes	104	541	<0.0001	0.62 (0.50, 0.78)
None	694	2250		
Antenatal Care				
Yes	732	2556		1
No	106	205	<0.0001	1.8 (1.41, 2.37)

* COR=Crude Odds Ratio, ** CI=Confidence Interval, *** Binary logistic regression

After all the variables which had an association with ENM (P <0.05) were entered in to a multivariable logistic model to control the effect of confounders, from the socio-demographic and reproductive variables: a lower age at admission, multiple gestation, being a second born, absence of antenatal care follow up, and absence of a functional marriage were the independently associated variables (Table 4).

From the maternal and neonatal factors that affect ENM, those which were independently associated included: preterm birth , a first minute APGAR of 3 or less, presence of any congenital anomaly, presence of perinatal asphyxia, requirement of oxygen therapy and a lower birth weight. A normal length at birth (AOR=0.58 CI= (0.40, 0.85) *P-value*=0.005) and presence of jaundice were protective of ENM (Table 5).

Table 4: **Multivariable Logistic Regression of Socio-demographic Factors Associated with early Neonatal Mortality (ENM) in the UICU of Tikur Anbessa Specialized Hospital in Ethiopia from 2001-2005**

Variable	P-value	AOR* 95% CI** for AOR
Age of newborn at admission		
≤ One day	<0.0001	2.53 (1.66, 3.85)
1-3 days	<0.0001	2.20 (1.38, 3.48)
4-7 days		1
Gestation		
Singleton	0.005	0.70 (0.54, 0.90)
Multiple		1
Number of Siblings		
None		1
One	0.222	1.79 (0.49, 1.25)
Two	0.312	2.04 (1.15, 3.64)
Three and More	0.015	
Birth Order		
First		1
Second	0.001	1.79 (1.28, 2.51)
Third	0.116	1.57 (0.91, 2.37)
Fourth	0.384	0.75 (0.40, 1.43)
Fifth and above	0.164	0.63 (0.34, 1.21)
Antenatal Care		
Yes		1
No	<0.0001	1.70 (1.28, 2.26)
Marital Status		
In Marriage		1
Not in Marriage	0.001	1.55 (1.20, 2.00)

* AOR=Adjusted Odds Ratio, ** CI=Confidence Interval

Table 5: **Multivariable Logistic Regression of Maternal and Newborn Factors associated with Early Neonatal Mortality (ENM) in the NICU of Tikur Anbessa Specialized Hospital in Ethiopia from 2001-2005**

Variable	P-value	AOR* 95% CI** for AOR
Gestational Age		
≤ 32 weeks	<0.0001	10.46 (5.39, 20.31)
32-37 weeks	<0.0001	3.60 (1.39, 6.69)
37-42	0.014	2.05 (1.16, 3.64)
≥ 42 weeks		1
Length		
≤ 45 cm	0.241	0.74 (0.46, 1.23)
45-51 cm	0.005	0.58 (0.40, 0.85)
≥ 51 cm		1
APGAR at 1st Minute		
≤ 3	<0.0001	2.12 (1.39, 2.23)
4-6		1.15 (0.85, 1.56)
7-10		1
Congenital Anomaly		
Any	0.001	2.02 (1.33, 2.51)
None		1
Perinatal Asphyxia PNA)		
Yes	<0.0001	1.82 (1.32, 2.51)
None		1
Oxygen Treatment		
Any	<0.0001	2.65 (1.89, 3.72)
None		1
Jaundice at Admission		
Yes		1
None	<0.0001	2.65 (1.89, 3.72)
Birth weight		
≤ 1500 gm	<0.0001	9.64 (3.32, 27.97)
1501-2449 gm	0.015	3.54 (1.28, 9.78)
2500-3999 gm	0.018	3.16 (1.21, 8.24)
≥ 4000 gm		

* AOR=Adjusted Odds Ratio, ** CI=Confidence Interval

Discussion

This study showed that there was a high early neonatal mortality rate of 23.3%; this figure indicated an institution-based neonatal mortality and may not be as high a figure to say an alarming mortality as in out of health facility studies. The findings also revealed that various socio-demographic and maternal/neonatal factors were associated with an increased risk of mortality.

The high mortality (23.3%) in this study is comparable to another NICU study by Mostafa *et al.* which reported a mortality of 23.8% in Saudi Arabia (7); low mortality rates of 4%, 6% and 9% were reported from Canada, Brazil and Pakistan, respectively (8-10). A high NMR of very low birth weight infants of 32.8% in TASH-NICU was also reported by Worku B in 1999 (11). Higher figures of mortality rates than the findings of this study were reported from Togo and Kenya (24.6% and 27%) (12, 13). A lower mortality rate of 13.6% was also reported from rural area of Malawi, 13.8% from South Africa, KwaZulu-Natal and 4.63 percent from rural area in Burkina Fasso (5, 14, 15). This variability in the mortality rate could be explained by the differences in the risk factors associated particularly with each study population (7).

Despite reports of an improved survival of preterm and low birth weight infants due mainly to the interventions introduced in the labor and delivery site and an improved admission and treatment in intensive care units (16), this study revealed that prematurity and low birth weight were still the strongest predictors of early neonatal mortality. This finding is in agreement with the study in Saudi Arabia by Mostafa *et al.* and at Malawi by Merimaaria *et al* (7, 14).

Admission to the NICU at an earlier age of less than one day was found to be one of the independent predictors of early neonatal mortality; this goes with the well established fact that most neonatal deaths occur in the first 24 hours (1). This is the period of transition from fetal to neonatal physiology and needs an appropriate support for the needy (1, 2).

Multiple gestation pregnancy (which included twin and triplet pregnancy) was found to be an independent predictor of early neonatal mortality; singleton pregnancy was found to be protective of mortality. A similar finding was reported from rural Burkina Faso by Diallo *et al*. They specifically indicated that twin births are associated with increased odds of neonatal death (5). Other similar studies also confirmed the same (17, 18). The high probability of preterm birth, and low birth weight could be a possible explanation for this fact.

The risk of neonatal death was higher for those who had three or more siblings. This finding was similarly reported by Jennifer *et al*. and they found that it was more associated with white newborns as compared to blacks (19). This variable may indicate that the family size of which the newborn is born is high. And association of family size with an increased mortality has been established with studies elsewhere (20).

The absence of a proper antenatal care follow-up is associated with an increased neonatal mortality; this would be the reason for hampering prevention of most other preventable factors during pregnancy. The failure of having a proper antenatal care is associated with an increased neonatal mortality in this study. A prospective study in Bangladesh showed that the timing of first antenatal visit, frequency of visits and administration of tetanus toxoid (TT) during follow-up had an impact on mortality cohorts (21).

Being in positive marriage was found to be protective against neonatal mortality. Absence of marriage was associated with a 1.55 odds of neonatal mortality. This important socio-demographic variable might have an important direct/indirect impact on the support of the pregnancy and of the newborns. It was also shown to be associated with neonatal death in a study of neonatal mortality risk factor analysis between black and white races in North Carolina and another study which showed an increased NMR in single mothers (6, 19).

A normal length of the newborn was associated a protective effect against neonatal mortality, whereas an abnormal length at birth had no impact on mortality. This could be explained by the fact that newborns with a normal length are more likely to be term babies and without gross intrauterine retardation.

Fifth minute APGAR score was associated with increased odds of neonatal mortality in many studies. (22-24) whereas, in the this study a low fifth minute APGAR score didn't have an effect on neonatal mortality; rather a low first minute APGAR was associated with increased risk of early neonatal mortality. A low first minute APGAR is often an indication for neonatal resuscitation; in the absence of a proper and organized resuscitation measures, the neonatal mortality would be high in this group of newborns.

The other independently associated variable with neonatal mortality was requirement of and treatment with oxygen administration. Administration of oxygen was associated with increased odds of neonatal mortality. This could be simply because those newborns that required oxygen therapy had a serious illness requiring oxygen therapy.

Improving NMR does not succeed with only facility-based interventions. Present evidence emphasizes the need for countries investing in facility-based newborn care should also give impetus to establishing regionalized systems of perinatal care. Strengthening of lower level facilities with high case loads can yield optimal reduction in neonatal mortality rates (25).

Our study analyzed a large number of newborns to identify the risk factors associated with even a slight increment in neonatal mortality which is not a simple study in Ethiopia under most circumstances. However, the limitation of our study is that it used secondary data; issues relating to incomplete recording may have an impact on the number of cases for final logistic models.

In conclusion, this study found a high neonatal mortality rate in the NICU; and that various factors are significantly associated with an increased mortality. Preterm delivery and low birth weight were found to be strongest predictors of neonatal mortality calling for more coverage of an appropriate antenatal care where risk groups can best be identified and managed. The NICU should also beef up itself for the care and treatment of newborns with various risk factors.

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