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Research Article

Survival Status and Predictors of Time to Death among Neonates Admitted to Neonatal Intensive Care Units in West Shewa Zone, Oromia Region, Ethiopia: A Prospective Cohort Study

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Abstract

Background: Neonatal mortality is the death of neonates that happens within the first 28th day of life. The first 28 days of life is the most vulnerable time for a child's survival. Despite a declining neonatal mortality rate globally, marked disparities in neonatal mortality exist across regions and countries. Hence the aim is to estimate the survival time and to investigate predictors of neonatal mortality among neonates admitted NICU at public hospitals west Shewa zone, Ethiopia.

Methods: Hospital -based prospective cohort study was conducted among 495 newborns admitted in public hospital neonatal intensive care unit from August 01 to December 2019. Data was entered into EPI info version 7.1 and exported to Stata version 14 statistical software for analysis. The Kaplan Meier survival curve together with log rank test was used to estimate the survival time of the newborns and Cox-proportional hazard regression analysis used to identify independent predictors of time to death.

Results: A total of 495 neonates were followed for 28 days at NICU and 78were died and making the neonatal mortality rate (NMR) was 157 per 1000 live births. During the follow-up, 20 (25.6%) neonates died in the first day, 39 (50%) neonates died within three days and 70 (89.7%) neonates died within a week. The independent predictors of time to death were, having hypertension during pregnancy (AHR: 1.78(95%CI:1.04-3.03), having anemia during pregnancy (AHR: 2.00;95%CI:1.13-3.54), sever APGAR at five minutes (AHR: 2.59;95%CI:1.53-4.38), short term birth interval (AHR: 1.55;95%CI:1.03-2.34), induced labor (AHR: 3.25; 95%CI:1.87-5.65), not initiating breastfeeding within one hours (AHR: 1.8;95%(CI:1.13-2.99), neonates born from mothers who didn't attend ANC visits (AHR: 2.06;95% (CI:1.26-3.38).

Conclusions and Recommendations: The risk of mortality among neonates admitted to NICU was high. Short birth interval, neonates with lower Apgar score, neonates who not initiating breastfeeding within one hours, neonates born from mothers diagnosed with hypertension and anemia during their pregnancy, neonates born from mothers who didn't attend ANC visits during their pregnancy and neonates born by induction are at higher risk of death in the NICU. Therefore, screening women and regular control diseases during pregnancy and inter-pregnancy interval through family planning counseling and provision, providing all initial newborn cares, and having the recommended ANC follow-up was recommended.

Keywords: Neonatal mortality; NICU; Public hospital; Ethiopia

Introduction

NM (Neonatal mortality) indicates the death of neonates that happens within the first 28th day of life. It is also divided into early NM which is before the seventh day of life and late NM which is occurring there after [1]. Globally, in 2019 alone, an estimated 4.01 million children died, mostly from preventable causes. Real progress in reducing deaths of new-born babies in a country with higher neonatal mortality like Ethiopia demands a higher coverage of optimally standard neonatal services with special focus on the poorest segment of the population and at the time of greatest risk, which is at birth and in the first few days of life [2,3]. The first 28 days of life is the most hazardous period for the child's survival. According to the recent estimates of WHO (World Health Organization) about 2.5 million neonatal deaths occur in each year globally and approximately 7,000 neonatal deaths every day. Among these, most of which was occurred

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in the first week of life, with about 1 million neonatal deaths occur within the next six days [4]. Globally, the neonatal mortality rate fell by 51 per cent from 37 deaths per 1,000 live births in 1990 to 18 in 2017. Despite a declining NM rate globally, marked disparities in NM exist across regions and countries. In Sub Saharan Africa (SSA), which has an average NMR of 27 per 1000 live births, this burden still remains unresolved [4,5]. Consequently, all newborn action plan initiatives set specific targets neonatal mortality, and these targets were reflected in the sustainable development goals (SDGs), which call for ending preventable deaths of newborn babies by 2030. The SDGs specify that all countries should aim to reduce the neonatal mortality rate (NMR) to 12 /1000 live births or fewer in 2030 [6]. 28 neonatal deaths per 1000 live births recorded in Ethiopia in 2019, neonatal mortality remains a considerable concern [3]. The Ethiopian government and other stakeholders involve in the reduction of neonatal mortality focus and delivered integrated health service packages of health as evidence-based interventions across a continuum of care at different levels like at the level of the family, community and facility levels by enhancing the availability and accessibility of health services such as maternal health promotion, skilled birth attendance and essential new-born care/treatment but neonatal mortality still high in Ethiopia [3,7].

Other similar studies [8-12] have been conducted in Ethiopia using a retrospective design, thus there is a risk that some of the records studied were not correctly filled with resultant inaccurate results on neonatal hospital mortality and incomplete recording may have an impact on the number of cases for final logistic models. Therefore, this prospective cohort aimed to fill these gaps in determines the neonatal hospital mortality rate and its predictors by taking accurate information from the study participants. Similar but limited number of studies have been conducted in different parts Ethiopia declared that the NM is incomparably high Shewa [13-15]. Despite high the magnitude of NM, the survival time of neonates, incidence of mortality among neonates admitted to NICU was not well investigated and most the studies either included only low birth weight and preterm as NM not limited to these groups. Therefore; this study was aimed to estimate the survival time and to investigate predictors of neonatal mortality among neonates admitted NICU at public hospitals west Shewa zone, Ethiopia.

Methods

Study Setting, Period and Design

A Hospital-based prospective cohort study was carried out at the neonatal intensive care units from August 01 to December 2019 public Hospitals in west Shewa zone, Oromia region. West Shewa zone which is located in the Oromia Regional State is found114 kilometers away to the west of Addis Ababa the capital city of Ethiopia. According to the zonal health office, the total population in the zone is estimated to be 2,381,079 of which 1,214,350 of them are females. In the zone there are an estimated total of 26, 7399 pregnant women. Currently, there are 8 hospitals providing NICU service in the zone

Sample Size Determination and Sampling Procedure

The sample size was calculated by using Epi Info version 7.0.1. The following considerations were made for the cohort study neonatal survival status was considered as an outcome variable and from predictors of time to death, neonates with asphyxia compared with neonates without asphyxia. We assumed neonates with asphyxia were exposed and neonates without asphyxia were considered unexposed considering 1.81 adjusted hazard ratio, 95% confidence level, 80% of power, and a ratio of 1:1 (r=1), the minimum sample size computed was 460 and 10% of non-response rate the final sample size become 506 neonates admitted into NICUs of selected hospitals. Five hospitals (Ambo General, Ambo University Referral hospital, Guder, Gedo and Gindeberet Hospitals) that provided neonatal intensive care unit services in the zone were selected by lottery method. The sample size was proportionally allocated to the five hospitals based on monthly estimated caseload. All consecutive mothers who gave a live birth neonate and admitted to NICU in the selected hospital were included and followed up for a total of 28 days.

Dependent Variable: Survival Time to Death

Independent/exposure Variables: Neonatal characteristic, maternal characteristics and Obstetrical data:

Operational Definitions:

Survival Time: Measures the follow-up of time from a defined starting point/from admission in NICU up to the occurrence of the outcome/last neonatal period.

Survival status: Is the final outcome of neonate; either death or censored.

Data collection instrument, procedures and follow-up: The English version questionnaire was initially prepared by reviewing different related literatures conducted previously [9-17] and then translated to Afan Oromo and back to English by language experts to check consistency. The data were collected from all mothers who delivered a live birth or (from a parents or guardians) and clinical information was extracted using checklist and assessment of the neonate and mother. The data collector visited the neonate daily, while he/she was in the hospital. After the mother was discharged; the data collector met the mother at 7days, 14days, and 21days and 28 days either using appointment at post natal care or a phone call about the neonatal condition and survival. When death occurred, the date and cause of death was recorded. Training was given for data collectors for three days on the objectives of the study, data collection process for the 10 data collectors and 5 supervisors. The pre-test was done on 5% of samples at Wolliso hospital and necessary correction was made one week before actual data collection time.

Data Processing and Analysis

The data was entered into EPI info version 7.1 and exported to Stata version 14 statistical software for further analysis. Basic descriptive analyses were done and presented as frequency and percent for categorical variable. Continuous variables were reported using mean with SD and median with inter quartile range. Kaplan and Meier survival curve with a log-rank test was fitted to test for the presence of a difference in survival time among different predictor variables. The relationship between survival time and the covariates was analyzed using cox regression model. Kaplan and Meier method was used to estimate survival functions and Cox-proportional hazard regression analysis used to identify independent predictors of time to death. Before fitting the covariate into the model proportional hazard assumption was checked by examining Log (-Log) S (t) plots.

Results

Socio-demographic Characteristics

From a total of 506 neonates and their mother involved in the study 495 participated fully in this study making a response rate of 97.8%. The mean ± standard deviation (SD) of the mother's age was 26.6 ± 4.9 years. The majority of the study participants, 481 (97.2%) were married and 262 (52.9%) were rural residents. Regarding educational status, 167 (33.7%) participants didn't attend any formal education and 131 (26.5%) attended only primary education. One hundred thirty-eight (27.9%) of the participants' husbands were learned college and above while 117(23.6%) of them were not educated. Regarding monthly family income, the median (IQR) of family monthly income was 2000 ETB (800 to 4000) ETB (Table 1)

Past Obstetrics and Gynecologic History

In this study, 56 (11.3%) of the mothers had the previous history of abortion and35 (7.1%) of the mothers had a history of stillbirth, and 47(9.5%) low birth weight. The study also indicates that the majority of the study participant 299(60.4%) used family planning and 105(21.2%) used implant, 127 (25.7%) inject able, 46(9.3%) used oral contraceptive 21(4.2%) intrauterine device by type.

Current Obstetrics History

The majority of the mothers were multiparous (had more than one child) 245 (82.2%) and 236 (487.7%) gave birth to the current newborn within two years of previous birth. Among the total of mothers, 404 (81.6%) had ANC and 231 (46.7%) had more than four visits of ANC. Pregnancy- related problem was present among 47 (9.5%) of the mothers, 21(44.9%) develop vaginal bleeding during child. Regarding on labor and delivery process, 362 (73.1%) of the mothers delivered through spontaneous vaginal delivery (SVD), a single baby 438 (88.5%) at public hospital 351 (70.9%)

Neonatal Assessments at Birth

From the total of neonates involved in the follow- up, 320 (64.6%) were males, term gestational age 372 (75.2%) and, had a normal birth weight 292 (59.0%). APGAR (Appearance, Pulse, Grimace, Activity, and respiration) was measured at first and fifth minutes and 133 (26.9%) and 189 (38.2%) were normal at 1st and 5th minute APGAR scores. Regarding the newborn assessment result at birth, 361 (72.9%) cried at birth, 484 (97.8%) dint had a birth injury, 408 (82.4%) had skin to skin contact with their mothers and 231(46.7%) had a normal temperature. Meanwhile, 269 (54.3%) of them didn't start breastfeeding breast feeding within one hour.

Incidence of Death During the Follow-Up

A total of 495 neonates were followed for 28 days at NICU and 78were died and making the neonatal mortality rate (NMR) was 157 per 1000 live births. During the follow-up, 20 (25.6%) neonates died in the first day, 39 (50%) neonates died within three days and 70 (89.7%) neonates died within a week. The median (IQR) follow-up time for the neonates who died was 3 (1-5) days. The incidence rate of neonatal mortality was 27 per 1000 person-days-of observation. Concerning the reason for neonatal death at the NICU were neonatal sepsis (44%), prematurity (25.7%), and respiratory distress syndrome (26.1%) the most reason for death.

Table 1: Socio-demographic characteristics of mothers of neonates admitted at NICU centers of Public hospitals in Oromia regional state, 2019.

Variable	Categories	Frequency	Percentage (%)
Age	18-24	164	33.1
	25-29	175	35.4
	30-34	105	21.2
	>=35	51	10.3
Ethnicity	Oromo	465	93.9
	Amhara	29	5.9
	Gurage	1	0.2
Religion	Orthodox	170	34.3
	Muslim	35	7.1
	Protestant	283	57.2
	Catholic	3	0.6
	Other	4	0.8
Residence	Rural	262	52.9
	Urban	233	47.1
Marital status	married	481	97.2
	others	14	2.8
Mother Education	No Formal Education	167	33.7
	Primary Education (1-8)	131	26.5
	Secondary Education (9-12)	98	19.8
	Collage and above	99	20.0
Father education	No Formal Education	117	23.6
	Primary Education (1-8)	120	24.2
	Secondary Education (9-12)	120	24.2
	Collage and above	138	27.9
Occupation mother	Government employee	63	12.7
	Private employee	60	12.1
	Farmer	141	28.5
	Merchant	63	12.7
	House Wife	168	33.9
Occupation of father	Government employee	118	23.8
	Private employee	74	14.9
	Farmer	215	43.4
	Merchant	88	17.8
Monthly income	<= 1000	171	34.5
	1001 - 2000	98	19.8
	2001 - 4000	111	22.4
	4001+	115	23.2
Distance between home to health institution in KM	less than 10 km	14	2.8
	10-50 km	408	82.4
	greater than 50 km	73	14.7

The Kaplan Meier estimates of mean survival time for the covariates of variables among different group of newborns admitted at neonatal intensive care unit.

The median survival time during one minute APGAR with normal neonates was 5 days (95 % CI: 4.1-5.8), moderate asphyxia 4 days (95 % CI: 2.6-5.3) and severe asphyxia 3 days (95 % CI: 1.9-4.1). The median survival time of neonates with low birth weights was found to be significantly lower than those with normal birth weight, 3 days (95% CI: 1.4-4.6) and 4days (95% CI: 2.4-5.6) respectively. Low birth weight neonates' median survival time is 3 days which was significantly lower by one day than normal birth weight neonates (The median survival time of neonates born from mothers who didn't attend ANC visits during their pregnancy while neonates born from

mothers who attend ANC visits5days (95% CI: 4.2-5.8) (Figure 1). The median survival time of neonates who breastfed within one hour were found to be higher by two days than those who didn't breastfed, 5 days (95% CI: 4.1-6.0) and 2 days (95% CI: 2.1-4.0) respectively. The median survival time of hypothermic neonates was found to be significantly lower than those with normo-thermic, 3 days (95% CI: 1.9-4.2) and 5days (95% CI: 3.2-7.5) respectively). Median survival of neonates born from mothers diagnosed with hypertension during their pregnancy 4days (95% CI: 3.1-4.8) and neonates born from mothers without hypertension during their pregnancy 3days (95%CI: 1.8-4.2) (Table 2).

Table 2: The Kaplan Meier estimates of mean survival time for the covariates of variables among different group of newborns admitted at neonatal intensive care unit.

Characteristics	Dead Number (%)	Median survival time Estimate (95 % CI)	log rank X^2-value	P-value
Ever used family planning			35	0.0001
Yes	24(30.8)	3(1.4-4.6)		
No	54(69.2)	3(1.4-4.6)		
Supported by partner during pregnancy				
Yes	70(89.7)	4(2.8-5.2)	5.58	0.01
No	8(10.3)	2(0.0-4.8)		
Supported by family				
Yes	66(84.6)	4(2.8-5.1)	14.9	0.001
No	12(15.4)	2(0.3-3.6)		
Birth interval				
Within 24 month	23(29.5)	4(2.5-5.5)	10.97	0.001
Greater than 24 month	55(70.5)	3(1.4-4.6)		
Labour onset				
Spontaneous	33(42.3)	5(4.5-5.5)	122.04	0.0001
Induced	45(57.7)	3(2.2-3.8)		
Laour duration				
Less than 12hrs	23(29.5)	4(2.5-5.5)	7.99	0.005
Greater than 12hrs	55(70.5)	3(1.4-4.6)		
Brest feeding within 1hr				
Yes	25(32.1)	5(4.0-5.9)	6.01	0.014
No	53(67.9)	3(2.1-3.9)		
One minute APGAR Normal Moderate Asphyxia Sever Asphyxia	 4 (5.1) 37 (47.4) 37 (47.4)	 5.0 (4.1-5.8) 4.0 (2.6-5.3) 3.0 (1.9-4.1)	138.1	0.0001
Birth Weight Low Birth Weight Normal	 45 (57.7) 33 (42.3)	 3.0 (1.4-4.6) 4.0 (2.4-5.6)	7.5	0.006
Has been diagnosed with Anemia Yes No	 35 (44.9) 43 (55.1)	 4.0 (3.1-4.8) 3.0 (2.8-3.9)	119.3	0.0001
Has been diagnosed with Diabetes mellitus Yes No	 29 (37.2) 49 (62.8)	 4.0 (1.6-4.3) 3.0 (2.7-5.3)	135.1	0.0001
Has been diagnosed with Hypertension Yes No	 34 (43.6) 44 (56.4)	 4.0 (3.1-4.9) 3.0 (1.8-4.2)	83.8	0.0001
Has ANC follow up Yes No	 42 (53.8) 36 (46.2)	 5.0 (4.2-5.8)	54.0	0.0001
Cry at birth Yes No	 49 (62.8) 29(37.2)	 4.0 (2.8-5.1) 2.0 (1.2-2.9)	5.9	0.015
Temperature Hypothermic Normo-thermic	 59 (83.3) 19 (16.7)	 3.0 (1.9-4.2) 5.0 (3.2-7.5)	18.5	0.0001

Predictors of Neonatal Mortality Admitted to NICU

To identify predictors of time to death, Cox proportional regression model was used. Before fitting the covariate into the model, the proportional hazard assumption was checked by examining Log (-Log S (t)) plots. In the final Cox proportional regression model,

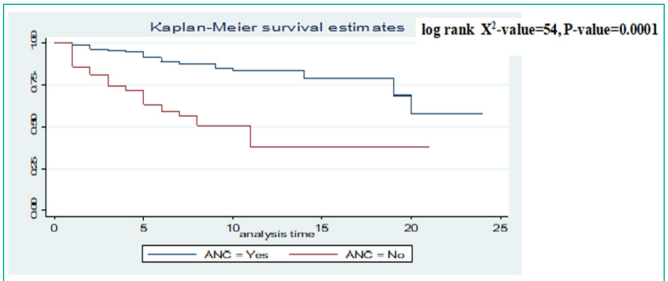

Figure 1: Kaplan and Meier estimate of survival neonates among mothers didn't attend ANC visit Oromia, regional State, 2019.

Table 3: Cox Regression analysis predictors of neonatal mortality admitted at NICU centers in Oromia regional State, 2019.

Characteristics	Status		CHR (95% CI)	AHR (95% CI)
	Dead Number (%)	Censored Number (%)		
Fifth minute APGAR				
Normal	9(1.8)	180(36.4)	1	
Moderate Asphyxia	22(4.4)	219(44.2)	1.93(0.88-4.21)	2.00(0.85-4.75)*
Sever Asphyxia	47(9.5)	18(3.6)	20.32(9.94-41.56)	2.59 (1.53-4.38)*
Has been diagnosed with hypertension				
Yes	34 (6.9)	31(6.3)	6.15(3.93-9.66)	1.78(1.04-3.03)*
No	44 (8.9)	386 (78)		1
Has been diagnosed with anaemia				
Yes	35 (7.1)	18 (3.6)	7.98(5.09-12.51)	2.00 (1.13-3.54)*
No	43 (8.7)	399 (80.6)		1
Birth interval				
Less than 24 month	53(10.7)	197(39.8)	4.6(2.86-7.42)	1.55(1.03-2.34)*
Greater than 24month	25(5.1)	220(44.4)		1
Labour onset				
Spontaneous	33(6.7)	373(75.4)		1
Induced	45(9.1)	44(8.9)	8.30(5.27-13.05)	3.25(1.87-5.65)*
ANC				
Yes	42(8.5)	362(73.1)		1
No	36(7.3)	55(11.1)	4.5(2.90-7.09)	2.06(1.26-3.38)*
Brest feeding within 1hr				
Yes	25 (5.1)	201 (40.6)	1	1
No	53 (10.7)	216 (43.6)	3.07 (1.81-5.22)	1.8 (1.13-2.99)*

*NB: * P-Value less than 0.05.*

seven variables were found to be significantly associated with time to death. Neonates with moderate fifth minute APGAR 2.9 times more likely to die the first 28 days as compared with those with normal APGAR score [AHR: 2.9 (95% CI: 1.1-7.5)]. Neonates born from mothers diagnosed with hypertension and anemia during their pregnancy were 1.78 times and 2.00 more likely to die earlier than their counterparts [AHR: 1.78 (95% CI: 1.04-3.03)], AHR: 2.00 (95% CI: 1.13- 3.54)] respectively. Neonates born from mothers who didn't attend ANC visits during their pregnancy were2.06 times at higher risk of death than neonate born from mother who had ANC visits 4 and above [AHR: 2.06 (95% CI: 1.26-3.38)]. Neonates born by induction has 3.25 times of risk of death as compared with spontaneous vaginal delivery days [AHR: 3.25 (95% CI: 1.87- 5.65)]. Neonates initiated breastfeeding after 1.8 times at higher risk of dying than neonates-initiated breastfeeding [AHR: 1.97(95% CI: 1.16-2.94) (Table 3).

Discussion

This study established that a NMR (157 per 1000 live births) among neonates admitted in the NICU. Similar findings reported in Cameron (157 per 1000 live births) [16], Nepal (200) [17], Amhara region (186) [18], Wolaita Sodo (173) [19]. However, the current study findings higher than the result of other previous studies done in Iran- 91 [20], Suriname- 129 [21], Indonesia- 52 [22] and EDHS 2019 report- 30 [3]. It is also higher as compared to local studies conducted in various part of Ethiopia such as the Somali region of Ethiopia- 57 [9], Jimma Zone- 35.5 [15], in Kersa distric - 28.37 [23], Tigray, Ethiopia-62.5 [13], Debremarkos 25.8 [24] and Aroresa district-41 [14]. The higher mortality in our study could be explained by the fact that neonates admitted to the NICU are usually those who need intensive care and held a higher risk of death. EDHS and Jimma studies were conducted at a community level and in both of the cases [3,15]; many healthy neonates included in the study which makes the mortality could be lower. This finding revealed that most neonatal deaths occurred in the first 24 h and in the first week of life, which is consistent with different studies in debre markos referral hospital, Black Lion Specialized hospital, Tigray region, Gondar Northwest Ethiopia and Aroresa district [11,13,14,25,26].

This study showed that neonates whose fifth minute Apgar score classified as moderate had three times higher a risk of neonatal death compared with those with a normal Apgar score. This finding is confirmed by other studies conducted Brazil, USA, New York, Sweden Debremarkos referral hospital and Black Lion Specialized hospital [25-30]; for example, Black Lion Specialized Hospital reported a threefold increased risk of neonatal death for this group compared with children who had normal Apgar scores [26]. The finding that an increase in the Apgar score from 5 minutes to 10 minutes may reflect a better health status at 5 minutes in infants whose scores subsequently increased than in those whose scores did not increase. Also, neonates born from mothers who had medical disorders increased the risk of death by 28% as compared with their respective referent group (AHR = 2.8), 95%CI (1.3-5.7). This finding agrees with study conducted in Tigray region, Aroresa district, southern nation Debra markos Ghana, north Shewa, amahara region [13,14,25,31-33]. This is might be timely initiation of breastfeeding guarantees that infants receive the colostrums, 'the first breast milk', which contains antibodies that protect the newborn against diseases. The current study found that a lack of ANC follow-up was significantly associated with increased neonatal mortality. Neonates born to mothers who didn't attend ANC visits were at higher risk of death as compared to neonates born to those who had ANC visit. This finding aligns with previous studies conducted in Nigeria, Uganda, North Shewa, Amahara region and Debra markos [19,25,32,34,35]. This is might be ANC visits may assist in screening, diagnosing and managing or controlling the risk factors that might adversely affect the pregnant women and/or the pregnancy outcome. This study showed that newborn mortality is increased if labor is initiated by induction as compared with spontaneous initiation of labor. This finding supported by a study conducted in Netherlands and southern nation [33,36]. This might be due to start of labour under primary care means, in principle, that pregnancy was uncomplicated. The spontaneous start of labour at 37 weeks of gestation carries more risk in itself, which needs more intensive monitoring during labour, delivery and in the first days/weeks of life. The chance of neonatal mortality in mothers diagnosed with hypertension is higher than in healthy mothers, which is consistent with the results of other studies conducted in the United States and Iran [37,38]. This might be due to decreased uteroplacental blood perfusion in hypertensive. Short birth intervals of less than 24 months were associated with increased stillbirth rate and neonatal mortality. Neonate born from mothers with less than 24 months before attempting a next pregnancy were two times more likely to die when compared to respective reference. This is supported by a study conducted in Bangladesh and WHO [39].

Conclusion and Recommendation

The risk of mortality among neonates admitted to NICU was high. Short birth interval, neonates with lower Apgar score, neonates who not initiating breastfeeding within one hours, neonates born from mothers diagnosed with hypertension and anemia during their pregnancy, neonates born from mothers who didn't attend ANC visits during their pregnancy and neonates born by induction are at higher risk of death in the NICU, therefore special attention and care should give to prolong their survival time. Therefore, screening blood pressure among women of reproductive age and regular control of blood pressure during pregnancy play a significant role in reducing the consequences of this disease for pregnant women and inter-pregnancy interval through family planning counseling and provision, providing all initial newborn cares, and having the recommended ANC follow-up was recommended. Study was conducted at a health facilities, therefore neonates delivered at home and died at home could be missed this can be as limitation of the study. Furthermore, in this study, the impact of supplies, equipment, and hospital service contexts have not been explored. Study was conducted at a health facilities, therefore neonates delivered at home and died at home could be missed this can be as limitation of the study. Furthermore, in this study, the impact of supplies, equipment, and hospital service contexts have not been explored.

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