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Neonatal mortality and associated factors among preterm neonates admitted to Jigjiga University Sheikh Hassan Yabare Comprehensive Specialized Hospital, Ethiopia: A retrospective cross-sectional study

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Research Article

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Abstract

Background

Globally one out of ten babies born are preterm. Preterm neonates have many morbidities and high risk of mortality. Although modifiable risk factors and cost-effective interventions exist, data on preterm neonatal mortality in Somali region is lacking. The study aimed to assess neonatal mortality and associated factors among preterm neonates admitted to Jigjiga University Sheikh Hassan Yabare Comprehensive Specialized Hospital, Somali, Eastern Ethiopia.

Methods

A retrospective cross-sectional study was conducted from February 09, 2024 to February 07, 2026 at Jigjiga University Sheikh Hassan Yabare Comprehensive Specialized Hospital. All 440 preterm neonates who were admitted during the study period were included. Data was entered into epidata 7.2.7.0 and analyzed using SPSS version 25.0. Multicollinearity was assessed by variation inflation factor and it was < 4. The model fitness was evaluated using hosmer lemeshow test and its P-value was 0.53. Statistical significance was declared with a P-value < 0.05.

Results

The magnitude of preterm neonatal mortality was 30.3% (95% CI: 25.9 to 34.8). Birth weight < 1500gram (AOR = 3.23;95% CI :1.65–6.32), 5th minute APGAR < 7(AOR = 4.09;95% CI :1.42–11.75) ,hypothermia during hospital stay(AOR = 5.09; 95% CI: 2.50-10.36), resuscitation at birth(AOR = 0.28;95% CI :0.09–0.87),kangaroo mother care (AOR = 0.17; 95% CI:0.09–0.32) and feeding initiation within 24 hours (AOR = 0.19; 95% CI: 0.10–0.37) were significantly associated factors.

Conclusion

In this study, mortality among preterm neonates was high. Therefore, proper labor follow up, resuscitation at birth, preventing and treating hypothermia, KMC and early feeding initiation should be implemented.In addition prospective, multicenter studies should be conducted.

INTRODUCTION

A live-born baby born before 37 full weeks of gestation, determined from the first day of the last normal menstrual period (LNMP), is referred to as a preterm neonate (1).Worldwide, an estimated 15 million babies are delivered prematurely every year, majority of them being in low- and middle-income countries (LMICs) (2, 3). Complications related to prematurity account for a substantial proportion of neonatal deaths and continue to pose major challenges to achieve global child survival targets (4).

Numerous complications, such as hyaline membrane disease(HMD) ,episodes of apnea, persistent patent ductus arteriosus (PDA), necrotizing enterocolitis (NEC), hyperbilirubinemia, hypoglycemia, hypothermia, retinopathy of

prematurity, abnormalities in electrolyte balance and neonatal sepsis are common in preterm infants due to biologic immaturity of organ systems (5) .

The highest neonatal mortality rate in the world is found in sub-Saharan Africa, where newborns are ten times more likely to die within the first 28 days of life than those born in wealthy countries (6).

In terms of global newborn mortality, Ethiopia is among the countries with high neonatal mortality (7). Ethiopia had planned to lower the neonatal mortality rate to 21 per 1,000 live births by 2025 as part of its Health Sector Transformation Plan II (8); yet, it persisted at a high rate 25 per 1,000 live births (9). Preterm delivery problems and other preventable causes account for almost 80% of newborn deaths in Ethiopia (10).

Various studies have identified that premature neonatal death is pertaining to factors related to the mother and newborn socio-demographic characteristics, maternal medical conditions, obstetric & gynecological factors, as well as aspects of treatment and healthcare facility provision (11–13).

However, evidence from the Somali region of Eastern Ethiopia remains limited. Identifying locally relevant determinants of mortality among preterm neonates is important for improving neonatal intensive care practices and guiding targeted interventions.

Therefore, this study aimed to assess the magnitude of preterm neonatal mortality and identify associated factors among preterm neonates admitted to the NICU of Jigjiga University Sheikh Hassan Yabare Comprehensive Specialized Hospital, Eastern Ethiopia.

METHODS

Study Area and Period

Jigjiga University Sheikh Hassen Yabare Comprehensive Specialized Hospital is the first and largest specialized hospital and medical school in Somali regional state of Ethiopia.

It is at center of Jigjiga city,which is located 610 Km away from Addis Ababa in the Eastern part of Ethiopia and it is expected to cover an estimated population of more than 7 (seven) million people living in the region and neighboring district of Oromia region. It also receives referrals from large part of neighboring countries, like Somaliland and Puntland.

It was inaugurated on 2017. The hospital is built on 60,000m2 land.it is ground plus two floors built with wide corridors with 364 different sizes of rooms ,4 lifts and large parking lots including mini-airport for helicopters use (if necessary).

The hospital has around 1680 health care professionals and supportive staff, 355 beds, 8 bed of intensive care unit, 3 beds of maternal intensive care unit, pharmacies and clinical lab facilities.

The pediatrics department has emergency OPD,inpatient service,nutritional unit,intensive care unit and NICU .

The NICU has triage room,KMC room, admission room and room for maternal side with a total of 40 beds.It has a level III neonatal care unit providing specialized care for preterm and critically ill newborns. Services include neonatal resuscitation, CPAP, KMC,oxygen therapy, phototherapy, intravenous fluid therapy,antibiotic treatment,

feeding support and neonatal surgical survices.The unit is staffed with 1(one) neonatologist,03 pediatricians,05 residents and 15 nurses.

The study was conducted at JJUSHYCSH, retrospectively from February 09, 2024 to February 07, 2026.

Study Design

An institution-based retrospective cross-sectional study design was employed.

Source and study Population

Source population: All preterm neonates admitted to the NICU of JJUSHYCSH

Study population: All eligible preterm neonates admitted to the NICU of JJUSHYCSH during the study period whose records met the inclusion criteria .

Inclusion & Exclusion Criteria

Preterm neonates with gestational age < 37 weeks, neonates with documented outcomes, neonates with relevant complete medical records relevant for the study were included. On the other hand neonates with relevant incomplete charts, neonates who were referred out, neonates discharged against medical advice and neonates admitted only for observation were excluded.

Sample Size and Sampling Technique

All of the 440 preterm neonates who were admitted during the study period were included. They were listed in the notebook based on their medical record numbers in order of admission. But only 412 neonates fulfill the inclusion criteria(Fig. 1).

OPERATIONAL DEFINITIONS

Neonatal mortality: death of a live born infant within the first 28 days of life (6).

Hypothermia: axillary body temperature less than 36.5 oc (1) .

KMC:the care of preterm or LBW infants in continuous and prolonged skin-to-skin contact(2).

Hypoglycemia: blood glucose < 25 in 1st 4hours, < 35 from 4 to 24hours, < 50 from 24-48hours and < 60 after 48hours of life(5).

Perinatal asphyxia

inability to start and maintain effective breathing at the time of birth(7) .

Type of pregnancy: singleton or multiple pregnancy

Congenital anomaly: any structural or functional abnormality present at birth(1).

Resuscitation at birth: any resuscitative intervention provided immediately after birth i.e. positive pressure ventilation or advanced resuscitation but does not include initial steps (drying / stimulation).(5)

Data Collection Methods

Pre-tested and organized data collection tool which was adapted from previous comparable studies (11, 15, 16, 17) and prepared in English was used to collect data. The tool was comprised of sociodemographic characteristics, maternal and obstetric factors, neonatal factors, and health care related factors. Before data collection begins recruitment of qualified data collectors (4 residents and 6 nurses) was done and was regularly supervised by the principal investigator. Data was collected by reviewing the registration records of the NICU at JJUSHYCSH.

Data quality control

The principal investigator supervised the data collection process. The completeness of collected data was reviewed and any missing or inconsistent information was addressed and corrected prior to entry into the database. One week ahead of the actual survey, pretest was carried out at Karamara General hospital, taking 5% of calculated sample size and necessary modifications were carried out before actual data collection on the study. The hospital was selected because it has similar neonatal care setting and patient population to the study hospital but was not included in the study.

Data Processing *and Analysis*

Data was cleaned, coded and imported into epiData and then was exported to SPSS version 25.0 for analysis. The dependent variable was analyzed as a binary outcome and coded. Independent variables were coded according to their recorded status in the data collection tool.Binary variables were coded according to the presence or absence of the respective condition. Categorical variables with more than two categories were entered as categorical predictors with an explicitly specified reference category. The study variables were summarized by descriptive statistics. Frequencies and percentages were used to present categorical variables ,whereas continuous variables were summarized using either the mean with standard deviation or the median with interquartile range, depending on the distribution of the data .

Maternal sociodemographic variables included maternal age (< 20, 20–34, and ≥ 35 years) and maternal residence (Jigjiga city and outside Jigjiga city).

Maternal obstetric and medical variables included type of pregnancy (singleton, multiple), parity (1, 2–4, and ≥ 5), ANC follow-up (0, 1–3, and ≥ 4 visits), duration of labor (no labor, < 8, 8–24, and ≥ 24 hours), mode of delivery (spontaneous vaginal delivery and cesarean section), place of delivery (home, health center, and hospital), PROM (no PROM, < 18 hours, and ≥ 18 hours), maternal triple I (no/yes), antepartum hemorrhage (no/yes), preeclampsia (no/yes), and maternal hepatitis (no/yes).

Neonatal characteristics included sex (female/male), age at admission (< 24 and ≥ 24 hours), gestational age (< 28, 28–$31^{6}/_{7}$, 32–$33^{6}/_{7}$, and 34–$36^{6}/_{7}$ weeks), birth weight (< 1000 g, 1000–1499 g, and 1500–2500 g), APGAR score at 1st minute (< 7 and ≥ 7), and APGAR score at 5th minute(< 7 and ≥ 7).

Neonatal clinical conditions were coded as dichotomous variables (no/yes) and included respiratory distress syndrome (RDS), neonatal sepsis, perinatal asphyxia, hypothermia, hypoglycemia, neonatal hyperbilirubinemia (NHB), necrotizing enterocolitis (NEC), and congenital anomalies.

Health service related variables included resuscitation at birth (no/yes), oxygen therapy (no/yes), antibiotic therapy initiated (no/yes), kangaroo mother care (KMC) (no/yes), feeding initiated within 24 hours (no/yes), antenatal corticosteroid administration (no/yes), antenatal antibiotic administration (no/yes), and antenatal magnesium sulfate administration (no/yes).

Length of hospital stay was categorized as < 1 day, 1–7 days, and ≥ 7 days.

The outcome variable was neonatal outcome at discharge, coded as survived or died .

The variance inflation factor (VIF) was used to assess multicollinearity among the independent variables. Multicollinearity was not shown and value of VIF was less than 4.The association between each independent variable and newborn mortality was investigated using bivariable binary logistic regression. In order to find factors independently linked to neonatal mortality, variables having a P-value < 0.25 in the bivariable analysis were included as candidates in the multivariable logistic regression analysis.

To identify the independent factors linked to newborn mortality for controlling relevant confounders, a multi-variable binary logistic regression analysis was used. Adjusted odds ratios with 95% confidence interval (CI) was used to illustrate how strong these associations were.Missing observations and variables with sparse or zero cells have been left because these could produce unstable estimates and wide confidence intervals.Variables were stated statistically significant if their P-value were less than 0.05.Model fitness was evaluated using the hosmer-lemeshow test, where a P-value was 0.53, which was acceptable model fitness. Tables and figures were used to display the results.

RESULTS

Among 440 preterm neonates, 412(93.6%) were included in the study. Fifteen charts were incomplete, six were referred out and seven were discharged against medical advice (Fig. 1).

Maternal socio-demographic, medical and Obstetric Characteristics

Most (76.5%) mothers were in the age range 20-34yrs. More than half of them (61.9%) were singleton pregnancies and 62.1% of mothers had ANC follow-up. 60.4% of mothers delivered through SVD, while 39.6% delivered via cesarean section(Table 1).

Table 1
Maternal factors of preterm neonates admitted to NICU JJUSHYCSH, 2026(n = 412).

Variables	Category	Total(%)	Survived (%)	Died (%)
Maternal age	< 20	41(10)	30 (10.4)	11(8.8)
	20–34	315(76.4)	229(79.8)	86(68.8)
	≥ 35	56(13.6)	28 (9.8)	28(22.4)
Maternal residence	Jigjiga city	256(62.1)	174(60.6)	82(65.6)
	Outside Jigjiga city	156(37.9)	113(39.4)	43(34.4)
Type of pregnancy	Singleton	255(61.9)	192(66.9)	63(50.4)
	Multiple	157(38.1)	95 (33.1)	62(49.6)
Parity	1	149(36.2)	110(38.3)	39(31.2)
	2–4	151(36.6)	108(37.6)	43(34.4)
	≥5	112(27.2)	69 (24.1)	43(34.4)
ANC Follow Up	0	156(37.9)	121(42.2)	35(28)
	1–3	192(46.6)	125(43.5)	67(53.6)
	≥ 4	64(15.5)	41 (14.3)	23(18.4)
Duration of labor(hours)	no	56(13.6)	49 (17.1)	7 (5.6)
	< 8	190(46.1)	134(46.7)	56(44.8)
	8–24	133(32.3)	81 (28.2)	52(41.6)
	≥ 24	33(8.0)	23 (8)	10(8)
Mode of delivery	SVD	149(36.2)	163(56.8)	86(68.8)
	Cesarean Section	163(63.8)	124(43.2)	39(31.2)
Place of delivery	Home	17(4.1)	15 (5.2)	2 (1.6)
	Health center	38(9.2)	28 (9.8)	10 (8)
	Hospital	357(86.7)	244(85)	113(90.4)
PROM(in hours)	no	318(77.2)	230(80.1)	88(70.4)
	< 18	36(8.7)	20 (7)	16(12.8)
	≥ 18	58(14.1)	37 (12.9)	21(16.8)
Maternal triple I	no	397(96.4)	279(97.2)	118(94.4)
	yes	15(3.6)	8 (2.8)	7 (5.6)
Antepartum Hemorrhage	no	352(85.4)	238(82.9)	114(91.2)

ANC, antenatal care; PROM, premature rupture of membrane; SVD, spontaneous vaginal delivery

Variables	Category	Total(%)	Survived (%)	Died (%)
	yes	60(14.6)	49 (17.1)	11 (8.8)
Preeclampsia	no	352(85.4)	243(84.7)	109(87.2)
	yes	60(14.6)	44 (15.3)	16 (12.8)
Maternal hepatitis	no	402(97.6)	282(71.9)	120(58.4)
	yes	10(2, 4)	5(18.1)	5(41.6)

ANC, antenatal care; PROM, premature rupture of membrane; SVD, spontaneous vaginal delivery

Neonatal Characteristics

Among the neonates, 60.9% were female. Most neonates (62.6%) were moderate to late preterm. Low birth weight (1500–2500 g) accounted for 58.0% of the neonates. Respiratory distress syndrome was diagnosed in 52.9% of neonates, neonatal sepsis in 86.7%, and hypothermia in 69.4%(Table 2).

Table 2
Neonatal factors of preterm neonates admitted to NICU of JJUSHYCSH, 2026(n = 412).

Variables	Category	Total (%)	Survived (%)	Died (%)
Sex of the neonate	Female	251(60.9)	178(62)	73(58.4)
	Male	161(39.1)	109(38)	52(41.6)
Age of the neonate at admission (in hours)	< 24	386(93.7)	267(93)	119(95.2)
	≥ 24	26(6.3)	20(7)	6.0(4.8)
Gestational age (in weeks)	< 28	20(4.9)	4(1.4)	16(12.8)
	28–31⁶⁄₇	134(32.5)	81(28.2)	53(42.4)
	32–33⁶⁄₇	105(25.5)	81(28.2)	24(19.2)
	34–36⁶⁄₇	153(37.1)	121(42.2)	32(25.6)
Birth weight(in grams):	< 1000	18(4.4)	5(1.8)	13(10.4)
	1000–1499	155(37.6)	83(28.9)	72(57.6)
	1500–2500	239(58)	199(69.3)	40(32)
APGAR score at 1st minute	< 7	232(58.7)	160(55.7)	72(58.5)
	≥ 7	163(41.3)	112(44.3)	51(41.5)
APGAR score at 5th minute	< 7	100(25.3)	52(19.1)	48(39)
	≥ 7	295(74.7)	220(70.9)	75(61)
Respiratory distress syndrome (RDS)	no	194(47.1)	158	36(28.8)
	yes	218(52.9)	129	89(71.2)
Neonatal sepsis	no	55(13.3)	42(14.6)	13(10.4)
	yes	357(86.7)	245(85.4)	112(89.6)
Perinatal asphyxia	no	345(83.7)	245(85.4)	100(80)
	yes	67(16.3)	42(14.6)	25(20)
Hypothermia	no	126(30.6)	108(37.6)	18(14.4)
	yes	286(69.4)	179(62.4)	107(85.6)
Hypoglycemia	no	374(90.8)	263(91.6)	111(88.8)
	yes	38(9.2)	24(8.4)	14(11.2)
Neonatal hyperbilirubinemia (NHB)	no	331(80.3)	229(79.8)	102(81.6)
	yes	81(19.7)	58(20.2)	23(18.4)
Necrotizing enterocolitis(NEC)	no	365(88.6)	263(91.6)	102(81.6)

APGAR=Appearance, Pulse, Grimace, Activity, Respiration

Variables	Category	Total (%)	Survived (%)	Died (%)
	yes	47(11.4)	24(8.4)	23(18.4)
Congenital anomalies	no	387(93.9)	274(95.5)	113(90.4)
	yes	25(6.1)	13(4.5)	12(9.6)
APGAR=Appearance, Pulse, Grimace, Activity, Respiration				

Health Service-Related Factors

More than half (65.5%) of neonates were managed with oxygen therapy, while 51.2% received kangaroo mother care. Feeding within 24 hours was initiated for 54.6% of neonates .72(57.6%) of them were early neonatal deaths (Table 3).

Table 3
Health service related factors of preterm neonates admitted to NICU of JJUSHYCSH, 2026(n = 412). KMC, kangaroo mother care; NICU, neonatal intensive care unit

Variables	Category	Total	Survived (%)	Died (%)
Resuscitation at birth	no	318(80.5)	228(83.8)	90(73.2)
	yes	77(19.5)	44 (16.2)	33(26.8)
Oxygen therapy	no	142(34.5)	112(39)	30(24)
	yes	270(65.5)	175(61)	95(76)
Antibiotic therapy initiated	no	43(10.4)	36(12.5)	7(5.6)
	yes	369(89.6)	251(87.5)	118(94.4)
KMC	no	201(48.8)	103(35.9)	98(78.4)
	yes	211(51.2)	184(64.1)	27(21.6)
Feeding initiated within 24 hours	no	187(45.4)	89(31)	98(78.4)
	yes	225(54.6)	198(69)	27(21.6)
Antenatal corticosteroid administration	no	320(77.7)	218(76)	102(81.6)
	yes	92(22.3)	69(24)	23(18.4)
Antenatal antibiotics administration	no	386(93.7)	271(94.4)	115(92)
	yes	26(6.3)	16(5.6)	10(8)
Antenatal magnesium sulfate administration	no	359(87.1)	247(86)	112(89.6)
	yes	53(12.9)	40(14)	13(10.4)
Length of hospital stay (in days)	< 1	24(5.8)	17(5.9)	7(5.6)
	1–7	183(44.4)	118(41.1)	65(52)
	≥ 7	205(49.8)	152(53)	53(42.4)
Outcome of the neonate			287(69.7)	125(30.3)

Magnitude of Preterm Neonatal Mortality

The magnitude of preterm neonatal mortality was 30.3% (95% CI: 25.9–34.8). Among them 55.2% were < 32 weeks and 68.0% were < 1500 grams (Fig. 2).

Factors Associated with Preterm Neonatal Mortality

After bivariable binary logistic regression analysis, variables with a P-value < 0.25 were imported to multivariable binary logistic regression analysis.

In the multivariable binary logistic analysis birth weight < 1500 gram,5th minute APGAR < 7, hypothermia at hospital stay, resuscitation at birth, kangaroo mother care (KMC) and feeding initiation within 24 hours were statistically significant factors.

The odds of preterm neonatal mortality was 3.2 times higher (AOR = 3.23; 95% CI: 1.65–6.32) among neonates whose birth weight was less than 1500grams compared to those ≥ 1500grams.

The odds of preterm neonatal mortality was 4.1 times higher (AOR = 4.09; 95% CI: 1.42–11.75) among neonates whose 5th minute APGAR < 7 as compared to those ≥ 7.

The odds of preterm neonatal mortality was 5.1 times higher (AOR = 5.09; 95% CI: 2.50-10.36) among hypothermic neonates as compared to normothermic babies.

The odds of preterm neonatal mortality was 72% lower (AOR = 0.28 ;95%CI: 0.09–0.87) among neonates who were resuscitated as compared to those who were not resuscitated.

The odds of preterm neonatal mortality was 83% lower (AOR = 0.17; 95% CI: 0.09–0.32) among neonates KMC given as compared to those who had not given KMC. In the meantime, the odds of preterm neonatal mortality was 81% lower (adjusted odd ratio (AOR) = 0.19;95% CI 0.10–0.37) among neonates whose feeding was initiated within 24 hours as compared to those whose initiation was more than 24 hours(Table 4).]

Table 4

Bivariable and multivariable analysis of factors associated with preterm neonatal mortality of neonates admitted to NICU of JJUSHYCSH, Jigjiga, Ethiopia, 2026 (n = 412)

Variables	Category	Outcome		COR(95%CI)	P-value	AOR(95%CI)	P-value
		Survived (%)	Died (%)				
Maternal age	< 20	30 (10.4)	11(8.8)	1		1	
	20–34	229(79.8)	86(68.8)	1.02(0.49–2.13)	0.95	0.36(0.11–1.17)	0.09
	≥ 35	28 (9.8)	28(22.4)	2.73(1.15–6.49)	0.02	1.32(0.29–6.09)	0.72
Type of Pregnancy	singleton	192(66.9)	63(50.4)	1		1	
	multiple	95 (33.1)	62(49.6)	1.99(1.30–3.05)	0.00	1.83(1.00-3.37)	0.05
Parity	1	110(38.3)	39(31.2)	1		1	
	2–4	108(37.6)	43(34.4)	1.12(0.68–1.87)	0.66	1.98(0.95–4.13)	0.07
	≥ 5	69 (24.1)	43(34.4)	1.76(1.04–2.98)	0.04	0.84(0.34–2.08)	0.70
ANC follow up	0	121(42.2)	35(28)	0.52(0.27–0.97)	0.04	1.17(0.42–3.30)	0.57
	1–3	125(43.5)	67(53.6)	0.96(0.53–1.73)	0.88	0.76(0.28–2.08)	0.77
	≥ 4	41 (14.3)	23(18.4)	1		1	
Duration of labor(hours)	no	49 (17.1)	7 (5.6)	1		1	
	< 8	134(46.7)	56(44.8)	2.93(1.25–6.85)	0.01	1.27(0.39–4.08)	0.69
	8–24	81 (28.2)	52(41.6)	4.49(1.89–10.67)	0.00	1.42(.40-5.07)	0.59
	≥ 24	23 (8)	10(8)	3.04(1.03–9.01)	0.00	0.53(0.11–2.73)	0.45
Mode of delivery	SVD	163(56.8)	86(68.8)	1		1	
	CS	124(43.2)	39(31.2)	0.60(0.38–0.93)	0.02	0.73(0.38–1.40)	0.35
Place of delivery	Home 15(5.2) 2(1.6) 0.29(0.07–1.28) 0.10 0.59(0.19–1.88) 0.38						
	H/center 28(9.8) 10 (8) 0.77(0.36–1.64) 0.50 0.47(0.79–1.62) 0.29						

* Significantly associated factors

AOR,adjusted odds ratio; COR,crude odds ratio; GA,gestational age; hrs,hours; KMC,kangaroo mother care ; MgSO4,magnesium sulfate ;NEC,necrotizing enterocolitis; RDS,respiratory distress syndrome

Variables	Category	Outcome		COR(95%CI)	P-value	AOR(95%CI)	P-value
		Survived (%)	Died (%)				
	Hospital	244(85)	113(90.4)	1	1		
PROM(in hours)	no	230(80.1)	88(70.4)	1		1	
	< 18	20 (7)	16(12.8)	2.09(1.04–4.22)	0.04	0.50(0.15–1.63)	0.25
	≥ 18	37 (12.9)	21(16.8)	1.48(0.82–2.67)	0.19	1.40(0.50–3.93)	0.52
Maternal triple I	yes	15(3.6)	8(2.8)	2.07(0.73–5.84)	0.17	0.87(0.06–11.80)	0.92
	no	279(97.2)	118(94.4)	1		1	
APH	yes	49 (17.1)	11 (8.8)	0.47(0.24–0.94)	0.03	0.92(0.34–2.49)	0.87
	no	238(82.9)	114(91.2)	1		1	
Maternal hepatitis	yes	5(18.1)	5(41.6)	2.35(0.67–8.27)	0.18	0.81(0.12–5.74)	0.84
	no	282(71.9)	120(58.4)	1		1	
GA(weeks)	< 32	85(29.6)	69(55.2)	2.93(1.90–4.52)	0.00	0.52(0.20–1.32)	0.17
	≥ 32	202(70.4)	56(44.8)	1		1	
Birth weight(grams)	< 1500	88(30.7)	85(68)	4.81(3.06–7.55)	0.00	3.23(1.65–6.32)	0.00*
	≥ 1500	199(69.3)	40(32)	1		1	
5th minute APGAR	< 7	52(19.1)	48(39)	2.71(1.69–4.34)	0.00	4.09(1.42–11.75)	0.01*
	≥ 7	220(70.9)	75(61)	1		1	
RDS	yes	129(44,9)	89(71.2)	3.03(1.93–4.76)	0.00	1.40(0.67–2.90)	0.37
	no	158(55.1)	36(28.8)	1			
Neonatal sepsis	yes	245(85.4)	112(89.6)	1.48(0.76–2.86)	0.248	1.21(0.40–3.63)	0.74
	no	42(14.6)	13(10.4)	1		1	
Perinatal asphyxia	yes	42(14.6)	25(20)	1.46(0.84–2.52)	0.18	0.68(0.22–2.13)	0.51

* Significantly associated factors

AOR,adjusted odds ratio; COR,crude odds ratio; GA,gestational age; hrs,hours; KMC,kangaroo mother care ; MgSO4,magnesium sulfate ;NEC,necrotizing enterocolitis; RDS,respiratory distress syndrome

Variables	Category	Outcome		COR(95%CI)	P-value	AOR(95%CI)	P-value
		Survived (%)	Died (%)				
	no	245(85.4)	100(80)	1		1	
Hypothermia	yes	179(62.4)	107(85.6)	3.59(2.06–6.24)	0.00	5.09(2.50-10.36)	0.00*
	no	108(37.6)	18(14.4)	1		1	
NEC	yes	24(8.4)	23(18.4)	2.47(1.34–4.56)	0.00	1.75(0.75–4.07)	0.20
	no	263(91.6)	102(81.6)	1		1	
Congenital anomalies	yes	13(4.5)	12(9.6)	2.24(0.99–5.06)	0.05	2.96(0.94–9.38)	0.07
	no	274(95.5)	113(90.4)	1		1	
Resuscitation at birth	yes	44 (16.2)	33(26.8)	1.90(1.14–3.17)	0.01	0.28(0.09–0.87)	0.03*
	no	228(83.8)	90(73.2)	1		1	
Oxygen therapy	yes	175(61)	95(76)	1		1	
	no	112(39)	30(24)	2.03(1.26-3,26)	0.00	0.62(0.23–1.68)	0.35
Antibiotic therapy	yes	251(87.5)	118(94.4)	1	0.11	1	0.99
	no	36(12.5)	7(5.6)	2.02(0.86–4.72)		0.99(0.24–4.17)	
KMC	yes	184(64.1)	27(21.6)	0.15(0.10–0.25)	0.00	0.17(0.09–0.32)	0.00*
	no	103(35.9)	98(78.4)	1		1	
Feeding within 24 hrs	yes	198(69)	27(21.6)	0.12(0.08–0.20)	0.00	0.19(0.10–0.37)	0.00*
	no	89(31)	98(78.4)	1		1	
Antenatal corticosteroid	yes	69(24)	23(18.4)	1	0.21	1	0.70
	no	218(76)	102(81.6)	1.40(0.83–2.38)		1.17(0.54–2.51)	

* Significantly associated factors

AOR,adjusted odds ratio; COR,crude odds ratio; GA,gestational age; hrs,hours; KMC,kangaroo mother care ; MgSO4,magnesium sulfate ;NEC,necrotizing enterocolitis; RDS,respiratory distress syndrome

Variables	Category	Outcome		COR(95%CI)	P-value	AOR(95%CI)	P-value
		Survived (%)	Died (%)				
Length of hospital stay (in days)	< 1	17(5.9)	7(5.6)	1.18(0.46-3.00)	0.73	6.10(1.66–22.47)	0.01
	1–7	118(41.1)	65(52)	1,58(1.02–2.44)	0.04	1.48(0.79–2.80)	0.22
	≥7	152(53.0)	53(42.4)	1	1		
* Significantly associated factors							
AOR,adjusted odds ratio; COR,crude odds ratio; GA,gestational age; hrs,hours; KMC,kangaroo mother care ; MgSO4,magnesium sulfate ;NEC,necrotizing enterocolitis; RDS,respiratory distress syndrome							

DISCUSSION

The magnitude of preterm neonatal mortality in this study was 30.3%(95% CI: 25.9 to 34.8), which is consistent to studies done in Uganda [31.6%] (18), Nigeria [31.5%] (19), and Ethiopia[30%, 29.31%, 29%](20, 21, 22).This may be due to study settings were in tertiary health care institutions ,studies were in LMICs and the studies were cross sectional studies, .

It was high compared with studies done in Iran [9.1%] (23), Gabon [18.7%](24), study on global prevalence of preterm neonatal mortality [8%](25) and Ethiopia(Wolayita Sodo [10.9%] (17)). The possible reason for the discrepancy with studies done in Iran and Gabon might be sociodemographic, economic variation, availability of basic interventions, especially surfactant and quality of care provided between the two countries and Ethiopia(2, 43). Discrepancy from remaining one could be due to variation in the study design. However,these factors were not evaluated in the present study; therefore,they should be considered as a possible explanations rather than conclusions from supported by our data.

However, it was low compared with studies done in Ethiopia (Mizan Tepi(2016–2019)[35%] (12),Bahir Dar (2017–2018)[36.1%] (13), multicenter study in Amhara region (2017–2018) [37.8%](26) and Jordan (2012–2013)[40%] (27). This might be due to the improvement in care in recent years due to access to healthcare service, the accessibility of trained healthcare professionals and the behaviour of the community toward the search and utilization of health in Ethiopia (8).

In the present study, Preterm neonates with birth weight less than 1500grams had higher risk of mortality as compared to those 1500grams and above. This finding was supported by findings in Bahir Dar(13) and Tigray (14) and Addis Ababa(28). This may be due to the fact that low birth weight preterm neonates have low levels of brown fat that predisposes them to hypothermia and hypoglycemia thereby increasing their risk of mortality. Physiologically, these neonates have immature organ development (especially the lungs), metabolic dysregulation, poor feeding ability, and higher risk of infections, all of which could increase susceptibility for various preterm morbidities and death(1, 5).

Preterm neonates with APGAR score less than seven had higher risk of mortality as compared to those greater than seven. This finding was supported by findings in Gondar (29),Guji and Borena (30). The increased risk of mortality among neonates with a fifth-minute APGAR score of < 7 may be attributed to the severity of their clinical condition at birth. A low APGAR score indicates difficulty in adapting to extrauterine life and is frequently

associated with complications such as birth asphyxia, respiratory failure, and hemodynamic instability. Consequently, these neonates often require intensive monitoring and advanced neonatal care and are more likely to die than their counterparts with higher APGAR scores.

Preterm neonates with hypothermia are at substantial risk of death compared to those with normothermia. This study is supported by studies in Uganda (18), Ethiopia (16, 31). Preterm neonates are highly susceptible to hypothermia due to their reduced subcutaneous fat and large body surface area relative to body weight. Hypothermia may precipitate several life-threatening complications, including hypoglycemia, impaired surfactant production, hypoxia, and respiratory and metabolic acidosis, thereby increasing the risk of death among preterm neonates (5).

Preterms who are resuscitated at birth have lower risk of mortality compared those who are not resuscitated. This finding was supported by study conducted in Tanzania(32), a systematic review and meta-analysis(33) and a global systematic review, meta analysis and Delphi estimation of mortality effect (34) .Although neonates requiring resuscitation at birth are generally a vulnerable group with increased risk of mortality, it may be explained by the timely provision of appropriate resuscitative interventions estabilishes effective breathing, improves oxygenation and ventilation, prevents complications of birth asphyxia and allows timely stabilization.

KMC had a protective effect on preterm neonatal mortality. This finding was in line with a systematic review and meta- analysis conducted in LMICs(35), study done in Kenya(36), Ethiopia(Hosaena (37),Keffa zone(38),Axum (39)). This might be due to the fact that KMC has the benefit of protecting the neonate from infection by more likely helping to be colonized by the mother's protective microbiome and less handling of the newborn by other individuals, encouraging breast feeding, effectively treating hypothermia and improving cardiorespiratory stability and gastrointestinal function (2).

Preterm neonates who had initiation of feeding within 24hrs have a low risk of mortality. The current finding was supported by studies conducted in Ethiopia (40, 41, 42).This can be explained by an effect of colostrum on reducing the risk of neonatal infections such as gastro intestinal and respiratory infections and can also reduce the risk of hypothermia and hypoglycemia (5).

LIMITATIONS OF THE STUDY

The study has the following limitations. Since data was obtained from secondary source some important variables such as maternal education level, marital status, occupation, monthly household income were not available in the medical records and their association on preterm neonatal mortality was not investigated.

The study did not address some health service related variables of mortality among preterm neonates due to the nature of the study design. In addition, the study covers only JJUSHYCSH which limits generalizability to other settings found in the Somali region and Ethiopia.

CONCLUSION AND RECOMMENDATIONS

In this study birth weight < 1500gram, 5th minute APGAR < 7 ,hypothermia during hospital say, resuscitation at birth, kangaroo mother care (KMC) and feeding initiation within 24 hours were significantly associated with preterm neonatal mortality

Therefore, to decrease the burden of this problem,proper labor follow up and management, resuscitation at birth, preventing and treating hypothermia, KMC and early feeding initiation should be implemented.In addition prospective, multicenter studies should be conducted.

Furthermore, we recommend prospective studies to identify effects of those variables not included in the study and multicenter studies to solve limits of generalizability.

Abbreviations

ANC Antenatal Care

CI Confidence Interval

COR Crude Odds Ratio

GA Gestational Age

HMD Hyaline Membrane Disease

IHRRC Institution of Health Research Review Committee

JJUSHYCSH Jigjiga University Sheikh Hassan Yabare Comprehensive Specialized Hospital

KMC Kangaroo Mother Care

LMICs Low and Middle Income Countries

LNMP Last Normal Menstrual Period

NEC Necrotizing Enterocolitis

NHB Neonatal Hyperbilirubinemia

NICU Neonatal Intensive Care Unit

PDA Patent Ductus Arteriosus

PROM Premature Rupture Of Membrane

RDS Respiratory Distress Syndrome

SD Standard Deviation

SPSS Statistical Package for the Social Sciences

SVD Spontaneous Vaginal Delivery

VIF Variance Inflation Factor

Declarations

Ethics approval and consent to participate

A letter of ethical approval was obtained from the Institution of Health Research Review Committee (IHRRC) of the Institute of Health Sciences, Jigjiga University, Ethiopia (Reference Number IHRRC 043/2026). Following ethical approval, a formal letter of cooperation was obtained from IHRRC and submitted to JJUSHYCSH to facilitate data collection. Institutional permission was obtained from JJUSHYCSH.

As this was a retrospective cross-sectional study based on review of medical records, the requirement for informed consent of participants (neonates), who are under the age of 16, for whom consent to participate must be obtained from their parents or legal guardians was waived by IHRRC. The study was conducted in accordance with the Declaration of Helsinki and relevant national and institutional guidelines. Confidentiality of patient information was maintained throughout the study.

Consent for publication

Not Applicable

Availability of data and materials

The datasets used and/or analyzed in this study are available from the corresponding author upon a reasonable request.

Competing interests

The authors declare that they have no competing interests.

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No funding was received for this study.

Authors' contributions

AFY conceived and designed the study. AFY, HGA, AKR, MA, AIM and BGE contributed to the study design,data collection ,data entry, data analysis and interpretation .AFY drafted the manuscript. HGA,AKR,MA,AIM,BGE,MSM and AAA critically revised the manuscript. All authors read and approved the final manuscript.

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Figures

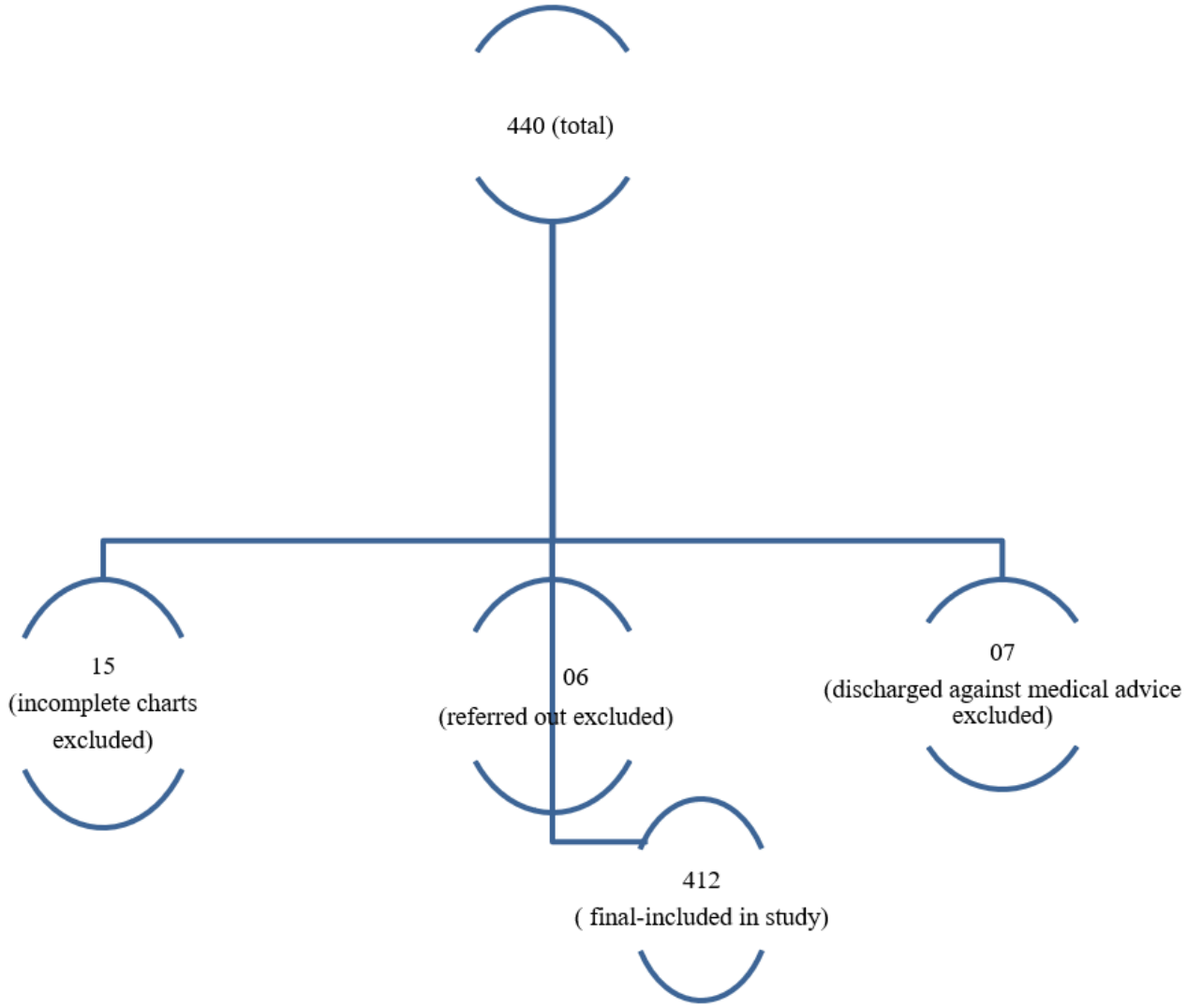


Figure 1

Schematic representation of the inclusions and exclusions among newborns admitted to NICU of JJUSHYCSH

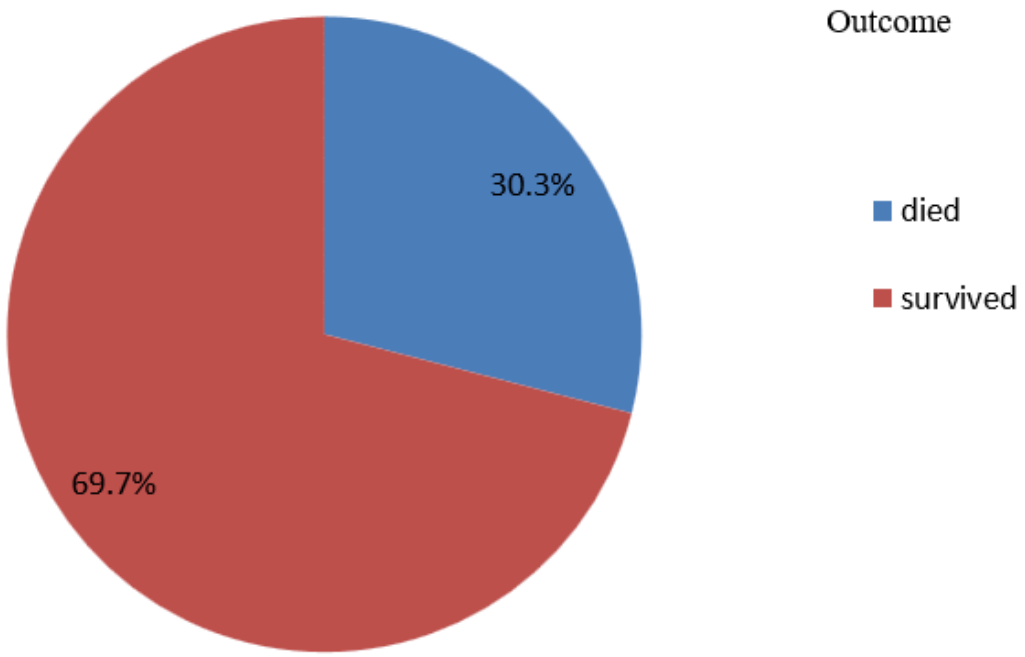


Figure 2

Magnitude of preterm neonatal mortality among preterm neonates admitted to NICU of JJUSHYCSH

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- supplementarytable.docx