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Escalating the limit of median survival time and predictors of mortality among preterm neonates in Northwest Ethiopia, 2021: a 1-year prospective follow-up study

Ermias Sisay Chanie ,[1] Destaw Engedaw,[1] Tahir Eyayu ,[2] Fitalew Tadele Admasu ,[3] Eninur Dejen Amera,[2] Kefyalew Amogne Azanaw,[4] Amare Kassaw,[1] Dejen Getaneh Feleke ,[1] Gashaw Walle Ayehu ,[3] Melkamu Senbeta Jimma,[5] Fisha Alebel GebreEyesus ,[6] Natnael Moges ,[1] Tamiru Alene Woelile,[7] Gashaw Kerebeh,[1] Endalk Birrie[8]

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For numbered affiliations see end of article.

Correspondence to
Ermias Sisay Chanie;
ermisis1888@gmail.com

ABSTRACT

Objectives To examine the survival rate and predictors of mortality among preterm neonates in the neonatal intensive care unit at South Gondar public hospitals, 2021.

Design Prospective follow-up study.

Setting South Gondar public hospitals, Northwest, Ethiopia.

Participants We recruited 283 preterm neonates who were admitted at neonatal intensive care unit at selected hospitals from 15 February 2020 to 22 January 2021.

Outcome measures The primary outcome measure of this study was the survival rate of preterm neonates in the neonatal intensive care unit. Moreover, the study assessed the predictors for the occurrence of mortality by the Cox-proportional hazard model. Data were entered into Epi data V.4.2 and exported to Stata V.14 statistical software for analysis. The log-rank test determines the survival difference between predictor variables.

Results A total of 283 preterm neonates, 61 died during the follow-up. Born from antepartum haemorrhage mother (adjusted HR (AHR)=2.2 (95% CI 1.10 to 4.37)), being small weight for gestational age (AHR=4.6 (95% CI 2.22 to 9.53)), not having kangaroo mother care practice initiated (AHR=2.7 (95% CI 1.39 to 7.74)), hypothermia (AHR=4.0 (95% CI 1.96 to 8.30)) and perinatal asphyxia (AHR=3.9 (95% CI 1.97 to 7.94)) were significant predictors of preterm neonate mortality.

Conclusion In this study, the preterm neonates survival rate (78.4%) and the median survival time (21 days) were found to be low. Preventing and managing the predictors, including an antepartum haemorrhagic mother, small weight for gestational age, hypothermia and prenatal asphyxia, is crucial. In addition, more emphasis should be placed on initiating universal kangaroo mother care practice soon after birth to increase the survival of preterm neonates.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study was conducted in multicentre and long-term follow-up period, which increase the generalisability and the relationship between the exposure and outcomes variable.
⇒ Some variables were not accessible in the medical records and, therefore, were not included in this study, which may affect the outcome variable.
⇒ Preterm neonates admitted without mothers or caregivers were excluded from the study, which may underestimate the result.

BACKGROUND

Each year, 15 million babies are born across the world. Of these, 1 in 10 births is a preterm neonate.[1] The neonatal period is the most vulnerable time for a child's survival.[2] In 2016, 2.6 million under 5 children died, and 46% of those deaths occurred during the neonatal period.[3]

Globally, the burden of preterm birth is disproportionately concentrated in Africa and Asia, where about 85% of all preterm births occur.[4] Moreover, of the total preterm births in Africa, the highest percentage was reported in sub-Saharan Africa,[5] and Ethiopia is one of them.[6] As a result, preterm birth is a significant challenge due to the rapid increase in the incidence and disproportionate contribution to infant mortality rates in sub-Saharan Africa.[7–9]

Worldwide, neonatal mortality due to preterm accounts for 15%–36%.[9] However, in low-income to middle-income countries, neonatal mortality contributed by preterm mortality ranges between 34% and 40%,[10] and preterm is the second-leading cause of under 5 mortality.[6 8]

In 2019, 47% of all under 5 deaths occurred in the newborn period, with close to 75% dying within the first week of life,[11] and the leading cause of neonatal deaths was preterm.[6 11]

In addition, in 2019, approximately 17 deaths per 1000 live births have been reported worldwide.[2] Preterm births accounted for 70% of neonatal mortality[12 13], with the majority of these deaths occurring in Africa.[8 14 15]

Sub-Saharan Africa had the highest neonatal mortality rate in 2019 at 27 deaths per 1000 live births, followed by Central and Southern Asia with 24 deaths per 1000 live births.[11] Ethiopia is one of the sub-Saharan African countries with the highest number of neonatal deaths in 2019.[11]

According to the Ethiopian Demographic Health Survey 2019, neonatal mortality increased by 30 deaths per 1000 live births, up from 29 deaths per 1000 in 2016,[6] representing a tenfold increase when compared with developed countries.[2] Of the total neonatal mortality in Ethiopia, 37% was among preterm infants.[6]

Despite the great success of neonatal care utilisation in Ethiopia, there is still a challenge to decreasing preterm mortality. Since preterm mortality is interlinked with different contributing factors[16–18], consequently preterm mortality is unacceptably high. However, it is not well explored in Ethiopia in general and in the study area in particular. In addition to this, the available studies were retrospective or cross-section in nature. Hence, this study aims to assess the survival rate and predictors of mortality among preterm neonates in the neonatal intensive care unit at South Gondar public hospitals in 2021.

METHODS AND MATERIALS

Study setting

The South Gondar public hospitals are located in the South Gondar zone, which is located in the Amhara region in the northwest part of Ethiopia. In addition, Debre Tabor town is the capital city of the south Gondar zone, which is 103 km from Bahir Dar (the capital city of the Amhara region) and 665 km from Addis Ababa. There are a total of eight hospitals in the South Gondar Zone (one compressive specialised hospital and seven primary hospitals). The hospital's services include an inpatient ward, outpatients and a neonatal intensive care unit.

Study design and study participants

A prospective follow-up study was conducted from 15 February 2020 to 22 January 2021, at South Gondar public hospitals. From a total of eight hospitals in south Gondar, three hospitals such as Debre Tabor Compressive Specialised Hospital, Nefas Mucha primary hospital and Mekan Eyesus primary hospitals were selected randomly. All preterm neonates admitted to the neonatal intensive care unit from 15 February 2020 to 22 January 2021, at South Gondar public selected hospitals were included. However, neonates admitted without mothers or caregivers were excluded from the study.

Patient and public involvement

There was no direct public or patient involvement in the design and implementation of this study.

Data collection tools and procedures

Data were collected using an interviewer-administered structured data abstraction tool prospectively. The abstraction tool contained sociodemographic, obstetrics and neonatal-related characteristics that enabled the evaluation of the outcome variable. At first, the abstraction tool was developed in English and translated into the local language, Amharic and then back to English to keep consistency. Data were obtained by interviewing mothers and caregivers. In addition, the clinically relevant information was obtained from the medical records of the preterm neonate. Six BSc nurses collected the data and were supervised by two MSc in Paediatric and Child Health Practitioners. Data cleaning and double data entry were carried out to check for any inconsistencies. The quality of the data was assured by giving 2 days of training for data collectors and supervisors. A pretest was conducted on 10% of the sample size in Nefas Mucha primary hospital, which is 79 km away from the capital town of Gondar (Debre Tabor).

Operational definitions

Time to death is the time from admission of the newborn at neonatal intensive care unit to the incidence of death during the study period.

Preterm refers to a baby born before 37 weeks of pregnancy has been completed.[19]

Perinatal asphyxia is defined as a profound metabolic or mixed acidemia, the persistence of an Apgar score of 0–3 for longer than 5 min.[20]

Clinical sepsis is defined as a clinical sign with the presence of risk factors, lab tests or confirmed by blood culture.[20]

An event (mortality) is when a neonate dies during the follow-up period.

A preterm neonate was considered as censored if he or she was discharged against medical advice, transferred to another healthcare facility, or remained alive until the end of the study period.

Data processing and analysis

Data were entered into Epi data V.4.2 and exported to Stata V.14 statistical software. Descriptive statistics are explored through tables and graphs. The mortality rate of the preterm neonate was calculated by dividing the number of preterm who died by the total of the preterm neonate follow-up period. The Kaplan-Meier curve was used to determine the median survival time. In addition, a log-rank test was used to see the difference between the predictor variables. The required Cox-proportional hazard model assumption was checked via the Schoenfeld residual pH test. For each predictor variable,

bivariable Cox-proportional hazard models were fitted. Moreover, those variables having a p value of 0.25 in the bivariable analysis were entered into the multivariable Cox-proportional hazards model at a 95% CI. In the multivariable analysis, variables having a p value less than 0.05 were considered significant predictors of preterm neonate mortality.

RESULTS

Sociodemographic and obstetric characteristics

A total of 283 preterm neonates were admitted during the follow-up period. From the total of 283 mothers paired with their preterm neonates, 118 (41.70%) and 137 (48.41%) of mothers were between 25 and 29 years of age and had primary educational status, respectively. Nearly half of the mothers (58.3%) and 160 (56.54%) were city dwellers and housewives, respectively. The majority of mothers, 253 (89.40%), and 237 (83.75%), had spontaneous vaginal delivery (SVD) and were multigravida, respectively. Moreover, a majority of 262 (92.58%) mothers were taking the tetanus toxoid vaccine (TT vaccine) two or more doses. A large proportion of 243 (85.87%) mothers had antenatal care (ANC) follow-up during the follow-up period. From a total of 283 mothers, 34 (12.01%), 36 (12.72%) and 56 (19.79%) had antepartum haemorrhage (APH), maternal HIV and premature rupture of membranes (PROM) in the study period, respectively (table 1).

Table 1 Sociodemographic and obstetric characteristics of mothers of preterm neonates admitted in NICU at South Gondar public hospitals from 15 February 2020 to 22 January 2021 (n=283)

Variable		Frequency	Per cent
Age of the mother	15–19	23	8.13
	20–24	71	25.09
	25–29	118	41.70
	>30	71	25.09
Educational status of the mother	Unable to read and write	29	10.25
	Primary	137	48.41
	Secondary	72	25.44
	Higher education	45	15.90
Occupation of the mother	Housewife	160	56.54
	Government employ	100	35.34
	Merchant	23	8.13
Residence	Rural	118	41.70
	Urban	165	58.3
Maternal HIV status	Positive	36	12.72
	Negative	247	87.28
Had APH	Yes	34	12.01
	No	249	87.99
Had ANC follow-up	No	40	14.13
	Yes	243	85.87
Gravida	Prim gravida	46	16.25
	Multigravida	237	83.75
PROM	Yes	56	19.79
	No	227	80.21
TT-Vaccine two or more dose	Yes	262	92.58
	No	21	7.42
Mode of delivery	SVD	253	89.40
	C/S	21	7.42
	Other	9	3.18

ANC, antenatal Care; APH, antepartum haemorrhage; C/S, caesarean section; NICU, Neonatal intesvie care unit; PROM, premature rupture of membranes; SVD, spontaneous vaginal delivery; TT-vaccine, tetanus toxoid vaccine.

Preterm neonates-related characteristics

Out of 283 neonates, 151 (53.36%) were male. The majority of preterm (220, 77.74%), 228 (80.57%) and 237 (83.75%) had a cephalic presentation, initiation of breast feeding 1 hour after birth and appropriate weight for gestational age, respectively. One hundred and ninety-nine (70.32%) of preterm infants were obtained from kangaroo mother care. At 1 min, nearly half of the 147 preterm (51.94%) had an Apgar score of 3–6. At 5 min, 218 (77.03%) preterm had an Apgar score of 7 or higher. Regarding the clinical disorders, 68 (24.03%), 62 (21.91%), 29 (10.25%) and 37 (13.07%) of preterm neonates had hypothermia, hypoglycaemia, perinatal asphyxia and neonatal sepsis, respectively, in the study period (table 2).

Kaplan-Meier estimates of preterm survival rate

From a total of 283 preterm neonates admitted to the neonatal intensive care unit at South Gondar public hospital, 61 or 21.6% (95% CI 17.1% to 26.8%), died, which provides 216 deaths per 1000 live births. The admitted preterm neonates were followed in different time ranges from 2 to 30 days, for a total of 3061 days at risk during the follow-up period. The median survival time was 21 days (figure 1). In addition, the Cox-Snell residual Nelson-Alen cumulative hazard graph was also estimated to check the required assumptions for Cox-proportional hazard models (figure 2).

Predictors of preterm mortality

In the bivariate Cox-proportional hazard model, age of the mother, occupation of the mother, residence, maternal HIV status, presence of APH, no ANC follow-up, primigravida, PROM, non-SVD mode of delivery, small weight for gestational age, kangaroo mother care, hypothermia, hypoglycaemia, perinatal asphyxia, Apgar score at 1 min 3, Apgar score at 5 min 3, neonatal sepsis, initiation of breastfeeding and fetal presentation of the variable had a p value less than or equal to 0.25 and entered into for

Table 2 Characteristics of preterm neonates admitted in NICU at South Gondar public hospitals from 15 February 2020 to 22 January 2021 (n=283)

Variable		Frequency	Per cent
Sex of the neonate	Male	151	53.36
	Female	132	46.64
Weight for gestational age	Small	46	16.25
	Appropriate	237	83.75
Newborn received kangaroo mother care	Yes	199	70.32
	No	84	29.68
Hypothermia	Yes	68	24.03
	No	215	75.97
Hypoglycaemia	Yes	62	21.91
	No	221	78.09
Perinatal asphyxia	Yes	29	10.25
	No	254	89.75
Apgar score at 1 min	< 3	31	10.95
	3–6	147	51.94
	≥7	105	37.10
Apgar score at 5 min	< 3	10	3.53
	3–6	55	19.43
	≥7	218	77.03
Neonatal spsis	Yes	37	13.07
	No	246	86.93
Initiation of breast feeding	< 1 hour	228	80.57
	≥1 hour	55	19.43
Fetal presentation	Cephalic	220	77.74
	Non-cephalic	63	22.26

NICU, Neonatal intesvie care unit.

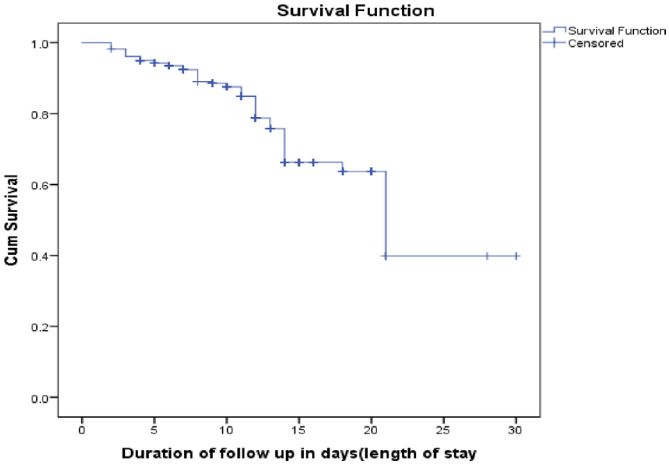

Figure 1 Kaplan-Meier curve of survival among preterm neonates admitted in NICU at South Gondar public hospitals from 15 February, 2020 to 22 January 2021 (n=283). NICU, Neonatal intesvie care unit

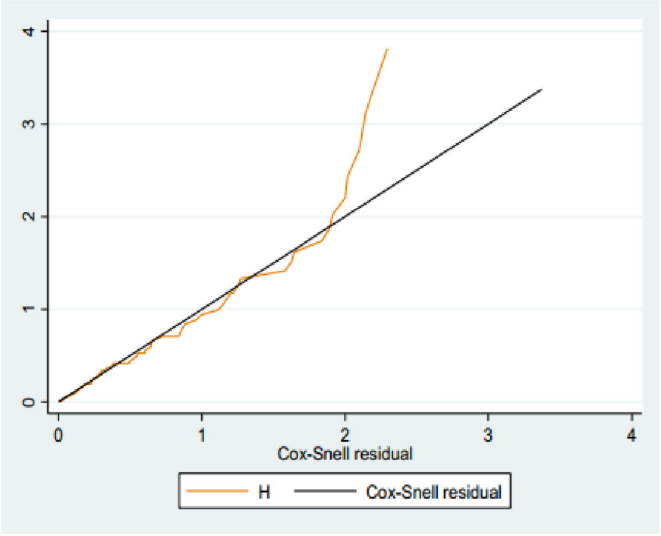

Figure 2 Cox-Snell residual Nelson-Alen cumulative hazard graph on preterm neonates admitted in NICU at South Gondar public hospitals from 15 February 2020 to 22 January 2021 (n=283). NICU, Neonatal intesvie care unit.

multivariate. In the multivariate Cox-proportional hazard model, preterm neonates born from APH mothers, had no kangaroo mother care, hypothermia, small weight for gestational age and perinatal asphyxia were significant predictors of preterm neonate mortality.

The risk of preterm neonatal mortality was 2.2 times higher in preterm neonates born from APH mothers compared with preterm neonates born from non-APH mothers (adjusted HR, AHR) = 2.2 (95% CI 1.10 to 4.37)). Preterm neonates with hypothermia were 4.0 times more susceptible to death than preterm neonates without hypothermia (AHR=4.0 (95% CI 1.96 to 8.30)). The risk of preterm neonatal mortality was 2.7 times higher for preterm neonates who didn't receive kangaroo mother care as compared with preterm neonates who obtained kangaroo mother care (AHR=2.7 (95% CI 1.39 to 7.74)).

Preterm neonates who were underweight for gestational age were 4.6 times more prone to death than compared with preterm with appropriate weight for gestational age (AHR=4.6 (95% CI 2.22 to 9.53)). Preterm neonatal mortality was 3.9 times higher among preterm neonates with perinatal asphyxia than among preterm neonates without perinatal asphyxia (AHR=3.9 (95% CI 1.97 to 7.94)) (figure 3, table 3).

DISCUSSION

Preterm mortality has decreased dramatically worldwide. However, in sub-Saharan Africa, the rate of preterm mortality is still very high and Ethiopia is one of the four places in the top ten with the maximum number of preterm deaths reported.[11] Similarly, this study also revealed that the preterm mortality at South Gondar public hospitals, Ethiopia was found to be very high (21.6% (95% CI 17.1% to 26.8%), which is equivalent to

the preterm neonatal mortality of 216 deaths per 1000 live births.

This finding is comparable with studies conducted in Gondar, Ethiopia.[20] However, the finding is much higher than from a global report of high-income countries that includes Australia, Belgium and Canada.[21] In addition, the findings were also higher than the studies conducted by Iran,[13] Uganda,[22] Tanzania[23] and Nigeria.[24] On the other hand, the finding of this study is lower than that of the studies conducted in Bahir Dar, Ethiopia[16] and Ghana.[25] Moreover, in this finding is the median survival time is lower than the study conducted in Tigray region of Ethiopia,[26] Bahir Dar, Ethiopia.[27]

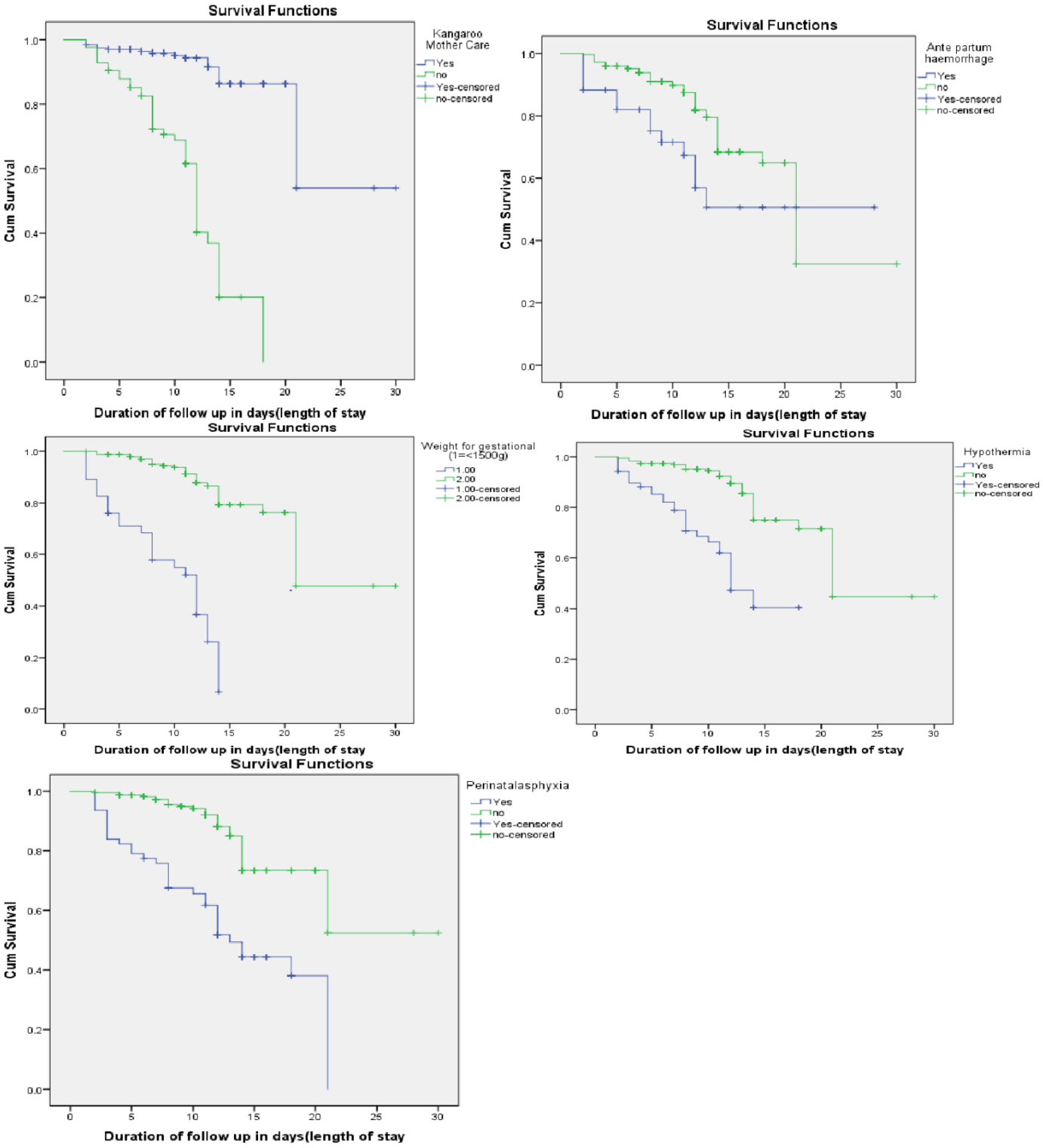

Figure 3 Kaplan-Meier curve estimate of main predictors for mortality among preterm neonates admitted in NICU at South Gondar public hospitals from 15 February 2020 to 22 January 2021 (n=283). NICU, Neonatal intesvie care unit.

Table 3 Predictors of mortality among preterm admitted in NICU at South Gondar public hospitals from 15 February 2020 to 22 January 2021 (n=283)

Variable		Mortality No	Yes	CHR (95% CI)	AHR (95% CI)	P value
Age of the mother	15–19	11	12	2.5 (1.2 to 5.4)	1.2 (0.47 to 3.30)	0.656
	20–24	54	17	1.9 (1.0 to 3.72)	1.5 (0.63 to 3.32)	0.378
	25–29	56	15	1.6 (0.82 to 3.29)	0.5 (0.22 to 1.33)	0.184
	>30	101	17	Ref	Ref	
Educational status of the mother	Unable to read and write	22	7	0.82 (0.29 to 2.28)	–	
	Primary	108	29	0.96 (0.44 to 2.11)	–	
	Secondary	55	17	1.2 (0.53 to 2.89)	–	
	Higher education	37	8	Ref		
Occupation of the mother	Housewife	124	36	0.61 (0.27 to 1.38)	0.7 (0.26 to 2.17)	0.594
	Government employ	82	18	0.5 (0.211 to 1.22)	0.9 (0.28 to 2.96)	0.877
	Merchant	16	7	Ref	Ref	
Residence	Rural	97	21	Ref		
	Urban	126	39	1.3 (0.75 to 2.20)	–	
Maternal HIV status	Positive	11	25	4.7 (2.80 to 7.82)	1.7 (0.81 to 3.710	0.158
	Negative	211	36	Ref	Ref	
Had ANC follow-up	Yes	21	13	2.1 (1.11 to 3.84)	1.3 (0.53 to 3.15)	0.570
	No	201	48	Ref	Ref	
Had APH	No	18	22	2.8 (1.66 to 4.87)	**2.2 (1.10 to 4.37**)	**0.028***
	Yes	204	39	Ref	Ref	
Gravida	Primigravida	20	26	3.5 (2.06 to 5.89)	1.0 (0.44 to 2.12)	0.931
	Multigravida	202	35	Ref	Ref	
PROM	Yes	28	28	2.9 (1.77 to 4.91)	1.4 (0.72 to 2.74)	0.315
	No	194	33	Ref	Ref	
TT-vaccine two or more dose	Yes	206	56	Ref		
	No	16	5	1.0 (0.40 to 4.87)	–	
Mode of delivery	SVD	201	52	Ref	Ref	
	C/S	15	6	1.1 (0.46 to 2.68)	0.4 (0.11 to 1.30)	0.124
	Other	6	3	1.8 (0.43 to 7.27)	0,7 (0.10 to 5.02)	0.728
Sex	Male	122	29	0.8 (0.47 to 1.32)	–	
	Female	100	32	Ref		
Weight for gestational age at birth	Small	16	30	**8.6 (5.07 to 14.5**)	**4.6 (2.22 to 9.53**)	**0.000†**
	Appropriate	206	31	Ref	Ref	
Hypothermia	Yes	37	31	**4.3 (2.56 to 7.20**)	**4.0 (1.96 to 8.30**)	**0.000†**
	No	185	30	Ref	Ref	
Hypoglycaemia	Yes	19	10	1.8 (0.92 to 3.57)	1.1 (0.47 to 2.59)	0.828
	No	203	51	Ref	Ref	
Newborn received kangaroo mother care	Yes	181	18	Ref	Ref	
	No	41	43	**9.9 (5.46 to 18.04**)	**2.7 (1.39 to 7.74**)	**0.007†**
Apgar score at 1 min	< 3	14	17	3.8 (2.02 to 7.27)	1.8 (0.71 to 4.33)	0.219
	3–6	125	22	1.2 (0.65 to 2.15)	0.8 (0.38 to 1.70)	0.569
	≥7	83	22	Ref	Ref	

Continued

Table 3 Continued

Variable		Mortality No	Yes	CHR (95% CI)	AHR (95% CI)	P value
Apgar score at 5 min	< 3	8	2	0.9 (0.22 to 3.88)	0.5 (0.07 to 2.96)	0.419
	3–6	45	10	1.5 (0.74 to 2.98)	2.5 (0.90 to 6.22)	0.064
	≥7	169	49	Ref	Ref	
Neonatal sepsis	Yes	22	15	2.2 (1.22 to 3.98)	1.5 (0.73 to 3.14)	0.270
	No	200	46	Ref	Ref	
Perinatal asphyxia	Yes	29	33	**4.1 (2.48 to 6.86)**	**3.9 (1.97 to 7.94)**	**0.000†**
	No	193	28	Ref	Ref	
Initiation of breast feeding	<1 hour	185	43	Ref	Ref	
	≥1 hour	37	18	1.7 (0.97 to 2.92)	0.8 (0.38 to 1.84)	0.655
Fetal presentation	Cephalic	176	44	Ref		
	Non-cephalic	46	17	1.1 (0.63 to 1.96)	1.3 (0.60 to 2.69)	0.524

*Significant at <0.05.
†Significant at <0.01.
AHR, adjusted HR; ANC, antenatal care; APH, antepartum haemorrhage; CHR, crude HR; C/S, caesarean section; NICU, Neonatal intesvie care unit; PROM, premature rupture of membrane; SVD, spontaneous vaginal delivery; TT-vaccine, tetanus toxoid vaccine.

The huge discrepancy in preterm mortality between Ethiopia and developed countries might be due to the level of quality of care, such as staffing, advanced material availability and neonatal care organisation or infrastructure. Even though healthcare providers have adequate knowledge and skills, the above-mentioned contributing factors have an impact on why the mortality rate of preterm infants remains high.[1 28 29] Moreover, this difference might be due to the study setting or the level ofNeonatal intesvie care units (NICU). Since most of the above studies were conducted at level III NICUs, whereas this study was conducted at level II, differences in sample size, study design and sociodemographic characteristics may also be considered for the variation in preterm mortality around the world.

The hazard of preterm neonatal mortality was 2.2 times higher among preterm neonates who had been born of APH mothers as compared with preterm neonates who had not been born of APH mothers. This finding is supported by the studies conducted in other settings.[23 30–32] The possible justification may be that the mother who had APH was presenting with malpresentation, premature labour and infections that contributed significantly to preterm death through life-threatening conditions such as intrauterine death, congenital malformations and birth asphyxia.[33 34]

The hazard of preterm mortality increased 4.0 times among preterm with hypothermia compared with preterm neonates without hypothermia. Another setting in Ethiopia has a similar finding report.[35] The strong and direct correlation between hypothermia and preterm mortality is striking. It is not surprising that hypothermia can result in hypoglycaemia, metabolic acidosis and an increased risk of late-onset sepsis for preterm neonates since they have no thermoregulatory mechanisms due to a lack of brown fat.[35 36]

The risk of preterm neonatal mortality is 2.7 times higher for preterm neonates who did not receive kangaroo mother's care as compared with preterm neonates who did receive kangaroo mother's care. This finding is supported by the studies conducted in Uganda and Ethiopia.[20 22] Preterm with kangaroo mother care is advantageous to maintain cardiopulmonary and temperature stability. Furthermore, the preterm advantageous to become the duration of quiet to sleep in and sufficient time to obtain breast feeding during their hospital stay.[37]

Preterm neonates who were underweight for gestational age were 4.6 times more susceptible to death as compared with preterm who were of appropriate weight for gestational age. A similar finding was reported across the world.[16 25 38] In fact, preterm infants with low birth weight may have trouble maintaining body temperature, eating and fighting off infections. In addition, low birthweight infants may be more at risk for many acute health problems and longer-term problems such as delayed motor and social development or learning disabilities, which increase the hazard of death.

The hazard of preterm neonatal mortality was 3.9 times higher among preterm neonates with perinatal asphyxia than among preterm neonates without perinatal asphyxia. This finding is supported by the studies conducted in other settings.[10 16 32 39] This can be explained by preterm exposure to prenatal asphyxia at the time of delivery, which results in marked systemic and neurologic sequelae due to diminished blood flow and/or oxygen to a fetus.[40 41]

Although this study was conducted in multicentre and long-term follow-up period, which increases the

generalisability of the study and enables the relationship between the exposure and outcomes variable; it has some limitations.

First, some variables were not accessible in the medical records and, therefore, were not included in this study, which may affect the outcome variable. Second, preterm neonates admitted without mothers or caregivers were excluded from the study, which may underestimate the result.

CONCLUSION

In this study, the survival rate of preterm neonates was found to be low. Preventing and managing the predictors, including an antepartum haemorrhagic mother, small weight for gestational age, hypothermia and prenatal asphyxia, is crucial. In addition, more emphasis should be placed on universal kangaroo mother care to increase the survival of preterm neonates.

Author affiliations
[1]Pedatric and Neonatal Nursing, Debre Tabor University, Debre Tabor, Ethiopia
[2]Department of Medical Laboratory Sciences, Debre Tabor University, Debre Tabor, Amhara, Ethiopia
[3]Biomedical Science, Debre Tabor University, Debre Tabor, Amhara, Ethiopia
[4]Nursing, Debre Tabor Health Science collage, Debre Tabor, Ethiopia
[5]Assosa University, Asosa, Benishangul Gumuz, Ethiopia
[6]Wolkite University, Welkite, Ethiopia
[7]Wolaita Sodo University, Sodo, Ethiopia
[8]Wollo University, Dessie, Ethiopia

Twitter Tahir Eyayu @Tahir

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Contributors All authors have read and approved the final article. ESC contributed to the conception, study design, data acquisition, data interpretation and writing of the original article. Authors including DE, TE, FTA, EDA, KAA and AK contributed to conception and design, data acquisition and critically revising the article. Besides, DGF, GWA, MSI, FGE, NMM, TAW, GK and EB contributed to data acquisition, statistical analysis and critically revised this article.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained from parent(s)/guardian(s).

Ethics approval This study involves human participants and was approved by Ethical clearance was obtained from Debre Tabor University's ethics review committee with Ref NO/HP/712/01/2020 G.C. Then, a permission letter was obtained from each South Gondar public hospitals. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available on reasonable request. All free text entered below will be published.

ORCID iDs
Ermias Sisay Chanie http://orcid.org/0000-0002-3124-5380
Tahir Eyayu http://orcid.org/0000-0002-2041-7183
Fitalew Tadele Admasu http://orcid.org/0000-0002-7191-2942
Dejen Getaneh Feleke http://orcid.org/0000-0003-0855-3630
Gashaw Walle Ayehu http://orcid.org/0000-0001-7333-152X
Fisha Alebel GebreEyesus http://orcid.org/0000-0001-7358-0577
Natnael Moges http://orcid.org/0000-0002-1274-5857

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