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Prevalence and associated factor of neonatal mortality among neonates admitted to Asella referral and teaching hospital, Asella, Ethiopia, 2024

Abstract

Background: The neonatal period, encompassing the first 28 days of life, is a critical phase for newborn survival. Neonatal mortality refers to the death of newborns within the initial four weeks of life and constitutes a significant portion of child mortality under five years old, accounting for 38% of these deaths in the developing world. The causes of neonatal mortality vary across different regions.

Objective: The aim of this study is to assess the prevalence, causes, and associated factors of neonatal mortality among neonates admitted to Asella Referral and Teaching Hospital in Asella, Ethiopia, in 2024.

Method: A facility-based retrospective cross-sectional study was conducted among neonates admitted to Asella Referral and Teaching Hospital from July 7, 2020, to July 7, 2023. Participants were selected using a systematic random sampling method. Data collected were entered into Epi Data Version 3.1 and analyzed using SPSS Version 26. Descriptive analysis was performed for all independent variables. Variables with a p-value < 0.25 in bivariable logistic regression analysis were further analyzed using multivariable logistic regression. A significant association between independent variables and the outcome variable was considered at a p-value < 0.05 in the multivariable regression analysis.

Results: This study included 194 neonates, with a neonatal mortality prevalence of 13.9%. The leading causes of neonatal mortality were birth asphyxia (22.1%), meconium aspiration syndrome (14.8%), and neonatal sepsis (11.1%). Factors such as obstructed labor [AOR=3.5: 95% CI (1.2–10.7)], instrumentally assisted vaginal delivery [AOR=3.5: 95% CI (1.03–11.9)], pregnancy-induced hypertension [AOR=2.0: 95% CI (1.2–14.5)], and lack of antenatal care follow-up [AOR=3.2: 95% CI (1.1–9.9)] were identified as predictors of neonatal mortalities (p <0.05).

Conclusion: The study revealed a high prevalence of neonatal mortalities. Obstructed labor, instrumentally assisted vaginal delivery, pregnancy-induced hypertension, and inadequate antenatal care follow-up were significant predictors of neonatal mortality. Improvements in obstetric care quality, antenatal follow-up, and emergency obstetric services are crucial to reducing neonatal mortality rates in the study setting.

Keywords: common cause, neonatal mortality, neonates

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Background

The neonatal period, encompassing the initial 28 days of a child's life, represents a crucial phase marked by rapid changes and significant developmental milestones. This period is further categorized into the very early (birth to less than 24 hours), early (birth to less than 7 days), and late neonatal periods (7 days to less than 28 days).[1] Neonatal mortality, defined as the death of newborns within the first month of life, is a primary concern worldwide. According to the World Health Organization (WHO), neonatal mortality accounts for nearly half (47%) of all deaths in children under the age of five.[1]

The neonatal mortality rate varies significantly among different populations worldwide. Despite deaths occurring at similar stages of life, the mortality rate differs between developed and developing countries, ranging from 4 to 46% and 0.2 to 63%, respectively.[2] Children in Sub-Saharan Africa or Southern Asia are nine times more likely to die in the first month of life compared to those in high-income countries. Five countries, including India (24%), Pakistan (10%), Nigeria (9%), the Democratic Republic of Congo (4%), and Ethiopia (3%), account for half of all neonatal deaths at a country level.

In terms of Sustainable Development Goal (SDG) Regions, sub-Saharan Africa (38%) and Southern Asia (39%) reported the highest neonatal mortality rates, each recording 28 deaths per 1000 live births in 2017.[3] WHO and the Maternal and Child Epidemiology Estimation group estimated that in 2017, 35% of all neonatal deaths were attributed to preterm birth, 24% to intra-partum events like birth asphyxia, 14% to sepsis or meningitis, and 11% to congenital anomalies. Nearly half of under-five deaths could be avoided by achieving high coverage of quality antenatal care, skilled birth attendance, postnatal care for both mother and baby, and specialized care for small and sick newborns.

In Ethiopia, the neonatal mortality rate remains a serious concern.[4] The Ethiopian Demographic Health Survey (EDHS) in 2019 reported a neonatal mortality rate of 30 per 1000 live births, with neonatal deaths constituting more than 50% of all deaths among Ethiopian children under five years old.[5]

Perinatal mortality rates are commonly utilized as key indicators reflecting both the health status and socioeconomic progress of a country.[6] In 2020, approximately 2.4 million children worldwide lost their lives in the first month after birth. Out of the estimated 6,700

daily neonatal deaths, about 33% occur within the first day of life, with close to 75% happening within the initial week.[7] The majority of neonatal deaths, around 80%, are concentrated in low- and middle-income countries, with South Asia and sub-Saharan Africa jointly accounting for this burden. Among sub-Saharan African nations, Ethiopia, Nigeria, the Democratic Republic of Congo, Uganda, and Tanzania contribute to about half of all neonatal mortalities.[8]

Ethiopia ranks among the top ten countries responsible for nearly two-thirds of global neonatal deaths and is one of the six nations accounting for half of all under-five deaths.[3] Despite the Ethiopian government's multifaceted efforts involving health, nutrition, and other interventions to curb neonatal mortality, the rates persist at high levels, deviating from trajectories outlined to achieve Sustainable Development Goals (SDGs) by 2030.[9] Due to limited specific data on common causes of neonatal mortality in the Arsi zone, where neonatal wards are predominantly available at Asella Referral and Teaching Hospital (ARTH), there is a critical gap in understanding the prevalence and patterns of neonatal mortality within this region. This study aims to address these gaps by examining the prevalence, causes, and associated factors of neonatal mortality among neonates admitted at ARTH.

The scarcity of studies on neonatal mortality in Ethiopia poses a challenge to designing evidence-based interventions and understanding the full extent of the issue for effective programming. Thus, this study seeks to fill this knowledge gap and establish a foundational dataset to inform targeted strategies for reducing neonatal mortality rates in the specific context of ARTH.

Methodology

Study area

The study was carried out at Asella Referral and Teaching Hospital (ARTH) situated in Asella town, Arsi Zone, Oromia region, Ethiopia. Asella is located approximately 167 km southeast of Addis Ababa, the capital city of Ethiopia. Established in 1964, ARTH encompasses various departments and 10 wards, including the outpatient department (OPD), medical ward, gynecology and obstetrics ward, pediatrics ward, pediatrics surgery ward, surgical ward, orthopedics ward, oncologic ward, and intensive care unit (ICU). The hospital boasts a total of 265 beds and offers a wide array of healthcare services and clinics, such as emergency services, dental clinic, mother-child health (MCH), psychiatry clinic, laboratory, radiology, pharmacy, and chronic disease and cancer follow-up. The hospital staff comprises a total of 605 members, including 200 doctors, 208 nurses, and 197 other healthcare providers. Within the Pediatrics ward, there are three OPDs, Emergency and ward (comprising critical, miscellaneous, and neonatal wards), totaling 89 beds (20 critical, 34 miscellaneous, and 35 neonatal beds). The staff in the Pediatrics ward includes specialist doctors, resident doctors, general practitioners, and nurses.

Study design and period

The study employed a facility-based retrospective cross-sectional study design, conducted from July 7, 2020, to July 7, 2023 GC.

Source population

All neonates admitted to ARTH

Study population

All patients in neonatal age group who were admitted in ARTH during the study period were considered as study population.

Inclusion criteria

All Patients of age group from birth to 28 days who admitted to neonatal ward of ARTH whose outcome was death was included.

Exclusion criteria

Incomplete information records on log book and cards will not be part of study.

Sample size determination

(1) Sample size (n) was determined based on a single population proportion (p) method

$$n = (Z\alpha/2)2\,P\,(1-P) \div d2$$

n = number of study subjects

$\alpha = 0.05$ *or* $Z\alpha/2 = 1.96$

P = 0.5

d = the margin of error to be tolerated (%) =5% =0.05

$$n = (Z\alpha/2)2\,p\,(1-p)\,d2$$

$$= (1.96)2\times\,(0.50)\,(1-0.50)\,(0.05)2\;3.84\times\;0.50\times0.5$$

$$= 384$$

$$0.0025$$

Where,

n=sample size

p=estimation of the population proportion 0.5

d=margin of error (5%)

q=1-p

Z is 95% which is CI=1.96

So n is 384

nn=*nn*1+*nnN*/, the final sample size was calculated after using correction factor:

nn=3841+384391= 194

Operational definition

The neonatal mortality rate (NMR) is the number of deaths occurring in live-born infants before the 28th day of life per 1000 live births.

Post neonatal mortality rate (PNMR) is the number of deaths of children between 28 days and one year per thousand live births. Calculated by subtracting NMR from the Infant mortality rate

Infant mortality rate (IMR) is the number of deaths in children before the age of one year per thousand live births**.**

Early Childhood mortality rate (ECMR) is the number of deaths in children over 12 months of age but less than five years of age per 1000 children reaching 12 months.

Variables

Dependent variables:

Neonatal mortality

Independent variables:

Socio-demographic

1. Age of the mother
2. Age of child at admission
3. Sex of child

Maternal factors:

1. Parity
2. Mode delivery
3. ANC follow up
4. Maternal fever
5. PPROM
6. Odor of liquor
7. Place of delivery
8. Fetal factor
9. Gestational age
10. Admission diagnosis
11. Presence Apgar score
12. Birth weight

Sampling techniques

Medical record numbers were extracted from the logbook and sequentially recorded with whole numbers. The sample population was then selected using a systematic sampling approach with a sampling interval (K value) of 2. A random starting point for selecting medical record numbers was determined using a simple random lottery method

Data collection instruments and techniques

A supervisor meticulously inspected the daily activities to ensure the consistency and completeness of the questionnaire, providing appropriate support throughout the data collection process. Structured data collection tools were utilized for gathering information. Retrospective reviews of neonatal records, maternal delivery room records, and antenatal care (ANC) records were conducted to obtain comprehensive data. The questionnaire, consisting of 20 questions to assess maternal socio-demographic information, ANC follow-up, and neonatal factors, was developed by referencing various literature sources.[10–12]

The data collection process was executed by three team members, comprising students, while two supervisors were appointed to oversee the data collection procedures

Data quality control method

Prior to commencing data collection, a feasibility check was conducted through a pilot survey using the logbook. Subsequently, after ensuring the reliability and validity of the questionnaire, it was cross-matched with available information in the records. The study questions were then reorganized for clarity and efficacy. Data completeness and consistency were monitored daily, with any missing or incomplete data rectified by the data collectors. Charts with incomplete data were flagged and excluded from the analysis.

Data entry was performed using SPSS software after coding each question for consistency and accuracy. Following data entry, a comprehensive quality check was conducted to ensure the integrity of the dataset. Subsequently, data analysis was conducted using SPSS after confirming the data quality to derive meaningful insights and outcomes from the gathered information.

Data analysis and process

The data underwent manual editing, cleaning, and verification to ensure accuracy before being entered into Epi Data version 3.1. Subsequently, the cleaned dataset was exported to SPSS software version 26 for analysis. Descriptive statistical analyses, including frequencies, percentages, cross-tabulations, and mean calculations, were performed.

Independent variables with a p-value < 0.25 were earmarked as potential candidates for inclusion in the multivariate binary logistic regression model. These variables were further subjected to multivariate analysis to explore their associations with the dependent variable. The results of the logistic regression were presented as adjusted odds ratios (AOR).

Variables with a p-value < 0.05 and a 95% confidence interval considered in the multivariate analysis were deemed statistically significant predictor variables for the dependent variables. These variables were crucial in identifying associations and drawing meaningful conclusions from the data analysis.

Ethical consideration

Prior to initiating the data collection process, ethical clearance was obtained from the institutional Ethical Review Committee of Arsi University, College of Medicine and Health Sciences. Official letters of cooperation were secured from Arsi University, College of Medicine and Health Sciences, specifically the Department of Public Health and School of Medicine, addressed to the respective departments involved in the study.

All patient information extracted from medical records was handled anonymously to protect patient privacy. In addition, the names of neonates in the records were intentionally excluded to maintain confidentiality. Stringent measures were implemented to safeguard the confidentiality of patient data and ensure that any responses obtained from neonatal records remained confidential and secure.

Results

Socio demographic characteristics

A total of 194 neonates were included in the study. Among the mothers of these neonates, 100 mothers (51.5%) were aged between 20 and 34 years, with a mean age of 29.21 ± 6.65 years.79 mothers (40.7%) had not received any formal education. The majority of participants, 104 (53.6%), resided in urban areas. 104 respondents (90.7%) were reported as married.

Among the respondents, 84 individuals (43.3%) identified as Muslim.

These demographic characteristics highlight the diverse backgrounds of the study participants and provide insights into the socio-demographic profile of the mothers involved in the study (Table 1).

Medical and obstetrics factors of the mothers

Regarding Antenatal Care Follow-up, 134 neonates (69.1%) were delivered from mothers with a history of antenatal care follow-up.

Pertaining of Parity, 100 newborns (51.5%) were born to multiparous mothers. About 187 mothers (98%) had a single pregnancy, while 7 mothers (3.6%) had twin pregnancies.

Regarding Maternal Conditions, about 30 mothers (15.5%) were Oligohydramnios, about 40 mothers (20.6%) experienced Pregnancy-induced Hypertension, about 40 mothers (20.6%) faced Gestational Diabetes Mellitus and 43 (22.2%) of mothers experienced Antepartum Hemorrhage:

On the other hand regarding Mode of Delivery and Membrane Status, 94 mothers (48.5%) came across Spontaneous Vaginal Delivery (SVD), 76 mothers (39.2%) faced Premature Rupture of Membranes and 24 mothers (12.4%) faced Obstructed Labor.

These obstetrical characteristics provide valuable insights into the maternal health status and pregnancy-related conditions of the study participants, offering a comprehensive overview of the obstetric history observed in the study population (Table 2).

Neonatal factors

One hundred four newborns (53.6%) were females, and 106 (56.6%) neonates were delivered at term. Regarding birth weight, 113 (58.2%) was within the range of 2,500–3999 g. One hundred and sixty-seven (86.1%) of the newborns were at the cephalic presentation. Besides, 102 (52,6%) and 130 (67%) of the newborn babies had normal Apgar scores at the first and fifth minutes after birth, respectively (Table 3).[7–10]

Prevalence and causes of neonatal mortalities

In the current study, the prevalence of neonatal mortalities was 13.9%. Among the neonatal deaths, 6 (22.20%) were attributed to birth asphyxia, followed by 4(14.8%) deaths due to Meconium Aspiration Syndrome (MAS) and neonatal sepsis (Table 4).

Table 1 Socio-demographic characteristics of mother for the study of prevalence, cause and associated factors of neonatal mortality among neonates admitted at ARTH, Asella, Ethiopia, 2024 (n=194)

Variables	Category	Frequency (n)	Percentage (%)
Age of the mothers	<20	43	22.2
	20-34	100	51.5
	35-49	51	26.3
Residency	Urban	104	53.6
	Rural	90	46.4
Marital status	Married	176	90.7
	Single	8	4.1
	Divorced	10	5.2
Educational status	No formal education	79	40.7
	Read and write	49	25.3
	Primary education	24	12.3
	Secondary education	23	11.8
	College, university and above	19	9.8
Religions	Muslim	84	43.3
	Orthodox	76	39.2
	Protestant	24	12.4
	Catholic	10	5.2

Table 2 Medical and obstetrics characteristics of mother for the study of cause and its associated factors of neonatal mortality among neonates admitted at ARTH, Asella, Ethiopia, 2024 (n=194)

Variables	Category	Frequency (n)	Percentage (%)
ANC follow-up	Yes	134	69.1
	No	60	30.9
Mode of delivery	SVD	94	48.50%
	Cesarean section	38	19.60%
	Vacuum delivery	34	17.50%
	Forceps delivery	28	14.40%
Pregnancy induced hypertension	Yes	40	20.6
	No	154	79.4
Oligohydramnios	Yes	30	84.5
	No	164	
Gestational diabetes mellitus	Yes	40	20.6
	No	154	79.4
Parity	Primiparous	94	48.5
	Multiparous	100	51.5
Antepartum hemorrhage	Yes	43	22.2
	No	151	77.8
Chronic hypertension	Yes	30	15.5
	No	164	84.5

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Table 2 Continued...

Variables	Category	Frequency (n)	Percentage (%)
Chronic diabetes mellitus	Yes	36	18.6
	No	158	81.4
Types of pregnancy	Single	187	96.4
	Twin	7	3.6
premature rupture of the membrane (PROM)	Yes	76	39.2
	No	118	60.8
Obstructed labor	Yes	24	12.4
	No	170	87.6

Table 3 Neonatal factors for the study for the study of cause and its associated factors of neonatal mortality among neonates admitted at ARTH, Asella, Ethiopia, 2024 (n=194)

Variables	Category	Frequency (n)	Percentage (%)
Sex of neonate	Male	90	46.40%
	Female	104	53.60%
Gestational age in weeks	Preterm (<37 weeks)	54	27.80%
	Term (37-42 weeks)	106	54.60%
	Post-term (>42 weeks)	34	17.50%
Birth weight	Low (<2500g)	43	22.20%
	Normal (2500-3999g)	113	58.20%
	Large (≥4000g)	38	19.60%
Fetal presentation	Cephalic	167	86.10%
	Breech	17	8.90%
	Face	4	2.10%
	Brow	6	3.10%
APGAR score at 1st minute after birth	Low (0-3)	61	31.40%
	Moderate (4-6)	31	16%
	Normal (7-10)	102	52.60%
APGAR score at 5th minute after birth	Low (0-3)	7	3.60%
	Moderate (4-6)	57	29.40%
	Normal (7-10)	130	67%

Table 4 Causes and its associated factors neonatal mortality among neonates admitted at ARTH, Asella town, Ethiopia, 2024

Variable	Category	Frequency	Percentage (%)
Causes	prematurity-related	3	11.1
	sepsis	4	14.8
	prenatal asphyxia	6	22.2
	congenital malformation	2	7.40
	low birth weight	4	14.8
	hyperbilirubinemia	3	11.1
	meconium aspiration syndrome	3	11.1
	others(specify)	2	7.40

The associated factors of neonatal mortality

Initially, bivariate logistic regression analysis was conducted for all independent variables to identify potential associations with neonatal mortality. Nine variables emerged as candidates for multivariate analysis with a p-value < 0.25, including ANC follow-up, mode of delivery, pregnancy-induced hypertension (PIH), parity, gestational diabetes mellitus (GDM), antepartum hemorrhage, obstructed labor, neonatal sex, and Apgar score at the 1st minute.

Hosmer-Lemeshow's goodness of fit (p = 0.244) and multicollinearity tests (VIF = 1.4–2.2) were conducted to evaluate model fit and variable independence, showing satisfactory results.

Eight variables, specifically gestational diabetes mellitus, obstructed labor, parity, ANC follow-up, instrumentally assisted vaginal delivery, pregnancy-induced hypertension, and male neonatal sex, exhibited a significant association with neonatal mortality at a p-value < 0.05.

The likelihood of neonatal mortality was 2.5 times higher [AOR = 2.5, 95% CI: (2.9–12.5)] among neonates born to primiparous mothers compared to multiparous mothers. Neonates delivered via instrumentally assisted vaginal delivery had a 5-fold higher susceptibility [AOR = 5.6, 95% CI: (1.5–20.7)] to neonatal mortality compared to those delivered through spontaneous vaginal deliveries. Neonates from mothers with obstructed labor had an 8-fold higher odds [AOR = 8.2, 95% CI: (1.7–38.8)] of neonatal mortality.

Neonates born to mothers with pregnancy-induced hypertension were 4 times more likely [AOR = 4.1, 95% CI: (1.2–13.7)] to experience neonatal mortality.

The probability of neonatal mortality was 2 times higher [AOR = 2.3, 95% CI: (0.5–9.3)] among neonates born to mothers with gestational diabetes mellitus compared to those without.

These results highlight the significant factors associated with neonatal mortality and provide valuable insights for understanding and addressing this critical issue (Table 5).[12–31]

Table 5 Bivariate and multivariate logistic regression analysis result showing factors associated with neonatal mortality among neonates at ARTH, 2024 (n=194)

Variables	Categories	Neonatal mortalities		COR [95% C.I]	AOR (95% C.I)	P-values
		No n (%)	Yes n (%)			
ANC follow-up	Yes	124 (92.6%)	10(7.4%)	1	4.51[1.5-13.2]	0.06*
	No	43(71.7%)	17 (28.3%)	4.9 [5.2-14.6]		
Mode of delivery	SVD	86(91.5%)	8 (8.5%)	1	1.8[0.44-7.3]	0.43
	C/S	32(84.3%)	6 (15.7%)	2.01[1.5-8.8]	5.6[1.5-20.7]	0.09*
	Instrumental delivery	49 (79.1%)	13 (20.9%)	2.8[2.1-10.3]		
PIH	No	137 (89.0%)	17 (11.0%)	1	4.1[1.2-13.7]	0.02*
	Yes	30 (19.4%)	10 (80.6%)	2.6[2.1-15.4]		
Parity	Multiparity	92 (92.0%)	8 (8.0%)	1	2.5 [2.9-12.5]	0.04*
	Primiparity	75 (79.8%)	19 (20.2%)	2.76[1.2-9.9]		
GDM	No	140 (79.1%)	14(19.9%)	1	2.3[.5-9.3]	0.2
	Yes	27 (67.5%)	13 (32.5%)	4.8[2.5-13.2]		
APH	No	136 (90%)	15 (10.0%)	1	4.5[1.5-14.05]	0.08*
	Yes	31 (72.0%)	12 (28.0%)	3.5[2.5-17.3]		
Obstructed labor	No	155 (91.0%)	15 (9.0%)	1	8.2[1.74-38.8]	0.008*
	Yes	12 (50.0%)	12 (50.0%)	10[8.5- 45.5]		
Sex of neonates	Female	94 (90.4%)	10 (9.6%)	1		
	Male	73(81.1%)	17 (18.9%)	2.1[1.8-6.5]		
APGAR score at 1st minute	7-10	121 (93.0%)	9 (7.0%)	1	3.1[1.2-10.5]	0.01*
	0-3	7 (46.6%)	8 (53.4%)	15.0[3.13-60]	2.3[1.7-5.5]	0.03*
	4-6	39 (79.6%)	10 (20.4%)	4.4[2.2-8.25]		

*: variables with significant association at p-value < 0.05, COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio, C.I: Confidence Interval, spontaneous vaginal delivery, 1: reference group.

Discussion

In this study, it was noted that instrumentally assisted births were associated with an increased risk of neonatal mortality in neonates [AOR = 5.6, 95% CI: (1.5-20.7)] compared to spontaneous vaginal deliveries. This finding aligns with previous research conducted at the Bombay Hospital[30] and in Southwest Nigeria.[31] The potential explanation for this observation is that the use of forceps and vacuum extraction during delivery could lead to soft tissue damage, intracranial bleeding, and extracranial hemorrhage, all of which could contribute to neonatal mortality.[32]

Furthermore, the study revealed a significant association between parity and neonatal mortality. This finding is supported by studies conducted in Chennai, India,[25] Kashan, Iran,[24] and Southwest Nigeria.[31] This association may be attributed to the fact that primiparous women tend to have tighter pelvic joints and birth canal muscles compared to multiparous women, potentially leading to increased pressure on the fetal presenting part during labor.[33]

Additionally, neonates born to mothers who experienced obstructed labor were found to have a higher risk of neonatal mortality compared to those born under other circumstances. The prolonged interruption of placental exchange due to obstructed labor could be a contributing factor. Studies from Pakistan[34] and Nigeria[35] have also reported similar findings.

Moreover, the odds of neonatal mortality were higher among neonates whose mothers did not receive antenatal care follow-up compared to those who did receive such care (AOR=4.51 [1.5-13.2]). This underscores the significant association between antenatal care follow-up and neonatal mortality. This result is consistent with research from Rwanda,[36] which highlighted a correlation between neonatal mortality and lack of antenatal care. This could be attributed to the impact of inadequate antenatal care on infant health and well-being, as it may lead to missed opportunities for integrated care, limited promotion of healthy lifestyle choices, and reduced access to timely referrals for pregnant women experiencing complications.[37]

Conclusion

The prevalence of neonatal mortality in the current study was high. The most common cause of neonatal mortality is birth asphyxia, followed by neonatal sepsis and low birth weight. Gestational diabetes mellitus, obstructed labor, parity, missing ANC follow-up, instrumentally assisted vaginal delivery, PIH, and male sex of neonates were factors associated with neonatal mortality.

Recommendations

The following organizations can actively contribute to improving the health of newborns by reducing the prevalence of neonatal mortality, which is on the rise.

1. For Asella government health department
2. Improve access to quality maternal and neonatal healthcare services, including prenatal care, skilled birth attendance, and postnatal care.
3. Enhance the training and deployment of skilled healthcare professionals, especially in rural and underserved areas
4. Implement community-based interventions to promote maternal and child health, such as education on proper nutrition, positive attitude to healthcare.

5. Strengthen health systems by investing in infrastructure, equipment, and supplies necessary for safe childbirth and neonatal care.
6. Support research and data collection to identify specific factors contributing to neonatal mortality and tailor interventions accordingly.
7. For Asella referral and teaching hospital
8. Provide continuous training and education for healthcare staff on neonatal resuscitation, infection control, and other relevant topics to improve clinical skills.
9. Implement standardized protocols and guidelines for neonatal care to ensure consistency and quality across all departments.
10. Establish a multidisciplinary team approach to neonatal care, involving neonatologists, pediatricians, nurses, and other healthcare professionals to provide comprehensive and coordinated care.
11. Ensure timely and accurate diagnosis of neonatal conditions through the use of advanced diagnostic tools and technologies.
12. Enhance monitoring and surveillance systems to track neonatal outcomes, identify trends, and implement targeted interventions.
13. For the researchers
14. To determine common cause of neonatal mortality, researchers should conduct longitudinal studies. Also, qualitative research should be conducted to determine the standard of delivery services and to evaluate the difficulties that medical staff members had while staying in the delivery ward.
15. Collaborate with healthcare professionals, policymakers, and community stakeholders to ensure research findings are translated into actionable policies and programs.
16. Focus on developing innovative interventions and technologies that can improve neonatal health outcomes, such as early detection tools or novel treatment approaches.
17. Prioritize research on evidence-based practices for neonatal care, including interventions that have been proven to reduce mortality rates.
18. Advocate for increased funding and support for research on neonatal health to drive advancements in the field.
19. Share research findings through publications, conferences, and other platforms to disseminate knowledge and promote best practices in neonatal care.

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Authors' contributions

MTA= Methodology, Software, Validation, Formal analysis, Review and editing

AH= Methodology, Review and editing

MB= Methodology, Review and editing

HL= Original draft preparation, Conceptualization, Methodology, Investigation, data curation,

HY= Methodology, Review and editing

HH= Analysis, Methodology

HA= Original draft preparation, Conceptualization, Methodology, Review and editing

GM= Original draft preparation, Conceptualization, Methodology, Formal analysis

Declarations

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This research was approved by Institutional Review Board of Arsi University College of Health Sciences.

Consent for publication

This section is not applicable because the research does not include individuals' image or videos.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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