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Magnitude and contributors of neonatal mortality among newborns admitted to the Intensive Care Unit of Gimbi General Hospital, Western Ethiopia

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Abstract	Article Information
<p>Background: Neonatal death remains a serious public health concern worldwide. The neonatal period is a high vulnerability time. As a result, neonates are subjected to high morbidity and mortality. More than 80% of neonatal mortality occurring in Ethiopia is due to preventable and treatable problems. However, there is a paucity of information on the magnitude of neonatal institutional death in the study setting. Therefore, this study aimed to determine the magnitude and determinants of Neonatal mortality among newborns admitted to the Intensive Care Unit of Gimbi General Hospital, Western Ethiopia, 2019.</p> <p>Methods: A facility-based cross-sectional study was employed on 124 neonates admitted to the Neonatal Intensive Care Unit (NICU) at Gimbi General Hospital from June 20, 2019, to February 20, 2020, by collecting data retrospectively. Data was extracted from neonate's records and death certificates using a pretested checklist. The data was entered into Epi-data version 3.1, cleaned, and exported to SPSS version 24 for final analysis. A Chi-square test was used to indicate association. A p-value of less than 0.05 was considered to decide the significance level statistically.</p> <p>Results: The Magnitude of neonatal mortality was 14.5 % (95% CI (8.9-21-8)). More than half of the newborns were males 75 (60.5%), and most were from rural areas 88%. Hypothermia (84.7%), Respiratory distress (52.4%), Meconium aspiration syndrome, and low birth weight were among the leading cause of neonatal admission, while early-onset neonatal sepsis, severe anemia, prematurity, birth trauma, and meconium aspiration syndrome are leading cause of neonatal death in Gimbi General Hospital. The majority of newborns were born between 37 and 42 gestational age, and more than half of newborns were delivered through spontaneous vertex delivery 67 (54%).</p> <p>Conclusion: The magnitude of the institutional neonatal mortality rate at Gimbi General Hospital is significantly high, which strongly suggests the hospital should be cautious about reducing the incidents as well as work on factors like early neonatal sepsis, prematurity, anemia, meconium aspiration, birth trauma, and respiratory distress as they are reported as the major reason for death.</p> <p>Copyright ©2024 MHSRJ Wallaga University. All Rights Reserved.</p>	<p>Article History Received: 01-02-2024 Revised: 06-04-2024 Accepted: 07-05-2024</p> <p>Keywords: Neonatal mortality, Neonatal period, Gimbi, Ethiopia.</p> <p>*Corresponding Author: Getahun Fetensa</p> <p>E-mail: fetensagetahun@gmail.com</p>

INTRODUCTION

Neonatal death is still a global concern (1). Globally, it accounts for 47% of all under-five mortality (2). Global neonatal mortality has steadily decreased over the last two decades, but this decline has been minimal in sub-Saharan Africa (SSA). Neonatal death is the chance of occurrence of loss of newborn life within 28 days of birth. Neonatal mortality decreased from 39 to 29 between the 2005 and 2016 Ethiopian Demographic and Health Survey (EDHS) even though it unchanged since the 2016 EDHS and it is 30 in 2019 nationally (3). The Ethiopian newborn death rate contributes to 42% of total under-5 mortality (4). Neonatal death is one of the increasingly crucial periods, which is not limited to high under-five contributions as it is the cause for health interventions related to neonatal mortality and prevents maternal mortality (2).

Most newborn deaths can be halted by maximizing care within health institutions (5, 6, 7, 8). Ethiopia has adopted the current global development agenda Sustainable Development Goals (SDGs), which has 17 goals, with Goal 3 targeting health (ensuring healthy lives and promoting well-being for all at all ages). The SDGs have adapted both the success and threats of the Millennium Development Goals (MDGs). It is thus strategic for Ethiopia that the success of the MDGs continues as a strategy as it systematically overcomes threats of SDGs (6).

In Ethiopia, less than five years of infant and newborn death rates were 55, 43, and 30 mortalities per 1,000 live births, respectively. Trends are indicating a continuous decrease in under-5 and post-neonatal childhood death

rates over time. However, the trend of the newborn death rate remained relatively stable (9). More than 80% of newborn deaths occurring in Ethiopia are due to preventable and treatable causes. Neonatal mortality (NMR) contributes to 41% of under-five mortality still (10). Neonatal death is decreasing globally but more slowly than post-neonatal death, which needs special attention in developing countries like Ethiopia and has to be prevented on a hospital base (11). Neonatal death has to be reduced more frequently to reach a sustainable development goal in Ethiopia's health aspect (4). Understanding the magnitude of neonatal death and contributing factors is important to identify interventions that can decrease mortality (2). Nowadays, research on neonatal mortality is important to inform clinicians, programs and policymakers; however, there is a limited amount of information concerning newborn deaths in the study area. Therefore, this study aims to identify the magnitude of neonatal death and contributing factors among newborns admitted to the Intensive Care Unit of Gimbi General Hospital, West Ethiopia, 2019-2020. The primary concern was to reduce the rate of neonatal mortality, which can be an example for the rest of the health facility, after which training for health professionals working in the area will be provided regarding the management and prevention of contributors.

METHODS & MATERIALS

Study area

Gimbi General Hospital is a vital healthcare facility in Gimbi Town, situated in the West Wallaga zone of the Oromia region, about 441 km west of Addis Ababa. The hospital's neonatal ward is designed to provide critical

care for newborns, featuring essential equipment such as incubators and ventilators to support infants with health challenges. Trained nurses' staff in the ward, ensuring that specialized care is available around the clock. However, the absence of pediatricians presents a significant gap in the hospital's capabilities, potentially limiting the range of care provided to the most vulnerable patients in the Zone.

Study Design and Period

The hospital-based retrospective cross-sectional study was conducted between June 21, 2019 to February 20, 2020.

Study population

The study populations were all neonates admitted to the Neonatal Intensive Care Unit (NICU) of Gimbi General Hospital

Inclusion and Exclusion criteria

Inclusion criteria

All complete medical records of neonates admitted to the Neonatal Intensive Care Unit (NICU) and their mothers' charts

Exclusion Criteria

All medical records of neonates with any missing diagnosis on admission, missing clinical outcomes, and transferred cases were excluded from the study.

Sample size determination

The sample size for the study was calculated using a one-population proportion formula based on a neonatal mortality prevalence of 29 per 1000 (0.029) and a margin of error of 3%. The formula used was:

$$n = \frac{(Z_{\alpha/2})^2 \cdot P \cdot (1-P)}{d^2}$$

Substituting the values, the calculation yielded a sample size of 124. To account for a 10% non-response rate, an additional 12 was added, resulting in a total sample size of 136

neonates. This approach ensures a reliable representation of the neonatal mortality rate within the study population, but during data collection, only charts fulfilling the inclusion criteria were included.

Data collection tool and procedure

Data collection tools were a checklist that was initially adopted from a previous study (12). The checklist constitutes socio-demographic characteristics of neonates and mother as well as factors affecting neonatal mortality in hospitals. The checklist contained variables including age, sex, address of parents, gestational age, birth weight, length of stay, causes of admission, causes of death, and medical outcomes. Professional nurses collected the data after obtaining training in collecting data from the records. The supervisors checked for completeness and clarity before data entry on the same day of data collection.

Data Quality Control

Daily supervision was performed during the entire period of data collection. The pre-tested data was not included in the main data analysis

Data Processing & Analysis

Data was entered into Epi-data version 3.1, cleaned, and exported to Statistical Package for Social Science (SPSS) version 24.0. Descriptive analysis was carried out for each variable to check frequency, distribution, and missing values. An association was tested using chi-square, and a $P < 0.05$ was considered statistically significant.

Ethical Considerations

An ethical clearance letter was obtained from the Gimbi General Hospital research and ethics review committee, and then a formal letter was written to the NICU of Gimbi General Hospital, Maternal and Child Health, and a recording

unit. Informed consent was obtained from all concerned bodies before data collection.

RESULTS

A total of 124 neonates were admitted to the NICU of Gimbi General Hospital, of which (60.5%) were male. More than one-third of the

neonate 47(37.9%) had low birth weight (1,500gms to <2,500gms), whereas 62.1% had normal body weight. ($\geq 2,500$ gms) (Table 1).

Table 1. Demographic Characteristics of the neonatal intensive care unit of Gimbi General Hospital, West Wallaga, Ethiopia, 2019.

Variables		Frequency (%), n=124
Birth Weight	LBW	47(37.9%)
	Normal	77(62.1%)
Prematurity	Yes	35(28.2%)
	No	89(71.8%)
Mother's Place of Residency	Urban	36(29.0%)
	Rural	88(71.0%)
Gestational age	<32	3(2.4%)
	33–37	110(88.7%)
	37–42	11(8.9%)
Duration of Stay within the hospital	≤ 7	110(88.7%)
	> 7	14(11.3%)
Sex of Neonate	Male	75(60.5%)
	Female	49(39.5%)
APGAR score of the first minute	APGAR score <5	60(48.4)
	APGAR score ≥ 5	64(51.6)

Causes of neonatal admission and death

Hypothermia was the determinant cause of admission for neonates, constituting 84.7%, while clinical jaundice, 0.8%, was the least factor leading to neonates' admission (Table

2). However, Early-onset of neonatal sepsis and anemia were the two prominent causes of neonatal death at Gimbi General Hospital in 2019 (Fig 1).

Table 2. Aggregate Causes of Admission to Neonatal Intensive Care Unit of Gimbi General Hospital, West Wallaga, Ethiopia, 2019.

Variables	Frequency (%)
Hypothermia	105(84.7%)
Respiratory Distress syndrome	65(52.4%)
Birth weight (grams) LBW (Weight 1,500 gms to <2,500 gms)	47(37.9%)
Meconium Aspiration syndrome	56(45.2%)
Perinatal Asphyxia	51(41.1%)
Neonatal sepsis	47(37.9%)
Abnormal heart rate	23(18.4%)
Fever	9(7.3%)
Mixed feeding	5(4%)
Hypoglycemia	3(2.4%)
Birth trauma	2(1.6%)
Clinical Jaundice	1(0.8%)

Institutional mortality

According to this survey, the magnitude of neonatal mortality among neonates admitted to the NICU of Gimbi General Hospital in

2019 was 14.5% (95% CI (8.9-21-8). Early neonatal sepsis onset was the main reason causing death, constituting (28%), followed by severe anemia (22%) (Fig 1).

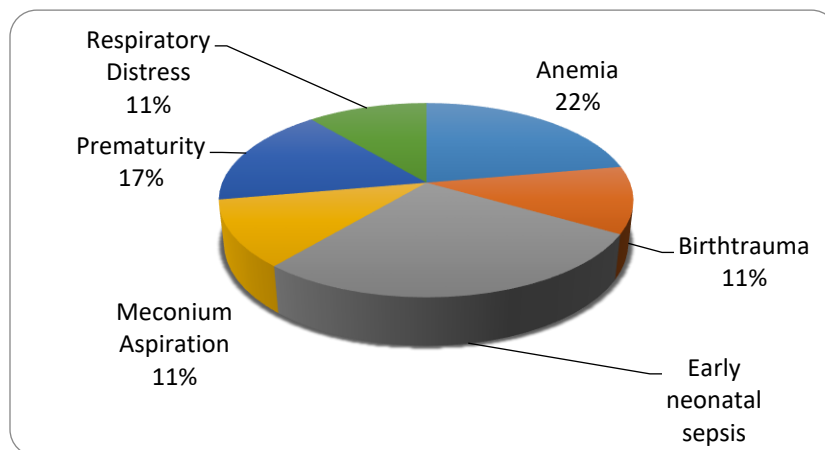


Figure 1. Aggregated Causes of Neonatal Death among Neonates Admitted to Gimbi General Hospital, West Wallaga, Ethiopia, 2019.

Maternal and Institutional related factors

More than half of mothers (62.9%) do not have ANC visit history for the current neonate. Around 66.1% of mothers know

their HIV serostatus, and 77% were from a rural area in residence, while 88.7% of mothers had given birth within the range of 33-37 weeks gestation (Table 3).

Table 3. Maternal and health service-related Characteristics of study participants at Gimbi General Hospital, 2019.

Variables	Frequency (n=124) (Percent=100%)	
	ANC visit	Yes
	No	78(62.9%)
Mother received Tetanus Toxoid Injection (TTI)	1 or none	99(74.2%)
	≥2	25(25.8%)
Maternal HIV status	Negative	82(66.1%)
	Unknown	42 (33.9%)
VDRL	Non -reactive	38(30.8%)
	Unknown	86(69.4%)
Multiple birth	Yes	3 (2.4%)
	No	121(97.6%)
Parity	1	72(58.1%)
	2	30(24.2%)
	3 and above	22(17.7%)
Prolonged labor	Yes	29(23.4%)
	No	95(76.6%)
Anemia	Yes	17(13.7%)
	No	107(86.3%)
Use of partograph	Yes	49(39.5%)
	No	75(60.5%)
PROM	Yes	3(2.4%)
	No	121(97.6%)
Does the mother have hypertensive disorders of pregnancy?	Yes	2(1.6%)
	No	122(98.4%)
Does the mother have any chronic medical conditions?	Yes	108.1% ()
	No	11491.9% ()
Any maternal infections	Yes	1 (0.8%)
	No	123 (99.2%)
Mode of Delivery	SVD	67(54%)
	C/S	57(46%)

Factors associated with institutional mortality

Birth weight, prematurity, type of treatment, body temperature, APGAR score, VDRL,

gravidity, Parity, Maternal age, Prolonged labor, PROM, Birth interval and anemia had a significant association with neonatal

outcomes (alive or death), with chi-square of greater than tabulated and p-value < 0.05.

Table 4. Factors associated with institutional neonatal mortality of Gimbi General Hospital, West Wallaga, Ethiopia, 2019.

Variables (n=124)		Response		p-value
		Alive	Death	
Birth weight	Low birth weight	34(32.1%)	13(72.2%)	0.003*
	Normal	72(67.9%)	5(27.8)	
Prematurity	Yes	20(18.9%)	15(83.3%)	<0.001*
	No	86(81.1%)	3(16.7%)	
Treatment given for neonates	Oxygen, antibiotics and glucose	46(43.4%)	5(27.8)	0.021*
	Oxygen, antibiotic, KMC and resuscitation	39(36.8%)	13(72.2%)	
Temperature	Normal	58(54.7%)	12(66.7%)	0.029*
	Hypothermia and hyperthermia	48(45.3%)	6(33.3%)	
APGAR score	4-7	62(54.7%)	16(88.9%)	0.002*
	≥8	48(45.3%)	2(11.1%)	
VDRL	Non –reactive	28(26.4%)	10(56.6%)	0.028*
	Unknown	78(73.6%)	8(44.4%)	
Gravida	1-3	104(98.1%)	14(77.8%)	0.002*
	≥4	2(1.9%)	4(22.2%)	
Parity	1-2	91(85.9%)	11(61.1%)	0.022*
	≥3	15(14.1%)	7(38.9%)	
Maternal age	≤20	15(14.2%)	2(11%)	0.021*
	20-35	94(85.8%)	16(89%)	
Prolonged labor	Yes	29(27.4)	11(61.1%)	0.002*
	No	77(72.7%)	7(38.9%)	
PROM	Yes	1(0.9%)	5(27.8%)	<0.001*
	No	105(99.1%)	13(72.2%)	
Birth interval	Only one	67(63.2%)	6(33.3%)	0.034*
	Two and above	39(36.8%)	12(66.7%)	
Anemia	Yes	95(89.6%)	12(66.7%)	0.025*
	No	11(10.4%)	6(33.3%)	

* Significant association APGAR: Appearance (skin color), Pulse (heart rate) Grimace response (reflexes) Activity (muscle tone) and Respiration (breathing effort, VDRL: Venereal Disease Research Laboratory (a blood test for syphilis); PROM: Premature Rupture of Membranes

DISCUSSION

The study revealed that the prevalence of neonatal mortality at Gimbi General Hospital

was 14.5 %. (95% CI (8.9-21-8). In Ethiopia, newborn deaths reduced from 39 to 29 between the 2005 and 2016 EDHS; however, it has remained unchanged after 2016, and now 30

per 1000 live births, according to EDHS, 2019 (3). The present study aimed to identify the reason and magnitude of neonatal mortality among inpatient newborns at Gimbi General Hospital in western Ethiopia. In the current study, the neonatal mortality rate was (14.5%) among neonates admitted to Gimbi General Hospital in 2019. This result is in line with the study done in Jimma Medical Center 13.3% (12). However, this finding is slightly less than the research undertaken in Debrebran, Northern part of Ethiopia, which was 21.5% (1), a prospective study conducted on selected hospitals of Ethiopia 29% (2), Ayder Hospital 16.7% (13), Arbaminch General Hospital 20.2% (14) and Eastern of Ethiopia 20% (15). In another way, the finding is extremely higher than the study findings from the northern part of Ethiopia (16) and North Gonder (17). This might be due to differences in hospital capacity and the geographical alignment of the study population. The current neonatal mortality rate is slightly higher than that of the study done in Nekemte Referral Hospital, which is 8.8% (18), in the Tigray region (19).

Hypothermia 84.7%, low birth weight 37.9%, and neonatal sepsis (37.9%) were the prominent cause of neonatal admission. The proportion of causes of neonatal admission to neonatal intensive care units differs across parts of Ethiopia (12). In the same way, respiratory distress syndrome 52.4%, Meconium aspiration syndrome 45.2% and Perinatal asphyxia 41.1% the contributors to neonatal admission, which is consistent with a study from Jimma Medical Center (12), Ayder Hospital (13). This implies that all reasons for neonatal admission were from avoidable causes (3, 8). Factors like Low birth weight are evidenced by different studies conducted in a different part of the globe as

causes of both admission and death for newborns (20, 21).

In this study, early neonatal sepsis (28%), Anemia (22%), Prematurity (17%), birth trauma (11%), Meconium aspiration (11%), and respiratory (11%) were the significant cause of neonatal mortality among newborn admitted to Gimbi General Hospital, which is consistent with a study conducted in Ayder Hospital (13, 19). All conditions can easily be preventable (18).

The early neonatal period was the period in which the majority of deaths occurred in our study, which is similar to research undertaken in different parts of Ethiopia (1, 4, 7, 13, 18). In this study, most of the neonatal death was reported very early, indicating a high early neonatal mortality, indicating that neonatal survival interventions have to focus on the intrapartum as well as immediate and early neonatal periods for better outcomes (18).

Newborns born from a mother who experienced prolonged labor for current pregnancy were at higher risk for mortality, which is in line with the study results from Arbaminch General Hospital (14). As we can understand from this point, prematurity is one of the significant factors for neonatal which is consistent with conducted in Jimma (12), Nationally study analyzed by EDHS, 2016, and study results from the Eastern part of Ethiopia (22-24), Nekemte Referral Hospital (18). Hypothermia is a significant reason for the occurrence of newborn deaths within the current study, which is the same as a study from Jimma Medical Center and selected hospitals in Ethiopia (2, 12). The current study indicates that the birth interval was one of the determinant causes of neonatal death, consistent with the case-control study used in 2011 EDHS data (25), Arbaminch General

Hospital (14). Anemia is one significant contributor to neonatal mortality in our study, consistent with other studies conducted in Ethiopia (2). In the current study, respiratory distress (11%) was identified as a contributor to neonatal death, which is similar to research undertaken on selected hospitals in Ethiopia (21). Generally, intervening in the symptoms of serious neonatal morbidity is important in neonatal life (26).

Strength and Weakness of the study

The research has considered maternal and neonatal factors that contribute to neonatal death. However, it does not consider multivariable analysis. Also, the definition of neonatal sepsis is based on the clinical basis, which we cannot base blood culture on as the facility cannot allow the procedure.

Conclusion

In general, the magnitude of neonatal death was high in the study area. Most of the neonatal death was reported very early, indicating a high early neonatal mortality. Therefore, interventions have to focus on the intrapartum and immediate and early neonatal periods for better neonatal survival.

DECLARATIONS

Ethical approval and consent to participate

An ethical clearance letter was obtained from the Gimbi General Hospital research and ethics review committee. Then, a formal letter was written to the NICU of Gimbi General Hospital, the Maternal and Child Health Department, as well as a recording unit. Informed consent was obtained from all concerned body before data collection.

Consent to publish

Not Applicable

Operational definitions and definition of terms

Neonatal mortality: The chance of loss of newborn life within the first month of life/ \leq 28days [3]

Prematurity: - A newborn delivered before a gestational age of completed 37 weeks (259 days) (3).

Neonatal sepsis: a clinical syndrome of bacteremia with systemic signs and symptoms of infection in the first month of life [3].

List of acronyms/ Abbreviations

AIDS -Acquired Immune Deficiency Syndrome, **ANC** -Antenatal Care **AOR**- Adjusted Odds Ratio, **CSA**-Central Statistical Agency, **EDHS**- Ethiopia Demographic and Health Survey, **EONS**-Early onset neonatal sepsis, **HIV** -Human Immunodeficiency Virus **LBW**- Low birth weight, **MDG**- Millennium Development Goal, **MOH** - Ministry of Health, **UNICEF**- United Nations Children's Fund, **SNCU**- Special Newborn Care Unit **SPSS**-Statistical package for social science, **VLBW**-Very low birth weight, **PROM**-Prolonged rupture of membranes, **SVD**-Spontaneous vertex delivery.

Availability of data and materials

All the data and materials are available with the authors.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

KE and GF have been involved in the conception of the study protocol, formulation of the study design, training of data collectors, data entry, analysis, and interpretation of data.

GF, BW, and GN participated in the design, interpretation of data, reviewing intellectual content, supervised the overall process of the process, and manuscript preparation, and they have provided important comments to supervise the overall process and review the manuscript.

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