



Research article

Preparedness for neonatal emergencies at birth and associated factors among healthcare providers working at hospitals in northwest Ethiopia: A multi-center cross-sectional study



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ARTICLE INFO

Keywords:

Ethiopia

Neonatal emergencies

Preparedness

Healthcare provider

ABSTRACT

Background: Neonatal mortality remains a public health concern, especially in Southern Asia and Sub-Saharan Africa. Despite substantial efforts, the neonatal mortality rate is increasing from 29 per 1000 live births in 2016 to 33 per 1000 live births in 2019 in Ethiopia. To avert this unacceptably high mortality, the healthcare provider's readiness for neonatal emergencies at birth is crucial. Hence, this study aimed to assess healthcare providers' preparedness for neonatal emergencies at birth in northwest Ethiopia.

Methods: A multicenter cross-sectional study was conducted at hospitals in northwest Ethiopia from November 15/2020 to March 10/2021. A simple random sampling technique was used to select 406 study participants. Data were collected through face-to-face interviews using a structured questionnaire, and direct observation and chart review using standardized checklists. The data were then entered into EPI INFO version 7.1.2 and exported to SPSS version 25 for analysis. Both bivariable and multivariable logistic regression analyses were undertaken. The level of significance was claimed based on the adjusted odds ratio (AOR) with a 95 % confidence interval (CI) at a p-value of ≤ 0.05 .

Results: The proportion of healthcare providers having adequate preparedness for neonatal emergencies was 60.1% (95% CI: 55.3, 64.8). The final model analysis illustrates that healthcare providers who received neonatal resuscitation training (AOR = 2.87; 95% CI: 1.74, 7.74) and working at the general hospital (AOR = 5.2; 95% CI: 1.96, 13.8) were adequately prepared for neonatal emergencies. On the other hand, healthcare providers who complained about workload or shortage of staff (AOR = 0.41; 95% CI: 0.26, 0.66) were poorly prepared for neonatal emergencies.

Conclusion: In this study, about two-fifths of the healthcare providers were inadequately prepared for neonatal emergencies at birth. Strengthening the provision of neonatal resuscitation training, deploying adequate healthcare professionals, and reducing the healthcare provider's workload would improve healthcare providers' preparedness for neonatal emergencies.

1. Introduction

Globally, about 6700 newborns every day, and 2.4 million neonates every year died in their first months of life in 2019 [1]. Neonatal mortality (NM) remains much higher in resource-limited countries [2]. Sub-Saharan Africa (SSA) and Central and Southern Asia alone accounted for 80% of the global neonatal mortalities [1, 3]. Ethiopia is one of the SSA countries with the highest neonatal mortality rate (NMR), 33 deaths

per 1000 live births in 2019 [4, 5]. In 2019, Ethiopia along with Nigeria, India, Pakistan, and the Democratic Republic of Congo accounted for 49% of all the global under-five mortalities [1, 6]. In most of the cases, neonatal mortalities are highly associated with poor quality of care during childbirth and the time immediately after birth [7].

Birth asphyxia along with preterm birth, infection, and congenital anomalies are accountable for most neonatal deaths [7]. According to the World Health Organization (WHO 2016 report), asphyxia contributes to

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<https://doi.org/10.1016/j.heliyon.2021.e08641>

Received 13 July 2021; Received in revised form 19 November 2021; Accepted 16 December 2021

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one-quarter of neonatal mortalities [8]. Related to this, evidence indicated that about one-third and nearly three-fourths of all neonatal deaths occur during the first 24 h and 7 days of life after birth, respectively [9, 10]. In this aspect, early anticipation and effective resuscitation have a substantial contribution to preventing neonatal death related to birth asphyxia and other complications [11]. However, babies delivered at home and in less equipped health institutions are less likely to access timely resuscitation service, and are highly vulnerable to asphyxia and its complications [12]. Birth asphyxia could also affect neonates who were delivered at well-equipped facilities unless healthcare providers adequately prepared for and timely respond to neonatal emergencies. Although birth asphyxia is preventable neonatal emergency, it can bring about plenty of devastating complications including neonatal death and long-term sequels to the newborn such as cerebral palsy, intellectual impairment, and mental retardation [13].

In Ethiopia, an estimated 122,000 neonates die every year [14]. About 24% of these neonatal deaths are attributable to birth asphyxia [15], with the prevalence ranging between 2.5% to 32.9% [16, 17, 18, 19, 20]. A meta-analysis on the effect of perinatal asphyxia showed that asphyxia increases the risk of neonatal death by 3.52 times [21].

Moreover, the management of perinatal asphyxia is somewhat complex and often challenging [22]. Effective neonatal resuscitation using a bag and mask has a substantial role in preventing neonatal morbidities and mortalities related to birth asphyxia [23, 24]. In this perspective, healthcare providers' preparedness and risk anticipation are pivotal life-saving interventions [25]. Basic elements of preparedness and risk identification for emergencies (i.e. perinatal risk assessment, supply and equipment assembling, and resuscitation team formation) are the initial and integral phases of neonatal resuscitation to prevent undue neonatal mortalities and morbidities [26]. Preparedness and readiness also require a list of items or a checklist to confirm the availability and functionality of supplies and equipment in the health facility [27]. Besides, keeping the healthcare providers up-to-date with knowledge and skills of neonatal resuscitation, and undertaking periodical performance evaluations are advisable to decrease birth complications [28, 29]. Existing evidence indicated that training on helping babies survive and neonatal resuscitation programs increase healthcare providers' knowledge and skill retention, thereby reducing fresh stillbirth and immediate neonatal death [30, 31].

Many factors are responsible for the occurrence of birth asphyxia and other birth complications. Antepartum factors which have been associated with neonatal emergencies, particularly birth asphyxia include prelabor rupture of membrane (PROM) [19, 32, 33], being primigravida [33, 34], malaria during pregnancy [32, 35], preeclampsia or eclampsia [25, 32], and malpresentation [16, 19, 32]. In addition, some of the intrapartum conditions that negatively affect the fetal outcome or associated with birth asphyxia include prolonged labor [12, 25, 32, 34, 36], meconium-stained amniotic fluid [19, 25, 34, 36], instrumental delivery [12, 17, 19], and cesarean delivery [36, 37]. This implies that there is a need to prepare adequately in the presence of the aforementioned risk factors and other anticipated complications.

In Ethiopia, data regarding healthcare providers' preparedness for neonatal emergencies and other complications during childbirth is limited. Therefore, this study aimed to assess healthcare providers' preparedness for neonatal emergencies at birth and associated factors in northwest Ethiopian hospitals.

2. Methods and materials

2.1. Study area and population

The study was conducted at Gondar province hospitals, Amhara regional state, northwest Ethiopia. A multi-center institution-based observational study was conducted from 15 November 2020 to 10 March 2021 among healthcare providers working at hospitals of Gondar province. In the Gondar province, there are four zones namely South Gondar,

Central Gondar, West Gondar, and North Gondar zone. Besides, there are a total of 22 hospitals in Gondar province. Among these, the University of Gondar and Debre Tabor are referral hospitals. The remaining 20 hospitals are primary hospitals except Debarq general hospital. These hospitals are serving more than 10 million population in the four zones of Gondar province and surrounding zones such as North Wollo and Waghimra zones. The study includes all healthcare providers working at the maternity ward and attending women at or after 28 weeks of gestation (i.e. after fetal viability in the Ethiopian context) at hospitals of northwest Ethiopia during the data collection period. The sample size for this study was determined by using a single population proportion formula by considering the following assumptions: 95% level of confidence, 50% provider's preparedness for neonatal emergencies, and 5% margin of error. Therefore, $n = \frac{(Z\alpha/2)^2 p(1-p)}{d^2} = n = \frac{(1.96)^2 0.5(1-0.5)}{(0.05)^2} = 384$. Where, n = required sample size, α = level of significant, z = standard normal distribution curve value for 95% confidence level = 1.96, p = provider's preparedness for neonatal emergencies, and d = margin of error. After considering a non-response rate of 10%, we obtained a total sample size of 422. Data were collected from 15 hospitals in northwest Ethiopia. The lists of healthcare providers were obtained from each hospital and the sampling frame was designed by numbering the list of healthcare providers. Then, the total sample size was distributed to each selected hospital proportionally. Finally, the participants were selected by a simple random sampling technique using a table of random generation. The outcome variable of the study was healthcare providers' preparedness for neonatal emergencies, whereas the independent variables include socio-demographic variables, and workplace and professional-related variables. These include age, sex, educational level, marital status, availability of smartphone or computer, and availability of media, year of experience, intention to stay in the profession, job satisfaction, facility type, working time, training on essential newborn care, training on basic emergency obstetric and newborn care (BEmONC), training on neonatal resuscitation, the workload in the delivery room, availability of internet, and location of the health facility.

2.2. Operational definitions

Adequate preparedness for neonatal emergencies: Healthcare providers who were able to score above the mean were considered to be adequately prepared.

Effective communication: Was measured based on the 6-item checklist adapted from the American Academy of Pediatrics (AAP) [38]. These items include: 01) identify team leader; 02) team member know their role, 03) talk out loud, 04) use closed-looped communication, 05) apply the mnemonics "SBARR" (i.e., explaining the Situation, Background, Assessment, and Recommendation or Repeat); and 06) all team members contribute. Accordingly, healthcare providers who applied 3 out of 6 items were considered to have effective communication.

2.3. Data collection tools, methods, and procedures

The data collection tool was developed by reviewing literature and guidelines [8, 38, 39] and data were collected using a structured questionnaire and checklists through face-to-face interviews and direct observation, respectively. The questionnaire was assessed by a group of researchers to evaluate and enhance the items in the question. The questionnaire contains socio-demographic characteristics, professional and environment-related factors, and questions assessing the healthcare providers' preparedness for neonatal emergencies. Fifteen Diploma and 5 Bachelor of Science in Midwifery holders, trained about the interview technique, collect and supervise the data, respectively. In the meantime, efforts to reduce the impact of observations on healthcare providers' preparedness (i.e. Hawthorn effect) have been tried. Besides, participants have been advised that their information is anonymous and no longer be exposed to the public. Moreover, the healthcare providers didn't know

what specific steps or activities were on the checklist, so there is no means to be prepared.

2.4. Data processing and analysis

The collected data were checked and coded manually. Thereafter, it was entered into EPI INFO version 7.1.2 and exported to SPSS version 25 for analysis. Descriptive statistics were used to present participants' characteristics and preparedness for neonatal emergencies. Binary logistic regression analysis was fitted to identify independent predictors and variables having a p-value of ≤ 0.2 were included in the multivariable logistic regression analysis. In the multivariable logistic regression, a p-value of ≤ 0.05 with 95% CI for the adjusted odds ratio was used to determine the significant association between the dependent and explanatory variables.

2.5. Ethical consideration

The study was conducted under the Ethiopian Health Research Ethics Guideline and the declaration of Helsinki. Ethical clearance was obtained from the Institutional Ethical Review Board (IRB) of the University of Gondar (Reference number: V/P/RCS/05/413/2020). A formal letter of administrative approval was gained from each selected hospital. Written informed consent was taken from each of the study participants after a clear explanation of the aim of the study.

3. Results

3.1. Socio-demographic characteristics of the study participants

A total of 406 healthcare providers were involved in this study, making a response rate of 96.2%. The mean age of the study participants was 28.4 years (SD \pm 4.7) and 60.8% of the participants were between the age group of 26–30 years. The majority of the healthcare providers

Table 1. Socio-demographic characteristics of study participants in Gondar province hospitals, northwest Ethiopia, 2020/2021 (n = 406).

Characteristics	Category	Frequency	Percentage (%)
Age of participant in year	≤ 25	85	20.9
	26–30	247	60.8
	≥ 31	74	18.2
Sex of the participant	Male	272	67
	Female	134	33
Current marital status	Single	164	40.4
	Married	242	59.6
Experience	≤ 2	140	34.5
	3–5	210	51.7
	≥ 6	56	13.8
Having smart phone or computer	Yes	256	63.1
	No	150	36.9
Ever watching TV	Yes	353	86.9
	No	53	13.1
Ever reading newspaper	Yes	207	51
	No	199	49
Professional category	Midwifery diploma	119	29.3
	Midwifery degree	243	59.8
	Midwifery master's degree	25	6.2
	Others	19	4.7
Monthly income	<5000 ETB	140	34.4
	5001- 10000 ETB	239	58.9
	>10001 ETB	27	6.7

were Midwifery diploma with an average monthly income of 5861.3 ETB. More than two-thirds of the participants were male (Table 1).

3.2. Workplace and profession-related characteristics

Of the total study participants, nearly two-fifths, nearly half, and a third of the study participants got training on essential newborn care, neonatal resuscitation program (NRP), and BEmONC, respectively. More than fourth-fifths of healthcare providers were interested to work in the delivery room (Table 2).

3.3. Healthcare provider's preparedness for neonatal emergencies at birth

Healthcare providers' readiness for neonatal emergencies was found to be 60.1% (95% CI: 55.3, 64.8). More than three-fourths of healthcare providers prepared the resuscitation area adequately. About 72.9% of participants prepared the necessary equipment and 71.4% of them checked the functionality of the equipment (Table 3).

Table 2. Workplace and profession-related characteristics of study participants in Gondar province hospitals, northwest Ethiopia, 2020/2021 (n= 406).

Characteristics	Category	Frequency	Percentage (%)
Facility	Primary hospital	214	52.7
	General hospital	32	7.9
	Tertiary hospital	160	39.4
Facility location	Urban	223	54.9
	Semi-urban	183	45.1
Self-rated relation with the nearby manager	Good	314	77.3
	Poor	92	22.7
Satisfaction on the profession	Satisfied	324	79.8
	Dissatisfied	82	20.2
Availability of internet in the hospital	Yes	232	57.1
	No	174	42.9
Working time	Day	295	72.7
	Night	111	27.3
Assistant present for the delivery	Yes	318	78.3
	No	88	21.7
Received BEmONC training	Yes	126	31
	No	280	69
When did you take the training (n= 126)	Within 2 years	66	52.4
	Before 2 years	60	47.6
Intention to stay in the profession	Yes	290	71.4
	No	116	28.6
Interest to work in the delivery room	Yes	340	83.7
	No	66	16.3
Workload load in the ward	Yes	179	44.1
	No	227	55.9
Working part-time at private health facility	Yes	51	12.6
	No	355	87.4
Education while working	Yes	151	37.2
	No	255	62.8
Training on essential newborn care	Yes	156	38.4
	No	250	61.6
When did you take the essential newborn care training	Within 2 years	102	65.4
	Before 2 years	54	34.6
Training on neonatal resuscitation	Yes	192	47.3
	No	214	52.7

Table 3. Assessing healthcare providers preparedness for neonatal emergencies at birth in Gondar province hospitals, northwest Ethiopia, 2020/2021.

Checklists for preparedness	Frequency (%)
Obtain pertinent information	198 (48.8%)
Anticipate appropriate outcome	185 (45.6%)
Have a respective plan	201 (49.5%)
Prepare equipment	296 (72.9%)
Check for equipment functionality	290 (71.4%)
Additional personnel prepared during childbirth	247 (60.8%)
Carry out effective communication	233 (57.4%)
Resuscitation area well prepared	321 (79.1)

3.4. Factors associated with healthcare provider's preparedness for neonatal emergencies at birth

The multivariable logistic regression analysis revealed that received neonatal resuscitation training, complain of workload or shortage of staff, and facility type were factors significantly associated with healthcare providers' preparedness for neonatal emergencies at birth.

Healthcare providers who have been trained with neonatal resuscitation were 2.87 times more likely to be prepared for neonatal emergencies at birth as compared to those who had no training (AOR = 2.87; 95% CI: 1.74, 7.74). Similarly, healthcare providers who were working in general hospitals were 5.2 times more likely to be prepared for neonatal emergencies during childbirth compared with those healthcare providers who were working in primary hospitals (AOR = 5.2; 95% CI: 1.96, 13.8). Moreover, healthcare providers who were working in hospitals having workload or shortage of staff were 59% less likely to be prepared for neonatal emergencies as compared to their counterparts (AOR = 0.41; 95% CI: (0.26, 0.66) (Table 4).

4. Discussion

Ethiopia has poor success in the prevention and reduction of neonatal mortalities. Despite substantial efforts to achieve the sustainable development goals (i.e. to NMR as low as 12 per 1000 live births), the magnitude of NM is still increasing in Ethiopia [4]. Nationally, there was a plan to decrease the NMR from 28 to 10 per 1000 live births by 2020 [40]. Paradoxically, NMR is increasing from 29 per 1000 live births in 2016 to 33 per 1000 live births in 2019. Moreover, the proportion of neonatal deaths from the total under-five deaths increased from 43% in 1990 to 55% in 2019 [4], and Ethiopia remains one of the top five countries accounting for half of the worlds' under-five mortality in 2019 [6]. To avert this unacceptably high figure of NMR, the Ethiopian government is working on it by far. For instance, one of the national targets which have been set in the second health sector transformation plan (HSTP-II) and are expected to be achieved by 2024/25 is reducing the NMR from 33 to 21 per 1000 live births [5]. Hence, assessing the healthcare system, including healthcare providers' readiness for neonatal emergencies is crucial to perspective corrective actions. Because healthcare providers' readiness to manage neonatal emergencies is very essential to avert neonatal mortalities related to birth asphyxia and other birth complications [26]. Even though several studies have been conducted on determinants of NM and birth asphyxia in Ethiopia, there was limited data on healthcare providers' preparedness for neonatal emergencies at birth. Therefore, this study was intended to assess the healthcare provider's preparedness for neonatal emergencies during childbirth at hospitals in Gondar province, northwest Ethiopia.

Accordingly, the present study found that the healthcare provider's preparedness for neonatal emergencies was 60.1%. In addition, about 72.9%, 71.4%, and 60.8% of the healthcare providers prepared the necessary equipment, checked the functionality of the equipment, and made ready additional personnel at the time of childbirth. This finding is higher than a study conducted in Kenya and Uganda, which was 36.8% in

Table 4. Bi-variable and multivariable logistic regression analysis of factors associated with healthcare providers preparedness for neonatal emergencies at birth among healthcare providers in Gondar province hospitals, northwest Ethiopia, 2020/2021 (n = 406).

Variables	Category	Preparedness for neonatal emergencies		COR (95% CI)	AOR (95% CI)
		Adequate	Inadequate		
Received training on neonatal resuscitation	Yes	138	54	2.6 (1.72, 3.93)	2.87 (1.74, 4.74)**
	No	106	108	1	1
Ever watched TV	Yes	219	134	1.83 (1.02, 3.27)	1.06 (0.54, 2.08)
	No	25	28	1	1
Having smartphone or computer	Yes	169	87	1.94 (1.28, 2.93)	1.26 (0.78, 2.05)
	No	75	75	1	1
Training on essential newborn care	Yes	109	47	1.97 (1.29, 3.02)	1.05 (0.61, 1.80)
	No	135	115	1	1
Facility type	Primary	111	103	1	1
	General	26	6	4.02 (1.59, 10.2)	5.2 (1.96, 13.8)**
	Tertiary	107	53	1.87 (1.22, 2.86)	1.74 (0.66, 2.07)
Workload or shortage of staff	Yes	94	85	0.56 (0.38, 0.84)	0.41 (0.26, 0.66)**
	No	150	77	1	1
Interested to work in the delivery room	Yes	214	126	2.03 (1.19, 3.47)	1.45 (0.82, 2.56)
	No	30	36	1	1
Availability of internet at the hospital	Yes	152	80	1.69 (1.13, 2.53)	1.52 (0.93, 2.47)
	No	92	82	1	1

Notes: *P ≤ 0.05, **P ≤ 0.001; Abbreviations: AOR, adjusted odds ratio; COR, crude odds ratio; CI, confidence interval; ETB, Ethiopia birr; 1, reference category.

the presence of newborn special care unit and 20% in the absence of newborn special care unit [41]. The extent of equipment preparation for neonatal emergencies in the current study is also higher than previous studies conducted in Nigeria-53.6% [42] and Ethiopia-48% [43]. This discrepancy might be related to variation in the study design, study area, and study population. Unlike the current study, the aforementioned studies included health centers and private health facilities. Also, the previous study from Ethiopia used secondary data to determine healthcare providers' readiness to treat neonatal problems. Hence, the level of preparedness of healthcare workers for neonatal emergencies tends to be lower in healthcare providers working at health centers (i.e. most of them are Diploma). In this study, 59.8% of the participants were Midwifery Degree holders, and nearly half of them were trained in neonatal resuscitation programs. This is supported by a study conducted in Ghana, in which providers having first Degree had more knowledge about neonatal resuscitation compared with Diploma holders [44]. Additionally, the inconsistency might be connected to profession and work-related factors like job satisfaction and interest to work in the delivery room. In the current study, 83.7% and 79.8% of healthcare providers are interested to work in the delivery room and satisfied with their job, respectively. In this regard, evidence support that job satisfaction and interest are key

factors for effective implementation of maternity health service programs and maternal and neonatal outcomes [45]. This implies that the concerned should pay special attention to the satisfaction of healthcare providers in all aspects of their work area to enhance their professional adherence. Thus, improving benefit packages for health workers, arranging education opportunities, maintaining good relationships, and creating a conducive working environment would increase the healthcare provider's job satisfaction and enrich them to take responsibilities.

Contrariwise, the extent of healthcare providers' readiness in terms of necessary equipment and supply preparation is lower as compared to a figure reported from a previous study conducted in Ethiopia-80.9% [46]. The disparity might be related to variation in data collection techniques as the previous study used face-to-face interviews to collect the data, while the current study utilized direct observation. Furthermore, the disparity might be ascribed to variation in the working unit of healthcare providers. In the previous study, more than half (51.7%) of the study participants had been assigned to pediatrics and neonatal intensive care unit (NICU) unlike the current study that included all healthcare providers working at the delivery unit. In this aspect, healthcare providers working at the pediatrics and NICU might be prepared adequately since their primary task is caring for children and newborns. In the maternity unit, however, there may have a stressful and crowded environment and dual activity of caring for the mother and her newborn baby that could make healthcare providers less prepared for neonatal emergencies. Moreover, the discrepancy might be secondary to the difference in receiving neonatal resuscitation training among the healthcare providers as 77.6% of participants from the previous study got the training, which is much higher compared with the current study, in which 47.3% of healthcare providers got training. Studies support that provision of effective NRP training is the pillar to enhance healthcare providers' readiness for neonatal emergencies and decrease neonatal mortalities [23, 47].

The current study found that healthcare providers who received NRP training were 2.87 times more likely to undertake adequate preparation for neonatal emergencies at birth as compared to those who had no training. This finding is supported by previous studies conducted in Ethiopia [46, 47]. This might be due to the fact that training on NRP is associated with improved provider performance and neonatal death reduction [23, 46, 47]. Besides, training on helping babies survive has paramount importance in reducing the incidence of stillbirth and neonatal death in the first 24 h [31]. Thus, provision of training on neonatal resuscitation and other basic emergency obstetric and neonatal cares (BEmONC) would sustainably increase healthcare providers' knowledge and skill regarding neonatal emergencies during childbirth.

On the contrary, healthcare providers who complained of workload or shortage of staff were 59% less likely to be prepared for neonatal emergencies compared with their counterparts. Task overlap or shortage of obstetric care providers is associated with poor adherence to maternal and neonatal healthcare standards and lack of concentration for each specific lifesaving activity during childbirth. Thus, giving specific tasks and assigning adequate healthcare providers in the maternity ward is imperative for practice to enhance positive maternal and neonatal health [48]. In contrast, a study from Ghana found that providers in health facilities with higher workloads had better compliance with antenatal care (ANC) guidelines [49]. This could be explained by the nature of tasks in the delivery unit is much tiresome than that of at the ANC unit. Nowadays, the facility-based delivery rate is getting increased from time to time. However, the rate of professional deployment in maternity units is not that much comparable. This generally further underlines the urgency of deploying sufficient and qualified healthcare providers in maternity units closer to the community, which is one of the strategies of HSTP-II to achieve the national target of reducing NMR to 21 per 1000 live births by 2024/25 in Ethiopia [5].

Type of health facility was significantly associated with provider's preparedness for neonatal emergencies at birth. Accordingly, healthcare providers working at the general hospital were 5 times more likely to be

prepared for neonatal emergencies as compared to those healthcare providers who were working in primary hospitals. This finding is in agreement with a study conducted in northwest Ethiopia that shows healthcare providers who are working at primary hospitals had provided good quality of care as compared to providers working at health centers [50]. The explanation concerning this finding might be due to the fact that most of the general and referral hospitals are teaching hospitals and centers of referral. Hence, more relevant information about neonatal health may be forwarded and shared among providers at the time of morning sessions, bedside presentations, and rounds. Besides, general hospitals may have more senior and experienced staff and physicians who tend to receive NRP training, and thus have a rich experience in NRP as compared to primary hospitals.

4.1. Strength and limitation of the study

This study poses its own strength and limitations. The authors strongly believe that this study will have paramount clinical and public importance. It will aspire to pursue knowledge in this theme and can be employed as a benchmark for future studies as there was a dearth of similar studies in Ethiopia. It was also conducted through direct observation which could increase the reliability of the data and validity of the study. However, it could have certain limitations for which the readers need to consider. First, the reported magnitude of preparedness for neonatal emergencies could be overestimated due to the possible impact of the Hawthorn effect despite plenty of efforts. In addition, there might be inter-observer variability across the data collectors although observation guidelines have been provided to overcome this concern.

5. Conclusion

In this study, two-fifths of healthcare providers inadequately prepared for neonatal emergencies. Receiving NRP training and working at the general hospital show a positive association with healthcare providers' preparedness for neonatal emergencies at birth. Whereas, complaining of workload or shortage of staff in the hospital negatively affects the healthcare provider's preparedness for neonatal emergencies. Thus, strengthening the provision of neonatal resuscitation training, deploying adequate health professionals, and reducing healthcare providers' workload, and arranging a platform for dissemination of neonatal emergency-related information to the lower level of health facilities would alleviate the problem.

Declarations

Author contribution statement

Azmeraw Ambachew Kebede (AAK) and Muhabaw Shumye Mihret (MSM): Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Birhan Tsegaw Taye (BTT), Kindu Yinges Wondie (KYW), Agumas Eskezia Tiguh (AET) and Getachew Azeze Eriku (GAE): Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Acknowledgements

We are grateful to the School of Midwifery, health facilities, data collectors, and study participants.

Annex1. English version of the questionnaire**Part I: Socio-demographic characteristics.**

N.O	Questionnaire	Alternative choice for response	Skip code
101	How old are you?	(In years)	
102	What is your sex?	1. Male 2. Female	
103	Professional category	1. Midwifery- Diploma 2. Midwifery-Degree 3. Midwifery-Master's degree 4. Medical interns 5. IESO 6. Other specify	
104	What is your marital status?	1. Single 2. Married 3. Divorced 4. Widowed	
105	What is your religion?	1. Orthodox Christian 2. Muslim 3. Protestant 4. Catholic 5. Other specify	
106	What is your monthly income		
107	Have you ever read newspapers?	1. Yes 2. No	
108	Have you ever watched a television?	1. Yes 2. No	
109	If yes, how often did you watch?	1. Every day 2. One times per week 3. two times per week 4. Three and more	
110	Do you have a smartphone or computer	1. Yes 2. No	
111	Have you ever chew chat?	1.Yes 2. No	
112	Have ever smoke cigarette?	1.Yes 2. No	

Part II: Work environment and profession related questions.

NO	Questioners	Alternative choices for response	Skip code
201	Year of experience		
202	Self-rated relation with the nearby boss?	1.Good 2.Poor	
203	Are you satisfied with your profession/job?	1. Yes 2. No	
204	Facility type	1.Primary hospital 2.General hospital 3.Tertiary hospital	
205	Is there an internet connection in your hospital?	1. Yes 2. No	
206	Is there any guideline for postnatal care in the ward?	1. Yes 2. No	
207	Have you ever received training on postnatal care?	1. Yes 2. No	
208	When was the working time?	1. 1. Night 2. 2. Day	
209	Was there any assistance for the delivery?	1. Yes 2. No	

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(continued)

NO	Questioners	Alternative choices for response	Skip code
210	Have you ever received training on essential newborn care?	1. Yes 2. No	
211	Have you ever received training on BEmONC?	1. Yes 2. No	
212	Time taken from home to the health facility		
213	Facility location	1.Urban 2.Semi-urban	
214	Are you intended to stay in the profession for the future?	1. Yes 1. 2. No	
215	Did the nearby manager regularly monitor for the complete fullness of immediate postnatal cares?	1. Yes 2. No	
216	Is there workload in the hospital and/or shortage of staffs?	1. 1. Yes 2. No	
217	Are you interested to work in the delivery unit?	2. 1. Yes 3. 2. No	
218			

Part III- Providers preparedness for neonatal emergencies

1. Anticipate and plan for resuscitation	
1.1 Obtain pertinent perinatal information	1. YES 2. NO
1.2 Anticipate appropriate outcomes	1. YES 2. NO
1.3. Have a respective plan	1. YES 2. NO
2. Prepare and check equipment's before resuscitation	
2.1 Check for the equipment's availability	1. YES 2. NO
2.2 Check for the equipment's functionality	1. YES 2. NO
3. Call for additional personnel for complex delivery	1. YES 2. NO
4. Carry out an effective Communication	
4.2 Team members know their role	1. YES 2. NO
4.3 Talk out loud	1. YES 2. NO
4.4 Use close-looped communication	1. YES 2. NO
4.5 SBARR:	1. YES 2. NO
4.6 All team members contribute	1. YES 2. NO

References

- [1] Estimation UNIG for CM, United nations inter-agency group for child mortality estimation (EUN IGM), in: Levels & Trends in Child Mortality: Report 2020, Estimates Developed by the United Nations Inter-agency Group for Child Mortality Estimation, United Nations Children's Fund, 2020. New. Published online.
- [2] J De Graft-johnson, L. Vesel, H.E. Rosen, et al., Cross-sectional observational assessment of quality of newborn care immediately after birth in health facilities across six sub-Saharan African countries, *BMJ Open* 7 (2017).
- [3] E. Smith-greenaway, J. Trinitapoli, Maternal cumulative prevalence measures of child mortality show heavy burden in sub-Saharan Africa 117, 2020, pp. 4027–4033 (8).
- [4] Ethiopia Mini Demographic and Health Survey Key Indicators, EPHI and ICF, Rockville, Maryland, USA, 2019.
- [5] Health sector transformation plan II 2020/2021-2024/2025, Ethiop. Minist. Health 25 (February) (2021) 1–128.
- [6] The world bank report on neonatal mortality. <https://data.worldbank.org/indicator/SH.DYN.NMRT.2020>.
- [7] World Health Statistics 2019, Monitoring Health for the SDGs, Sustainable Development Goals, World Health Organization, Geneva, 2019. IGO, Licence: CC BY-NC-SA 3.0.; 2019.
- [8] WHO Technical Specifications of Neonatal Resuscitation Devices, World Health Organization, 2016.
- [9] L.H. Ma, M. Alexander, D. You, L. Alkema, U.N.I. Group, Estimation M. National , regional , and global levels and trends in neonatal mortality between 1990 and 2017 , with scenario-based projections to 2030 : a systematic analysis, *Lancet Glob. Health* 7 (6) (2019) e710–e720.
- [10] Chacha D. Mangu, Susan F. Rumisha, Emanuel P. Lyimob, Irene R. Mremib, Isolide S. Massawe, M. Veneranda, M.G.C. Bwana, LEGM, Trends , patterns and cause-specific neonatal mortality in Tanzania : a hospital-based retrospective survey, *Int. Health* (2020) 1–10.
- [11] World Health Organization (WHO), Guidelines on basic newborn resuscitation, World Health Organ, 2012, pp. 1–61. Published online 2012.
- [12] A.D. Meshesha, M. Azage, E. Worku, G.G. Bogale, Determinants of birth asphyxia among newborns in referral hospitals of Amhara national regional state , Ethiopia, *Pediatr. Health Med. Ther.* 11 (2020).
- [13] J.L. Wallander, E. McClure, F. Biasini, et al., Brain research to ameliorate impaired neurodevelopment-home-based intervention trial (BRAIN-HIT), *BMC Pediatr.* 10 (1) (2010) 27.
- [14] J.E. Lawn, M.V. Kinney, R.E. Black, et al., Newborn Survival: a Multi-country Analysis of a Decade of Change, 27, Health Policy Plan, 2012, pp. iii6–iii28 (suppl_3).
- [15] Federal Ministry of Health, Ethiopia, National Strategy for Newborn and Child Survival in Ethiopia. 2015/16-2019/20. Maternal and Child Health Directorate June 2015. Ethiopia, Addis Abeba, 2015.
- [16] Z.J. Wayessa, T. Belachew, J. Joseph, Birth asphyxia and associated factors among newborns delivered in Jimma zone public hospitals, Southwest Ethiopia: a cross-sectional study, *J. Midwif. Reprod. Health* 6 (2) (2018) 1289–1295.
- [17] N.A. Ibrahim, A. Muhye, S. Abdulie, Prevalence of birth asphyxia and associated factors among neonates delivered in Dilchora referral hospital, in Dire Dawa, Eastern Ethiopia, *Clin. Mother Child Health* 14 (4) (2017).
- [18] A. Alemu, G. Melaku, G.B. Abera, A. Damte, Prevalence and associated factors of perinatal asphyxia among newborns in Dilla University referral hospital, Southern Ethiopia– 2017, *Pediatr. Health Med. Ther.* 10 (2019) 69–74.
- [19] W.A. Bayih, G.Y. Yitbarek, Y.A. Aynalem, et al., Prevalence and associated factors of birth asphyxia among live births at Debre Tabor General Hospital, North Central Ethiopia, *BMC Preg. Childbirth* 20 (1) (2020) 1–12.
- [20] G. Gebreheat, T. Tsegay, D. Kiros, et al., Prevalence and Associated Factors of Perinatal Asphyxia Among Neonates in General Hospitals of Tigray, Ethiopia, 2018, 2018;2018.
- [21] S.R. Pratiwi, H. Prasetya, B. Murti, The effect of asphyxia on neonatal death: a meta-analysis, *J. Matern. Child Health* 5 (4) (2020) 413–421.
- [22] E. Ayebare, G. Ndeezi, A. Hjelmsstedt, et al., Health care workers ' experiences of managing foetal distress and birth asphyxia at health facilities in Northern Uganda, *Reprod. Health* 18 (2021) 1–11.
- [23] D.N. Shikuku, B. Milimo, E. Ayebare, P. Gisore, G. Nalwadda, Practice and outcomes of neonatal resuscitation for newborns with birth asphyxia at Kakamega County General Hospital, Kenya: a direct observation study, *BMC Pediatr.* 18 (1) (2018) 1–11.
- [24] Q. Mj, M. Kumar, Laryngeal Mask Airway versus Bag-Mask Ventilation or Endotracheal Intubation for Neonatal Resuscitation, WILEY, 2018. Published online, www.cochranelibrary.com.
- [25] G.T. Gebregziabher, F.B. Hadgu, H.T. Abebe, Prevalence and associated factors of perinatal asphyxia in neonates admitted to ayder comprehensive specialized hospital , northern Ethiopia : a cross-sectional study, *Indian J. Pediatr.* 2020 (2020) 8.
- [26] K. Carolyne, J. Jebet, P.A. Karani, Preparedness on newborn resuscitation : a study done in Kenyatta national hospital among health care providers in labour ward and maternity theatre, 2019, pp. 43–53.
- [27] T. Ogunlesi, O. Dedeke, F.A. Adekanmbi, B.M. Fetuga, A.J. Okeniyi, Neonatal resuscitation: knowledge and practice of nurses in western Nigeria, *South Afr. J. Child Health* 2 (1) (2008) 23–25.
- [28] C. Enweronu-laryea, K.E. Dickson, S.G. Moxon, et al., Basic newborn care and neonatal resuscitation : a multi-country analysis of health system bottlenecks and potential solutions, *BMC Preg. Childbirth* 15 (2015) 1–20.

- [29] Y.M. Kim, N. Ansari, A. Kols, et al., Assessing the capacity for newborn resuscitation and factors associated with providers' knowledge and skills: a cross-sectional study in Afghanistan, *IOSR J. Nurs. Health Sci.* (2013) 1–12.
- [30] F. Atiqzai, P. Manalai, S.S. Amin, et al., Quality of essential newborn care and neonatal resuscitation at health facilities in Afghanistan: a cross-sectional assessment, 2019, pp. 1–12. Published online.
- [31] J. Dol, M. Campbell-Yeo, G. Tomblin-Murphy, M. Aston, D. McMillan, B. Richardson, The impact of the Helping Babies Survive program on neonatal outcomes and health provider skills: a systematic review protocol, *JBI Database Syst. Rev. Implement Rep.* 15 (6) (2017) 1528–1536.
- [32] A. Chaibi, Seraphin Nnguefack, M.A.H.S.N. Evelyne, M.D.3 Lawrence Mbuagbaw, P.-F.T. Elie Mbonda, A.D. Frcog, Risk factors for birth asphyxia in an urban health facility in Cameroon, *Iran J. Child Neurol.* 7 (3) (2013) 46–54.
- [33] Abay Woday, Ayesheshim Muluneh, Christine St Denis, Birth asphyxia and its associated factors among newborns in public hospital, northeast, *PLoS One* 14 (2019) 1–13.
- [34] R.A. Abdo, H.M. Halil, B.A. Kebede, A.A. Anshebo, Prevalence and contributing factors of birth asphyxia among the neonates delivered at Nigist Eleni Mohammed memorial teaching hospital, Southern Ethiopia: a cross-sectional study, *BMC Preg. Childbirth* 6 (2019) 1–7.
- [35] P. Jagannathan, How does malaria in pregnancy impact malaria risk in infants? *BMC Med.* 16 (1) (2018) 13–15.
- [36] L. Wosenu, A.G. Worku, D.F. Teshome, Determinants of birth asphyxia among live birth newborns in University of Gondar referral hospital, northwest Ethiopia: a case-control study, *PLoS One* (2018) 1–12. Published online.
- [37] Tewodros Mulugeta, Girum Sebsibe, M.S. Fikirtemariam Abebe Fenta, Risk factors of perinatal asphyxia among newborns delivered at public hospitals in addis ababa, Ethiopia: case-control study, *Pediatr. Health Med. Ther.* 11 (2020) 297–306. <https://www.dovepress.com/getfile.php?fileID=61023>.
- [38] G.M.Z.J. Weiner (Ed.), *Textbook of Neonatal Resuscitation (NRP) 326*, American Academy of Pediatrics, 2016.
- [39] A.K. Usman, E. Wolka, Y. Tadesse, et al., Health system readiness to support facilities for care of preterm, low birth weight, and sick newborns in Ethiopia: a qualitative assessment, *BMC Health Serv. Res.* 2 (2019) 1–16.
- [40] Ethiopians National Health Care Quality Strategy for 2016-2020 Placed Maternal and Child Health as a Priority with the Ambitious Goals to Reduce the Maternal Mortality Ratio from 412 to 199 Per 100, 1000; to Reduce Neonatal Mortality from 28 to 10 Per 1000.
- [41] M.C. Morgan, H. Spindler, H. Nambuya, et al., Clinical cascades as a novel way to assess physical readiness of facilities for the care of small and sick neonates in Kenya and Uganda, *PLoS One* 13 (2018).
- [42] Datonye Christopher Briggs, AUE, Preparedness of primary health care workers and audit of primary health centres for newborn resuscitation in Port Harcourt, Rivers State, Southern Nigeria, *Pan Africa Med. J.* 36 (2020) 1–10.
- [43] W.A. Gobezie, P. Bailey, E. Keyes, A.L. Ruano, H. Teklie, Readiness to treat and factors associated with survival of newborns with breathing difficulties in Ethiopia, *BMC Health Serv. Res.* 19 (1) (2019) 1–10.
- [44] A. Alhassan, A. Fuseini, W. Osman, A.B. Adam, Knowledge and experience of neonatal resuscitation among midwives in tamale, *Nurs. Res. Pract.* 2019 (2019) 8.
- [45] B.K. Deriba, S.O. Sinke, B.M. Ereso, A.S. Badacho, Health professionals' job satisfaction and associated factors at public health centers in West Ethiopia, *Human Resour. Health* 15 (2017) 1–7.
- [46] A. Mersha, S. Shibiru, T. Gultie, N. Degefa, A. Bante, Training and well-equipped facility increases the odds of skills of health professionals on helping babies breathe in public hospitals of Southern Ethiopia: cross-sectional study, *BMC Health Serv. Res.* (2019) 1–12.
- [47] M.W. Abrha, T.T. Asresu, A.A. Araya, H.G. Weldearegay, Healthcare professionals' knowledge of neonatal resuscitation in Ethiopia: analysis from 2016 national emergency obstetric and newborn care survey, *Indian J. Pediatr.* 2019 (2019) 1–8.
- [48] *Defining Competent Maternal and Newborn Health Professionals*, World Health Organization, Geneva, 2018. Licence: CC BY-NC-SA 3.0 IGO.; 2018.
- [49] M. Amoakoh-coleman, I.A. Agyepong, G.A. Kayode, D.E. Grobbee, K. Klipstein-grobusch, E.K. Anshah, Public health facility resource availability and provider adherence to first antenatal guidelines in a low resource setting in Accra, Ghana, *BMC Health Serv. Res.* (2016) 1–9.
- [50] H. Gebrehiwot, W. Id, A.B. Kahsay, A. Medhanyie, H. Godefay, P. Petrucka, Quality of and barriers to routine childbirth care signal functions in primary level facilities of Tigray, Northern Ethiopia: mixed method study, *PLoS One* 15 (6) (2020) 1–22.