

# Knowledge of Basic Neonatal Resuscitation and Associated Factors Among Midwives and Nurses in Public Health Institutions in Eastern Ethiopia

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**Background:** Neonatal resuscitation is a means to restore life to a baby from the state of asphyxia. It is a single intervention of birth asphyxia. Over 1.2 million African babies are supposed to die in the first four weeks of their life and many of them in the first 24 hours of birth in Sub-Saharan Africa. The major cause of early neonatal death is neonatal asphyxia, which can be prevented by neonatal resuscitation. However, there is limited evidence on midwives' and nurses' knowledge of neonatal resuscitation in the study area. Therefore, this study aimed to assess the knowledge of midwives and nurses about neonatal resuscitation and its associated factors.

**Methods:** This facility-based cross-sectional study was done on 427 midwives and nurses, who were selected using simple random sampling technique. Data were collected on facility type, availability of essential equipment, socio-demographic characteristics, working unit, professional experience, in-service training, and knowledge of neonatal resuscitation. First-degree holder midwives collected the data using a pre-tested face-to-face interviewer-administered questionnaire. Bivariate and multivariate logistic regression was used to analyze the association between the dependent and independent variables.

**Results:** The study showed that 9.8% of the study participants had good knowledge about neonatal resuscitation. Factors significantly associated with knowledge of neonatal resuscitation were being trained on newborn resuscitation (AOR = 3.79, 95% CI: 1.73, 8.32), being unmarried (AOR = 2.36, 95% CI: 1.11, 5.02), holding bachelor sciences degree or above (AOR = 2.67, 95% CI: 1.11, 6.47), and working under West Hararghe health institutions (AOR = 0.30, 95% CI: 0.10, 0.88).

**Conclusion:** The study participants had low knowledge of neonatal resuscitation. Being unmarried, holding bachelor sciences degree or above, being trained on neonatal resuscitation, and working under West Hararghe health institutions were factors associated with the knowledge of the study participants on neonatal resuscitation.

**Keywords:** neonate, neonatal resuscitation, newborn, knowledge

## Background

Neonatal resuscitation (NR) is a means to restore life to a baby from the state of asphyxia. It is a single intervention of birth asphyxia.<sup>1</sup> Resuscitation of a neonate is more challenging than that of an adult or even older infant or child.<sup>2</sup> Basic newborn resuscitation refers to airway clearing (suctioning if required), head positioning, and positive pressure ventilation with bag and masks.<sup>3</sup>

Annually, approximately four million babies die within the first month of life, of these deaths about 99% occur in low-middle income countries, where most births occur at home, without a skilled attendant.<sup>3</sup> Nearly 1.2 million African babies are

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assumed to die in the first four weeks of their life, and half of the deaths occur in the first 24 hours of birth. This is particularly true in Sub-Saharan African countries.<sup>4,5</sup>

Neonatal mortality is an indicator of a country's socio-economic condition and quality of life. A large proportion of maternal and neonatal deaths occur during the 48 hours after delivery, which is a critical time for monitoring complications arising from the delivery.<sup>6,7</sup>

In the short term, asphyxia could lead to multi-organ dysfunction or even death, whereas in the long term, childhood survivors of neonatal hypoxic-ischemic encephalopathy might develop cerebral palsy, developmental delay, visual, hearing, and intellectual impairments; epilepsy, and learning and behavioral problems.<sup>8</sup> Despite the important advances in perinatal care in the past decades, neonatal mortality and morbidity have remained a serious problem, and thus it is critical to address its main causes, which often differ from the causes of death for older children. Preterm birth, intrapartum-related complications (birth asphyxia or lack of breathing at birth), infections and birth defects cause most neonatal deaths.<sup>9</sup>

Immediate newborn assessment and stimulation reduce both intrapartum related and preterm related deaths by 10%.<sup>10</sup> However, studies done in Kenya and Nepal have reported that a shortage of equipment and health provider's knowledge are problems with NR performance.<sup>11,12</sup> Additionally, maintaining knowledge of resuscitation is a challenge, particularly in settings where providers attend very few deliveries and infrequently resuscitate newborns.<sup>13,14</sup> Current trends predict that close to 26 million newborns will die between 2019 and 2030. These deaths can be prevented through quality antenatal care, skilled care at birth, postnatal care for mothers and babies, and care of small and sick newborns.<sup>15</sup> Neonatal resuscitation and comprehensive emergency obstetric care are among those recommended to reduce deaths due to intrapartum-related events.<sup>16</sup> In short, knowledge of health care providers about NR is of crucial importance.<sup>17</sup> In resource-poor areas, nurses and midwives are the medical persons available to perform neonatal resuscitation.<sup>18</sup>

Midwives and nurses are health care providers who are able to provide promotive, preventive, curative and rehabilitative services at all levels of the health care system. Midwifery and nursing training in Ethiopia offered in three ways in both public and private science and higher education: the diploma, the post-basic, and the direct BSc (Bachelor of Sciences) degree qualification in midwifery and nurse. Diploma and direct BSc degree in midwifery

and nurse is open to all senior high school graduates depending on their achieved score of national exam criteria. The post-basic entry is available as post-diploma. The diploma and the post-basic program runs for three years and four years for the direct BSc degree program and given their certificate when they attain the requirement per Ministry of Science and Higher Education of Ethiopia. In addition to these, some midwives and nurses are given in-service training that can help them to give quality care at where they assigned.

However, there is limited evidence on midwives' and nurses' knowledge of neonatal resuscitation (ie, crucial to overcome death due to asphyxia) and its associated factors in Eastern Ethiopia. Therefore, this study aimed to identify knowledge of basic neonatal resuscitation and associated factors among midwives and nurses in public health institutions in Eastern Ethiopia.

## Methods and Materials

### Study Area

The study was conducted in the eastern part of Ethiopia (i.e., Harari Regional State, Dire Dawa City Administration, and West and East Hararghe zones of the Oromia Regional state). There were 14 public hospitals and 221 public health centers in the study area. These public health institutions have 7816 health care workers (of whom 3256 were midwives and nurses) who serve 6,565,406 populations.

### Study Design and Population

A health facility-based cross-sectional study was employed among midwives and nurses who were working in public health institutions in Eastern Ethiopia from October 1 to December 15, 2018.

### Sample Size Determination and Procedure

After calculating the sample size for both objectives, we selected larger sample size. A single population proportion formula;  $n = (Z\alpha/2)^2 pq/d^2$  whereas, P (78.8%) was the prevalence of knowledge taken from a previous study.<sup>19</sup> 95% confidence level, and 5% margin of error and 1.5 design effect. By adding 15% non-response, the final sample size was 442 study participants. There were four clusters in the study area: Harari regional state, Dire Dawa city administration, East Hararghe, and West Hararghe zones of the Oromia Regional state. From these four clusters, 28 public health institutions were selected using a simple

random sampling method. Then midwives and nurses were selected using a simple random sampling method with proportional allocation to sample size to health facilities.

## Data Collection and Quality Control

Data were collected from the study subjects (as well as the heads of the selected health institutions) in a pre-selected comfortable setting and using a pre-tested face-to-face interview administered questionnaire using paper printed English version language. Data were collected on facility type, availability of essential resuscitation equipment, socio-demographic characteristics of participants, current working unit, years of professional experience, whether a nurse or midwife received in-service training and knowledge related to neonatal resuscitation. We adopted a questionnaire based on model assessment forms in the Needs Assessment Toolkit (based on the Averting Maternal Death and Disability Program's Needs Assessment taken from another study).<sup>20</sup> The questionnaire was pre-tested on a similar population and corrections were made accordingly. Also, regular supervision has been done and filled questionnaires were checked daily. The data were cleaned and double data entry was done. The data collectors, who were BSc holders and experienced on maternal and neonatal care, and the supervisors (MPH graduates), were given a five-day training on the objectives, method, ethical issue of the study and questionnaire.

## Measurement of Knowledge

Knowledge of midwives and nurses on neonatal resuscitation was determined using a set of 25 Yes/No questions. Each correct answer was valued at one point, and a wrong answer given zero points. Questions not answered were considered as wrong answers. Eventually, participants were then grouped into two categories based on their total score on the knowledge scale: good knowledge (score 80% or higher) and poor knowledge (score less than 80%), which have been used in different studies.<sup>11,20-23</sup> after the overall cumulative mean score and the cumulative mean percentage score were calculated.

## Data Processing and Analysis

After the data had been checked for completeness and internal consistency, they were coded and entered into the Epi data Version 3.1-computer software package and cleaned for inconsistency. Then, they were exported to SPSS Version 23 for further data cleaning and analysis. The respondents who answered more than 80% of the

knowledge questions correctly were coded 1 (good knowledge) and 0 (poor knowledge) otherwise. Descriptive statistics were used to summarize the facility and provider characteristics. Also, a binary logistic regression was used to see the association between good knowledge and each independent variable. Variables that showed  $p \leq 0.25$  in the bivariate analysis were considered as candidates for multi-variable logistic regression analysis; this was to control all possible confounders and to detect associated factors of good knowledge. Hosmer and Lemeshow goodness-of-fit tests were used to assess whether the necessary assumptions were fulfilled. The direction and strength of the statistical associations were measured by the odds ratio with 95% CI. Adjusted odds ratio (AOR) with 95% confidence intervals (CI) using a  $P$ -value  $< 0.05$  was considered as statistically significant association with the outcome.

## Ethical Considerations

Institutional ethical clearance was first sought from the Institutional Health Research Ethics Review Committee (IHRERC) at Haramaya University, College of Health and Medical Sciences. Next, permission letters were collected from Regional and City administration Health Bureaus, zonal and Woreda health offices, and health facility officials. During data collection with each participant was informed about the aim of the study. The data collectors discussed the issue of confidentiality and were taken informed, voluntary, written, and signed consent before the start of data collection. The respondents were assured of confidentiality by excluding their names during data collection.

## Results

### Socio-Demographic Characteristics

A total of 427 nurses and midwives participated in the study, with a 96.6% response rate. Two hundred fifty-three (59.5%), participants were in the age range of 25–34 years with mean age  $\pm$  SD (28.4  $\pm$  7.05), female (60%), and married (57%). Moreover, 46.8% were Orthodox Christians, 66.7% were nurses, and 68.4% were bachelor degrees and above education. Two hundred sixty-three nurses and midwives had 1–5 years of work experience (Table 1).

### Exposure of Nurses and Midwives to Neonatal Resuscitation

The study showed that only one-fourth (25%) of the respondents were taken additional training on neonatal

**Table 1** Socio-Demographic Characteristics of a Study Conducted on Knowledge of Basic Neonatal Resuscitation and Associated Factors Among Midwives and Nurses Working in the Public Health Institutions in Eastern Ethiopia, 2018 [n = 427]

Variable	Frequency (n)	Percent (%)
<b>Age</b>		
15–24	116	27.2
25–34	253	59.3
35–49	42	9.8
50–61	16	3.7
<b>Sex</b>		
Female	258	60.4
Male	169	39.6
<b>Marital status</b>		
Never married	171	40.0
Married	245	57.4
Divorced/Separated	11	2.6
<b>Religion</b>		
Orthodox	200	46.8
Muslim	179	42.0
Protestant	48	11.2
<b>Profession</b>		
Midwifery	142	33.3
Nurse	285	66.7
<b>Level of education</b>		
Diploma	135	31.6
BSc and above	292	68.4
<b>Experience in complete years</b>		
1–5	263	61.6
6–10	114	26.7
≥11	50	11.7
<b>Current practicing unit</b>		
Obstetrics and MCH	290	67.9
Pediatrics and neonatal	137	32.1

**Abbreviations:** BSc, Bachelor of Sciences; MCH, maternal and child health.

resuscitation. Nearly half of the study participants had performed resuscitation at least once with the basic training they took in college before graduation, and had ever worked in the delivery room (Figure 1).

### Health Facilities Characteristics

In this study, almost all the health facilities had neonatal resuscitation corners; 63% had sufficient newborn resuscitation guidelines and 85% had essential equipment for newborn resuscitation. The study participants were selected from these facilities: 29.7%, 25.1%, 23.2%, and

22% were from Dire Dawa city administration health facilities, Harari health facilities, East Hararghe health facilities, and West Hararghe health facilities, respectively. Nearly 80% of the study participants were working in a hospital setting whereas the rest were working in health centers (20%).

### Knowledge of Neonatal Resuscitation

The study revealed that only one in ten of the nurses and the midwives had good knowledge of neonatal resuscitation (Figure 2).

Additionally, most of the midwives and nurses scored high the variable depressed breathing for the birth asphyxia diagnosis and scored lowest the variable call for help for the response of preliminary steps of newborn resuscitation (Table 2).

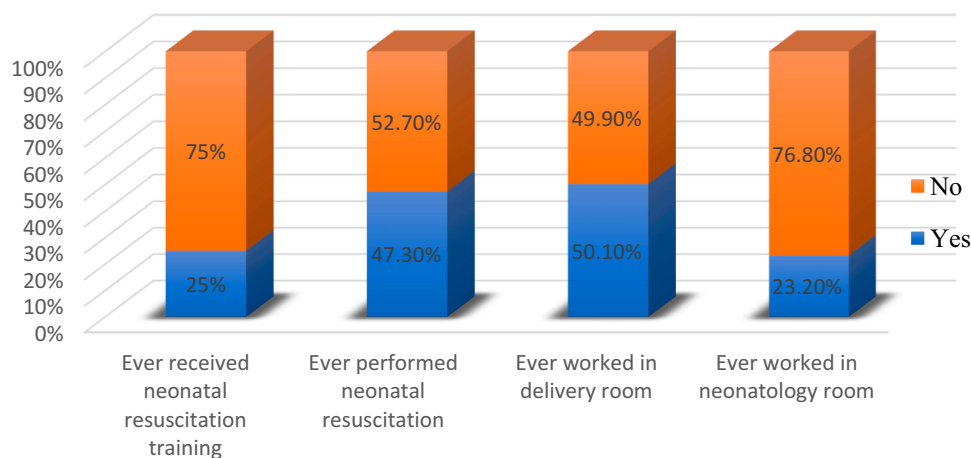
### Factors Associated with Knowledge of Neonatal Resuscitation

In the multivariable logistic regression analysis, the nurses and midwives who received in-training on newborn resuscitation were 3.79 times (AOR = 3.79, 95% CI: 1.73, 8.32) more likely to be knowledgeable about neonatal resuscitation compared to their counterparts. The analysis also revealed that the unmarried respondents were 2.36 times (AOR = 2.36, 95% CI: 1.11, 5.02) more likely to be knowledgeable than married ones. Moreover, the midwives and the nurses who had a bachelor's degree and above in educational level were 2.67 times (AOR = 2.67, 95% CI: 1.11, 6.47) more likely to be knowledgeable about neonatal resuscitation compared to those on diploma level. Furthermore, midwives and nurses working in west Hararghe health facilities were (AOR = 0.30, 95% CI: 0.10, 0.88) less likely to be knowledgeable than those working in Dire Dawa city administration (Table 3).

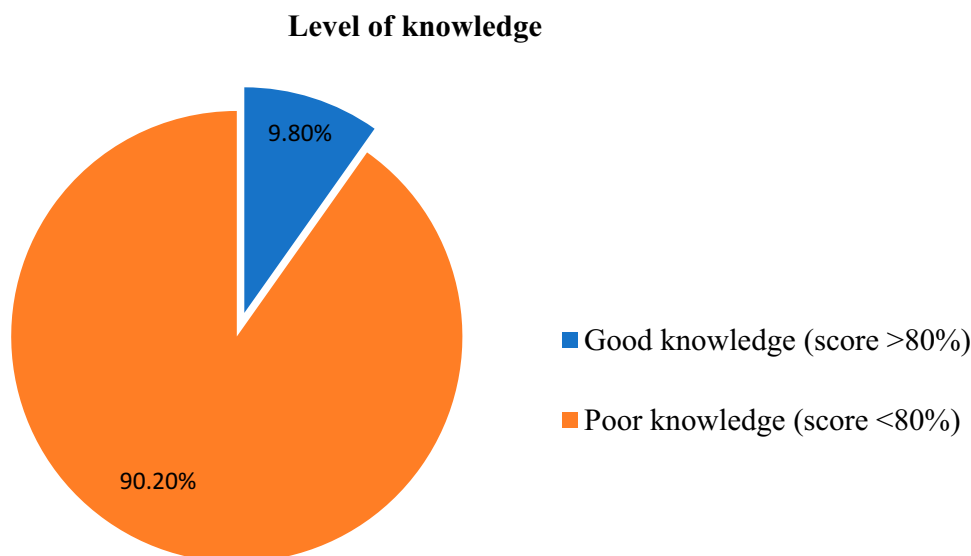
### Discussion

Birth is a major challenge for a newborn to negotiate successfully from intrauterine to extrauterine life. The first few hours after birth is the most crucial period in the life of an infant for further growth and development, which is largely determined by the quality of care that the newborn receives.<sup>21</sup>

There was inadequate knowledge (9.8%) of basic neonatal resuscitation among the study subjects. The lack of knowledge and inability to cope with emergencies can lead to loss of life. In the multivariate analysis, being never



**Figure 1** Exposure of a study conducted on knowledge of basic neonatal resuscitation among midwives and nurses working in the public health institutions in Eastern Ethiopia, 2018 [n = 427].



**Figure 2** Level of knowledge of a study conducted on knowledge of basic neonatal resuscitation and associated factors among midwives and nurses working in the public health institutions, in Eastern Ethiopia, 2018 [n=427].

married, BSc degree and above in educational status, receiving in-service neonatal resuscitation training, and working under West Hararghe health office health facilities were factors associated with the knowledge of the midwives and nurses about neonatal resuscitation.

This study revealed that about 9.8% of nurses and midwives had good knowledge of neonatal resuscitation. This finding is in the argument with the study Mangalore.<sup>2</sup> But lower than the studies in Pune City, India, Northern Ethiopia, Kenya, Nigeria, Afghanistan, Poland, India, central Ethiopia, and Uganda.<sup>1,10,19-29</sup> The difference might be due to the fact that most of the listed studies were conducted in a single facility and single urban town facilities.

However, this finding was from a multi-facility level including the rural area which had no access to updated neonatal resuscitation information, had a shortage of supplies due to transportation problems, even no internet access. In contrast, it is higher than the study conducted in Tamale, Ghana.<sup>22</sup> This difference might be due to that our sample size is higher and most of our participants are BSc degree and above in educational level.

After adjustment of logistic regression, the study showed that neonatal resuscitation training had a statistically significant association with the knowledge of the nurse and the midwives that is, the participants who had newborn resuscitation training were more likely to have a good knowledge

**Table 2** Provider Knowledge: Percent of Providers Who Gave Correct Responses to Each Knowledge Questions Items on Newborn Resuscitation [427]

Questions and Correct Response	Frequency (n)	Percentage (%)
<b>How would you diagnose birth asphyxia?</b>		
Depressed breathing	407	95.3
Heart rate below 100 beats per minutes	114	26.7
Floppiness	143	33.5
Central cyanosis (blue tongue)	333	78
<b>What are the preliminary steps of newborn resuscitation? Tell me in a sequential order</b>		
Call for help	24	5.6
Explain to mother condition of baby	28	6.6
Place newborn face up	295	69.1
Wrap or cover baby, except face and upper portion of chest	196	45.9
Position head so neck is slightly extended	287	67.2
Aspirate mouth then nose	344	80.6
Check the ambu-bag to be functional	247	57.8
Start ventilation using bag and mask	341	79.9
<b>Were the steps mentioned in sequential order?</b>		
Yes	27	6.3
<b>What do you do when resuscitating with a bag and mask or tube and mask?</b>		
Place mask to cover chin, mouth and nose	303	71
Ensure seal between mask and face	233	54.6
Ventilate 1 or 2 times and see if chest is rising	242	56.7
Ventilate 40 times per minute for 1 minute	113	26.5
Pause to determine whether baby is breathing spontaneously	283	66.3
<b>What do you do if the baby is breathing and there is no sign of respiratory difficulty?</b>		
Keep baby warm	264	61.8
Initiate breastfeeding	365	85.5
Continue monitoring the baby	227	53.2

(Continued)

**Table 2** (Continued).

Questions and Correct Response	Frequency (n)	Percentage (%)
<b>What do you do if the baby does not begin breathing, breathing is &lt; 30/minute, or if there is intercostal retraction or grunting?</b>		
Continue to ventilate	166	38.9
Administer oxygen, if available	257	60.2
Assess the need for special care	203	47.5
Explain to mother what is happening	39	9.1
Refer the baby to higher level care service	375	87.8

when compared to those who did not have neonatal resuscitation training. This is probably because the trained providers had more updated information than the untrained participants. This finding is supported by studies conducted in Kenya, Nepal, Afghanistan, Tamale, India, Ghana, Tanzania, Ethiopia.<sup>11,12,20,22,23,30-33</sup>

Those who were unmarried were almost two times more likely to have good knowledge than their counterparts' had. This is probably because most of the unmarried midwives and nurses have more time to read different updated resources/information on neonatal resuscitation than the married midwives and nurses. This is because married midwives and nurses might spare their time with their partners/children, but unmarried one uses this time to their reading. Also, unmarried are expected to be younger than married which implies that they have better capacity of retaining the reading materials and nearer to their educational award time. The BSc degree and above respondents were about two times more likely to have good knowledge than the diploma nurses and midwives had. This might be due to the fact that BSc degree and above providers could have a better chance of evidence-based reviewed information than diploma level providers. This finding is supported by a study conducted in Tamala.<sup>22</sup>

Nurses and midwives working in the health facilities of West Hararge health facilities were less likely knowledgeable than nurses and midwives working in the Dire Dawa city administration health office. This might be due to the fact that the health facilities under Dire Dawa City Administration's health facility might have access to more

**Table 3** Bivariate and Multivariate Analysis of a Study Conducted on Knowledge of Basic Neonatal Resuscitation and Associated Factors Among Midwives and Nurses Working in the Public Health Institutions, in Eastern Ethiopia, 2018 [n = 427]

Variables	Good Knowledge	Poor Knowledge	COR	AOR	p-value
<b>Administrative office</b>					
Dire Dawa health facility	17 (13.4)	110 (86.6)	1	1	
Harari health facility	8 (7.5)	99 (92.5)	0.52 (0.22, 1.27)	0.58 (0.22, 1.56)	0.284
East Hararge health facility	11 (11.1)	88 (88.9)	0.81 (0.36, 1.82)	0.70 (0.27, 1.77)	0.447
West Hararge health facility	6 (6.4)	88 (93.6)	0.44 (0.17, 1.17)	0.30 (0.10, 0.88)*	0.029
<b>Marital status</b>					
Married	19 (7.4)	237 (92.6)	1	1	
Never married	23 (13.5)	148 (86.5)	1.94 (1.10, 3.68)	2.36 (1.11, 5.02)*	0.026
<b>Profession</b>					
Nurse	15 (5.3)	270 (94.7)	1	1	
Midwifery	27 (19)	115 (81)	4.23 (2.17, 8.24)	2.06 (0.35, 12.12)	0.422
<b>Level of education</b>					
Diploma	8 (5.9)	127 (94.1)	1	1	
BSc and above	34 (11.6)	258 (88.4)	2.09 (0.94, 4.65)	2.67 (1.11, 6.47)*	0.029
<b>Newborn resuscitation training</b>					
No	17 (5.3)	303 (94.7)	1	1	
Yes	25 (23.4)	82 (76.6)	5.43 (2.80, 10.54)	3.79 (1.73, 8.32)*	0.001
<b>Ever done NR</b>					
No	8 (3.6)	217 (96.4)	1	1	
Yes	34 (16.8)	168 (83.2)	5.49 (2.48, 12.17)	1.44 (0.52, 4.00)	0.481
<b>Ever worked in a delivery room</b>					
No	8 (3.8)	205 (96.2)	1	1	
Yes	34 (15.9)	180 (84.1)	4.84 (2.18, 10.73)	2.31 (0.77, 6.91)	0.134
<b>Ever worked in neonatal or pediatrics unit</b>					
No	36 (11)	292 (89)	1	1	
Yes	6 (6.1)	93 (93.9)	0.52 (0.21, 1.28)	0.56 (0.17, 1.83)	0.333

Note: \*Statistically significant at  $p < 0.05$ .

Abbreviations: BSc, Bachelor of Sciences; COR, crud odds ratio; AOR, adjusted odds ratio; NR, neonatal resuscitation.

up to date information and close follow-up since most of their facilities were in the town, where there were easy transport accesses available. In addition, they might have close support from NGO's while almost all facilities of West Harerghe were found in a rural area. The above variables were not reported or were not tested in other studies. Therefore, these associated variables will be one input for other studies that will be conducted in the future.

## Conclusion

The level of knowledge among the midwives and nurses was very low. Being unmarried, holding BSc degree and above in educational status and received in-service neonatal resuscitation training had a positive influence on the knowledge of midwives and nurses about neonatal resuscitation, whereas working in West Hararghe health facility

had less influence on the respondents knowledgeable on neonatal resuscitation. The governing office and providers should try to plan neonatal resuscitation training and upgrade nurses and midwives with a diploma education level to a BSc degree or higher level.

## Data Sharing Statement

All related data has been presented within the manuscript. The dataset supporting the conclusions of this article is available from the authors upon reasonable request.

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## Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

## Disclosure

The authors declare no conflicts of interest in this work.

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