Original Article

Knowledge and skills of neonatal resuscitation of health professionals at a university teaching hospital of Northwest Ethiopia

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BACKGROUND: Competency in neonatal resuscitation is critical in the delivery rooms, neonatology units and pediatrics intensive care units to ensure the safety and health of neonates. Each year, millions of babies do not breathe immediately at birth, and among them the majority require basic neonatal resuscitation. Perinatal asphyxia is a major contributor to neonatal deaths worldwide in resource-limited settings. Neonatal resuscitation is effective only when health professionals have sufficient knowledge and skills. But malpractices by health professionals are frequent in the resuscitation of neonates. The present study was to assess the knowledge and skills of health professionals about neonatal resuscitation.

METHODS: An institution based cross-sectional study was conducted in our hospital from February15 to April 30, 2014. All nurses, midwives and residents from obstetrics-gynecology (obs-gyn), midwifery and pediatric departments were included. The mean scores of knowledge and skills were compared for sex, age, type of profession, qualification, year of service and previous place of work of the participants by using Student's *t* test and ANOVA with Scheffe's test. A *P* value <0.05 was considered statistically significant.

RESULTS: One hundred and thirty-five of 150 participants were included in this study with a response rate of 90.0%. The overall mean scores of knowledge and skills of midwives, nurses and residents were 19.9 (SD=3.1) and 6.8 (SD=3.9) respectively. The mean knowledge scores of midwives, nurses, pediatric residents and obs-gyn residents were 19.7 (SD=3.03), 20.2 (SD=2.94), 19.7 (SD=4.4) and 19.6 (SD=3.3) respectively. Whereas the mean scores of skills of midwives, nurses, pediatric residents and obs-gyn residents were 7.1 (SD=4.17), 6.7 (SD=3.75), 5.7 (SD=4.17) and 6.6 (SD=3.97) respectively.

CONCLUSIONS: The knowledge and skills of midwives, nurses and residents about neonatal resuscitation were substandardized. Training of neonatal resuscitation for midwives, nurses and residents should be emphasized.

KEY WORDS: Neonatal resuscitation; Knowledge; Skill; Health professionals

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INTRODUCTION

Neonatal deaths are the major obstacles for the improvement of survival of under five children in developing countries.[1] An estimated 4 million babies die in the neonatal period yearly and approximately all of these deaths occur in low- and middle-income countries.[2,3] The need for information on neonatal deaths is increasing because of an increase in the percentage of mortality

with a current report of about 40% of global under-five mortality occurs in the neonatal period.[4]

World Health Organization defined birth asphyxia as failure to initiate and sustain breathing at birth.[5] Every newborn should be considered at a high risk of birth asphyxia since most cases of asphyxia cannot be predicted.[6] Although neonatal death is multifactorial, the most important single causes of neonatal deaths were preterm birth, birth asphyxia, sepsis and pneumonia.[7–9] According to 2012 UN inter-agency group report for child mortality estimation, slower reductions in neonatal mortality than in under-five mortality were seen in all regions over the past 22 years.[10]

A study conducted in Nigeria showed that the common cause for neonatal deaths were prematurity and perinatal asphyxia.[11] Other studies[12–14] from Nigeria and Malawi found that the main cause for neonatal death was birth asphyxia, indicating that the skills of health professionals about neonatal resuscitation was very crucial to immediate neonatal outcome.

A study[15] conducted in Kenya showed that more than 70% of the health professionals considered that their knowledge about neonatal resuscitation was inadequate because of inadequate medical training. Similarly, a study from Western Nigeria found that the knowledge of nurses about neonatal resuscitation was poor.[16]

Although all health professionals were given training about neonatal resuscitation during their undergraduate courses, we found malpractices of neonatal resuscitation in our hospital. The aim of this study was to assess the knowledge and skills of health professionals about neonatal resuscitation.

METHODS

Study design and participants

An institution-based cross-sectional study was conducted in our teaching and referral hospital from February15 to April 30, 2014.

All midwives, nurses and residents from obs-gyn, pediatric and midwifery departments during the study period were included;whereas those individuals who were sick during the data collection time were excluded.

Operational definitions

Health professionals included midwives, nurses and residents. Midwives were those who worked in the obs-gyn and midwifery departments. Nurses included those who worked in the pediatric department. Residents included physicians who were on postgraduate study in obs-gyn and pediatric departments.

Study tools

A structured questionnaire was developed addressing socio-demographic, theoretical and practical aspects of the knowledge and skills of the participants about basic life support (BLS) and advanced cardiac life support (ACLS) based on the 2010 United Kingdom (UK) Resuscitation Council Guidelines. The questionnaire was validated and pilot tested in other hospitals and changes were made before the study. Forty-six questions used to assess knowledge and each correct answer was given one point. The knowledge level of midwives, nurses and residents was classified as sufficient for midwives, nurses and residents who answered correctly at least 37 of the 46 questions (total score of >80%) and insufficient for midwives, nurses and residents who correctly answered for less than 37 of the 46 questions (total score <80%) according to the 2005 American Heart Association (AHA) accreditation criteria.

Whereas 12 questions were used to assess the skills and each correct answer was given one point. The skills of the midwives, nurses and residents were classified as sufficient for midwives, nurses and residents who answered correctly at least 10 of the 12 questions (total score of >80%) and insufficient for midwives, nurses and residents who correctly answered less than 10 of the 12 questions (total score <80%) according to the 2005 AHA accreditation criteria.

Data collection procedures

The authors distributed the self administered questionnaires to the participants in the respective departments.

Data processing and analysis

The data were coded, entered and analyzed using SPSS version 20 software. The mean scores of knowledge and skills were compared for sex, age, type of profession, qualification, year of experience and previous places of work of the participants by using Student's *t* test and ANOVA with Scheffe's test. A P value <0.05 was considered statistically significant.

Ethical considerations

Ethical clearance was obtained from the institutional ethical review board of our university. Informed consent was obtained from each participant after explanation of what study they will be involved in. Confidentiality was ensured by using an anonymous questionnaire.

RESULTS

Socio-demographic characteristics of the participants

Altogether 150 participants were from the midwifery, obs-gyn and pediatric departments of the hospital. Eight participants were excluded because of the incomplete questionnaires and 7 participants refused to participate in the study. One hundred and thirty-five of the 150 participants were included in this study with a response rate of 90.0%. Males accounted for 58.5% of the participants. The minimum, maximum and median ages of the participants were 19, 50 and 26.0 years respectively. Of the participants, 51 (37.8%), 53 (39.3%), 11 (8.1%), and 20 (14.8%) were midwives, nurses, pediatric residents and obs-gyn residents, respectively.

In the 135 participants, 8 (5.9%), 87 (64.4%), 9 (6.7%), 7 (5.2%), 9 (6.7%), 14 (10.4%), and 1 (0.7%) were diploma holders, BSc holders, MSc holders, first year residents, second year residents, third year residents and fourth year residents, respectively. The periods of experience of 26 (19.3%), 39 (28.9%), 34 (25.2%) and 36 (26.7%) participants were < 1 year, 1–3 years, 4–5 years and > 5 years, respectively. The places of previous work of 73 (54.1%), 20 (14.8%), 24 (17.8%) and 18 (13.3%) of the participants were the University of Gondar, district hospital, other teaching hospital, and district clinic, respectively.

Knowledge levels of health professionals about neonatal resuscitation

The minimum and maximum knowledge scores of health professionals (midwives, nurses and residents) were 13 and 27 (IQR=4) respectively. The overall mean knowledge score about neonatal resuscitation in health professionals was 19.9 (SD=3.1). The mean knowledge scores of midwives, nurses, pediatrics residents and obs-gyn residents were 19.7 (SD=3.03), 20.2 (SD=2.94), 19.7 (SD=4.4) and 19.6 (SD=3.3) respectively. The overall knowledge about neonatal resuscitation in health professionals was poor (<80%).

The correct responses given by midwives were more than 50% for only 13 of 46 knowledge questions. Of these questions, the percentages of correct responses were > 80% for five questions. The percentages of responses ranged from 50% to 79% for 8 questions. On the other hand, the percentage of correct responses for 33 questions was <50% (Table 1).

The correct response given by nurses was more than 50% for 16 of the 46 knowledge questions. Of these questions, the percentage of correct responses was > 80% for 3 questions; wiping meconium from the face and nose while the head appears before delivery is important to prevent aspiration (43, 81.1%). If the baby is not breathing after full delivery, the mouth and nose should be suctioned before drying and stimulating (47, 88.7%) and face mask should cover the nose, mouth and chin during mask ventilation (46, 86.8%).

On the other hand, the correct response was in the range of 50%–79% for 13 questions. The nose followed by the mouth should be suctioned as soon as the head is at the perineum before shoulder delivery to prevent aspiration (34, 64.2%). The baby should be placed on the abdomen of the mother in skin to skin contact and be covered with fresh, dry linen to prevent hypothermia (41, 77.4%). During suctioning, the catheter should be placed in the mouth and nose before turning on the

Table 1. Correct responses to knowledge questions by midwives

Questions	Frequency	Percentage (%)
Wiping meconium from face and nose while head appears before delivery is important to prevent aspiration	46	90.2
The baby should be placed on the abdomen of the mother in skin to skin contact and be covered with fresh, dry linen to prevent hypothermia	45	88.0
Face mask should cover nose mouth and chin during mask ventilation	49	96.1
Measures for difficult mask ventilation	43	84.3
Ventilation should be commenced within one minute for newborns who have no breathing efforts immediately after delivery	39	76.5
If the baby is not breathing after full delivery, the mouth and nose should be suctioned before drying and stimulating	28	54.9
The recommended position for the baby to lie after delivery	31	60.8
How long the baby should be closely observed after the baby starts spontaneous breathing before deciding to do routine essential cares	35	68.6
Methods confirmation of effective mask ventilation	35	68.6
The correct size of laryngoscope for term newborn	15	29.4
What other equipments do you think are necessary for intubation other than ETT and laryngoscope	27	52.0
Depth of chest compression for neonates during CPR (31, 60.8%) and heart rate <60 bpm for neonates and infants is considered as cardiac arrest	27	52.9

device (35, 66.0%). Effective mask ventilation (34, 66.7%) was confirmed, and measures were taken for difficult mask ventilation (39, 73.6%). Ventilation should be commenced within one minute for newborns who have no breathing efforts immediately after delivery (37, 69.8%). The commonest cause for cardiac arrest in children (38, 71.7%), the depth of chest compression in neonates during CPR (32, 60.4%), the commonest arrhythmia in children (33, 62.3%), the dose of adrenaline for neonates during CPR (27, 50.9%), and the dose of amiodarone for neonates during CPR (31, 58.5%) were considered when adrenaline was given during CPR for neonates and children (29, 54.7%). The heart rate <60 bpm was considered as a sign of cardiac arrest for neonates and infants (27, 50.9%). The percentage of correct responses given by nurses was less than 50% for 30 questions.

The percentage of correct responses given by pediatric residents was more than 50% for 21 of the 46 questions.The percentage of correct responses was >80% for 9 questions. Wiping meconium from the face and nose while the head appears before delivery is important to prevent aspiration (10, 90.9%). Whether the baby starts spontaneous breathing after delivery (11, 100%) is decided. If the baby is not breathing after full delivery, his/her mouth and nose should be suctioned before drying and stimulating (9, 81.8%). Effective mask ventilation was performed (9, 81.8%), and measures were taken for difficult mask ventilation (10, 90.9%). The commonest cause for cardiac arrest was seen in children (11, 100%), and the depth of chest compression was detected in neonates during CPR (11, 100%). The dose of adrenaline was defined during CPR for neonates (10, 90.9%) and how much fluid should be given if hypotension is suspected for newborns (10, 90.9%). The percentage of correct responses was <50% for 25 questions.

Of the 46 questions, the percentage of correct responses given by obs-gyn residents was >50% for 24 questions. The percentage of correct responses was >80% for 6 questions. The baby should be placed on the abdomen of the mother in skin to skin contact and be covered with fresh, dry line to prevent hypothermia (17, 85%). Measures were taken for difficult ventilation (17, 85%), and ventilation should be performed within one minute for newborns who have no breathing efforts immediately after delivery (16, 80%). The commonest cause of cardiac arrest in children (16, 80%), the depth of chest compression in neonates during CPR (16, 80%) and the ratio of chest compression to ventilation for newborns were observed during CPR (17, 85%).

On the other hand, the percentage of correct responses given by obs-gyn residents was in the range of 50%–79% for 18 questions. The percentage of correct responses was <50% for 22 questions (Table 2).

Skills of health professionals about neonatal resuscitation

The minimum and maximum scores of skills of health professionals (midwives, nurses, pediatric

Table 2. Correct responses given by obs-gyn residents for knowledge questions

Questions	Frequency	Percentage (%)
Wiping meconium from face and nose while the head appears before delivery is important to prevent aspiration	12	60
The recommended time to decide whether the baby is breathing after full delivery	12	6
If the baby is not breathing after full delivery, the mouth and nose should be suctioned before drying and stimulating	13	65
The recommended position for the baby immediately after delivery	12	60
During suctioning, the catheter should be placed either in the mouth or nose before turning on the machine	12	60
How long the baby should be closely observed after the baby starts spontaneous breathing before deciding to do routine essential cares	10	50
Face mask should cover the nose, mouth and chin during mask ventilation	12	60
Methods of confirmations of effective mask ventilation (13, 65%),	13	65
Best method to confirm whether the baby is alive immediately after delivery if movement is not seen	11	55
The indication for endotracheal intubation	13	65
Rate of ventilation with ETT for term newborns	15	75
Other equipments for tracheal intubation other than laryngoscope and ETT	14	70
The commonest type of arrhythmia in children	15	75
The amount of energy for defibrillation in children	10	50
The dose of adrenaline for neonates during CPR	13	65
The dose of amiodarone for neonates during CPR	13	6
Fluid for newborns if hypotension is suspected	15	7
How much glucose should be given if hypoglycaemia is suspected for neonates, infants and children	14	70

residents and obs-gyn residents) were 0 and 17 (IQR=6) respectively. The overall mean skill score of health professionals about neonatal resuscitation was 6.8 (SD=3.9). The mean skill scores of midwives, nurses, pediatrics residents and obs-gyn residents were 7.1 (SD=4.17), 6.7 (SD=3.75), 5.7 (SD=4.17) and 6.6 (SD=3.97) respectively. The overall skill of health professionals about neonatal resuscitation was poor (<80%).

The percentage of correct responses given by midwives was >50% for only two questions of 12 skill questions, i.e., have you attended CPR session in your curriculum (26, 50.9%) and the time since last neonatal resuscitation attempt (38, 74.5%). The percentage of correct responses was <50% for 10 questions.

The percentage of correct responses given by nurses was > 50 % for 3 of 12 skill questions, i.e., time since the last training (27, 50.9%), the number of attempted real CPR cases on neonates (27, 50.9%), and time since the last neonatal resuscitation attempt (31, 58.5%). The percentage of correct responses was <50% for 9 questions.

The percentage of correct responses given by pediatrics residents was >50% for 5 of 12 skill questions. The percentage of correct responses was >80% for 2 questions, i.e., the number of attempted real CPR cases on neonates (10, 90.9%) and have you performed chest compression on a collapsed neonate (9, 81.8%). On the other hand, the percentage of correct responses was in the range of 50%–79% for three questions: time since you attended your last course on neonatal resuscitation (2, 54.55); have you participated in CPR session other than in the curriculum (7, 63.6%); and time since the last neonatal resuscitation attempt (7, 63.6%). The percentage of correct responses was <50% for 7 questions.

The percentage of correct responses given by obs-gyn residents was > 50% for 6 of 12 skill questions. Of these, the percentage of correct responses was > 80% for three questions: the number of attempted real CPR cases on neonates (19, 95%); time since the last neonatal resuscitation attempt (19, 95%), and have you performed chest compression on a collapsed neonate (18, 90%). In addition, the percentage of responses was in the range of 50%–79% for three questions: time since you attended your last CPR course on neonatal resuscitation (11, 55%); have you been a team leader during CPR (10, 50%); and have you intubated a neonate with an endotracheal tube (12, 60%). The percentage of correct responses was <50% for 6 questions.

Comparison of knowledge scores in relation to the different characteristics of the participants

There was no significant difference in the knowledge score of the participants in terms of age (P=0.303), type of profession (P=0.847), qualification (P=0.055), year of service (P=0.391) and place of previous work (P=0.209) (Table 3).

From the independent t-test, the mean knowledge score was significantly different in terms of sex of the participants (male vs. female, P=0.024) (Table 4).

Comparison of skill scores in relation to the different characteristics of the participants

There was no significant difference in skill scores of the participants in terms of sex (P=0.139), age (P=0.372), type of profession (P=0.769), year of service (P=0.121), qualification (P=0.340) and place of previous work (P=0.214) (Table 5).

Table 3. Comparison of knowledge scores in terms of type of profession and year of services, ANOVA test (n=135)

Parameters	Sum of squares	*df*	Mean square	*F*	Sig
Type of profession					
Between groups	8.142	3	2.714	0.270	0.847
Within groups	1 317.606	131	10.058		
Total	1 325.748	134			
Years of services					
Between groups	29.937	3	9.979	1.009	0.391
Within groups	1 295.811	131	9.892		
Total	1 325.748	134			

Table 4. Comparison of knowledge scores in terms of sex of the participants, independent t-test (n=135)

Demographics	Number	Mean score	Standard deviation	*P* value
Sex				0.024
Male	79	20.4	3.12	
Female	56	19.2	3.05	

Table 5. Comparison of skill scores in terms of type of profession and year of services, ANOVA test (n=135)

Parameters	Sum of squares	*df*	Mean square	*F*	Sig
Type of profession					
Between groups	18.030	3	6.010	0.379	0.769
Within groups	2 079.303	131	15.873		
Total	2 097.333	134			
Years of services					
Between groups	90.801	3	30.267	1.976	0.121
Within groups	2 006.532	131	15.317		
Total	2 097.333	134			

DISCUSSION

This study showed that the overall knowledge and skills of midwives, nurses, pediatrics residents, and obs-gyn residents were insufficient. The overall mean knowledge and skill scores of health professionals (midwives, nurses and residents) were 19.9 (SD=3.1) and 6.8 (SD=3.9) respectively.

In this study, the mean knowledge score of midwives was poor (42.8%). This finding was in line with a study from Ghana (38%).[17] This might be due to lack of exposure to an adequent number of real cardiopulmonary resuscitation cases, simulation-based training, updating training, and certification process before graduation.

The mean knowledge score of nurses was poor (43.9%). This finding was in agreement with the same study from Ghana (43.9%).[17] The low level of performance could be due to limited exposure to real cardiopulmonary resuscitation cases during the undergraduate course, lack of certification processes before leaving the university and updating training.

The mean knowledge score of pediatric residents was poor (42.8%). The finding was in sharp contrast to the result of a study from Khartoum University, Sudan (51.9%).[19] This difference in the score might be due to the difference in the quality of the training given to the residents and the facilities available.

In our study, the mean knowledge score of obs-gyn residents was very low (42.6%). This score was lower than that of a study of India (69.1%).[20] The discrepancy could be due to the difference in the quality of training on neonatal resuscitation and the facilities available for neonatal resuscitation.

The mean knowledge score of men was different and higher than women (men vs. women, 20.4 vs. 19.2, P=0.024). This could be probably because women might not actively participate in the resuscitation activities since there are cultural influences where most women are reserved to be involved in different occasions especially in developing countries like Ethiopia. Even if it is statistically significant, it is still difficult to generalize since our sample size was small.

In our study, the mean skill score of midwives was poor (59.2%). This finding was not consistent with a study conducted in Afghanistan.[18] This discrepancy might be due to the availability of simulation-based training, updating training, and certification process before graduation in Afghanistan which is not existed in our case.

The mean skill score of nurses was poor (55.8%). Our finding was similar to that in a study conducted in Western Nigeria (59.8%).[16] This might be due to the absence of standardized training during the undergraduate and postgraduate courses.

The mean skill score of pediatric residents was insufficient (47.5%). This finding was consistent with the result in a study from Iran (52%).[21] The low skill level of the residents might be due to lack of training during their undergraduate and postgraduate study. In our study, the percentage of their responses to skill questions was >80% for two questions, 50%–79% for three questions, and <50% for seven questions. Only 4 (36.4%) residents attended CPR sessions in their curriculum, 3 (27.3%) attended 1–5 real CPR sessions, and 7 (63.6%) attended greater than 5 real CPR sessions during the undergraduate course. Four (36.4%) residents got technical training in intubation and no resident defibrillated on a collapsed neonate or intubated neonate.

The mean skill score of obs-gyn residents was substandardized (55%). This finding was in agreement with a study from Iran (52%).[21] This could be due to inadequate training of obs-gyn residents about neonatal resuscitation during their undergraduate and postgraduate courses. In our study, the percentage of their response to skill questions was >80% for three questions, 50%–79% for three questions and <50% for six questions. Only 8 (40%) residents attended CPR sessions in their curriculum, 7 (35%) attended 1–5 real CPR sessions and 12 (60%) attended greater than 5 real CPR sessions during their undergraduate courses. Three (15%) residents got technical training in intubation None of the residents defibrillated on a collapsed neonate and 7 (35%) intubated neonates.

In conclusion, the knowledge and skill levels of midwives, nurses, pediatrics residents and obs-gyn residents about neonatal resuscitation were substandardized. There was no significant difference in the knowledge and skill scores of the participants in terms of sex (except knowledge), age, type of profession, qualification, year of services and previous place of work, which may be due to a small sample size. Training in neonatal resuscitation for midwives, nurses, pediatric residents, and obs-gyn residents should be emphasized.

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Ethical approval: This study was approved by the institutional ethical review board of the University of Gondar, Gondar, Ethiopia.

Conflicts of interest: The authors do not have any conflict of interest.

Contributors: Gebreegziabher E conceived the study, developed the proposal, collected the data, analyzed the data and wrote the draft. Aregawi A and Getinet H were also involved in the proposal development, data collection, data analysis, paper writing, and manuscript preparation.

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