Evaluating Neonatal Resuscitation Skills of Practicing Nurses and Midwives in Selected Hospitals in Central Uganda

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Abstract

Background: Uganda has a high neonatal mortality rate (27 per 1,000 live births), with birth asphyxia being the major contributor. Helping babies breathe (HBB) is an evidence-based program that aims to reduce neonatal mortality in resource-limited settings. Successful resuscitation depends on nurses' and midwives' knowledge and skills in neonatal resuscitation, and the state of neonatal resuscitation equipment. This study aimed to evaluate knowledge and skills retention in neonatal resuscitation after HBB training among nurses and midwives, and the state/availability of neonatal resuscitation equipment. **Methods:** This study used a cross sectional design. Participants were 75 nurses and midwives from two hospitals in Central Uganda. Data were collected using questionnaires and observation checklists. Ethics approval was obtained from the Uganda Christian University and the research and ethics committees of the participating hospitals. **Results:** Nurses and midwives showed a high level of knowledge (92%). However, neonatal resuscitation skills among 44 observed participants were poor, as 68.2% failed to check equipment and select the correct mask and 45.5% did not make a firm seal when applying the mask. In addition, about 72% of participants did not ventilate at a rate of 40 breaths per minute, and 18.2% failed to assess chest movement. Observation of 44 resuscitations to evaluate the state/availability of neonatal resuscitation equipment showed that 27.3% did not have a suction device, 59.1% did not have a heat source/pre-warmed towels to warm the babies, 50% did not have appropriate self-inflating bags and masks for normal and preterm babies, 72.7% had no clock/watch to count heart rate and determine the length of time ventilation was required, and 36.4% did not document that resuscitation was performed. **Conclusions:** To address Uganda's neonatal mortality rate, it is necessary to develop regulatory policies for neonatal resuscitation and build nurses' and midwives' skills for active interventions during neonatal resuscitation.

Background

In many cases, neonatal resuscitation is a primary requirement for life, especially for neonates with birth asphyxia [1-3]. Neonatal resuscitation is particularly important as the first few days following birth are deemed the most vulnerable [4-6]. A 2016 United Nations report showed that there are 7,000 neonatal deaths worldwide each day, with the majority (1 million) dying on their first day of life [7, 8]. Despite the global decline in neonatal mortality, sub-Saharan Africa still bears a disproportionate burden of neonatal mortality, with an estimated mortality rate of 27 deaths per 1,000 live births in 2017 [9, 10]. This suggests that in the first month of life, babies in sub-Saharan Africa are nine times more likely to die than their counterparts in developed countries [11].

Major causes of neonatal mortality in low- and middle-income countries, especially during the first week of life, include asphyxia, infections, and prematurity. Asphyxia is the leading cause of neonatal mortality in low resource countries [12, 13]. Similarly, birth asphyxia is the main cause of death among neonates in Uganda, followed by prematurity and sepsis [14, 15]. Around 60% of all neonatal deaths result from preventable and treatable conditions that can be managed at a low cost [16, 17]. Effective newborn

resuscitation is essential in reducing birth asphyxia, which is estimated to be associated with mortality for 2 million babies a year; 99% of these deaths are in developing countries [18, 19].

In Uganda, reducing neonatal mortality has been challenging, and the country failed to achieve the target of 20 deaths per 1,000 live births specified in the Millennium Development Goals. Uganda's neonatal mortality rate has remained at 27 per 1,000 live births since 2011 [14, 18]. Key components of reducing neonatal mortality are improved knowledge and clinical skills among nurses and midwives, and access to basic equipment such as towels or blankets, a bag and mask resuscitator, and a suction device [18]. To improve knowledge and skills among nurses and midwives, the global community introduced helping babies breathe (HBB) training in low resource countries [16]. National ownership of this initiative was advocated, and Uganda implemented HBB training in 2011. However, neonatal mortality in Uganda remained high (27/1,000 live births) despite HBB training. Research evidence revealed that an evidence-based training program for nurses and midwives reduced neonatal mortality significantly in Malawi [20]. In addition, Tanzania reported a 47% reduction in neonatal mortality from all causes following implementation of HBB [21, 22]. It is pertinent to note that skills retention relating to neonatal resuscitation diminishes over time [14, 23]. This highlights the need for continuous evaluation of nurses' and midwives' knowledge and skills regarding neonatal resuscitation, and retraining to maintain standards where necessary. However, deficiencies in nurses' and midwives' skills are not the only predictors of neonatal mortality. Another major contributor is inadequate neonatal resuscitation equipment [14, 18, 24].

As Uganda has not successfully reduced neonatal mortality after implementation of HBB, this study evaluated knowledge and skills retention among nurses and midwives, and the state/availability of neonatal resuscitation equipment in selected hospitals in Central Uganda.

Methods

A quantitative descriptive study with a cross sectional design was used to evaluate knowledge and skills retention among nurses and midwives and the state/availability of neonatal resuscitation equipment in Central Uganda. We recruited 75 HBB-trained nurses and midwives working in the labor wards, neonatal care units, and operating theaters of the participating hospitals using a total population sampling technique. Informed consent to participate in this study was obtained from all included nurses and midwives.

The inclusion criteria were: previous HBB training, working in labour, neonatal care units, and operating theaters in the study settings. Data were collected using questionnaires and observation checklists. Participants were observed in their usual work environment over a 1-month period in each hospital. At the end of the observation period, self-administered questionnaires were distributed to participants. We used knowledge and skills check tools developed by the American Academy of Pediatrics to evaluate knowledge and skills retention among nurses and midwives. A World Health Organization (WHO) checklist for neonatal resuscitation equipment was used to evaluate the state/availability of neonatal

resuscitation equipment in the participating hospitals. For the knowledge assessment, nurses and midwives were expected to correctly answer 80% of the questions (14 out of 17) [25]. Evaluation of skills retention was based on participants successfully completing a bag/mask ventilation performance evaluation (correctly performing all seven steps or 100%) [25].

SPSS version 16.0 was used for the data analysis, with a 0.05 level of significance. Chi-square was used for inferential statistics while data were presented using descriptive statics namely percentages and tables. Ethics approval from the Uganda Christian University and the research and ethics committees of the two participating hospitals was obtained in writing.

Study Setting

This study was conducted in two selected public hospitals located in Central Uganda: Mulago National Referral Hospital and Naguru China Friendship Hospital. Mulago National Referral Hospital was founded in 1913. It is the main (and largest) national hospital in Uganda and covers all specialties. The hospital is located in Kampala, Uganda's capital city. Naguru China Friendship Hospital was founded in 2012 with support from the Republic of China, with the aim of decongesting Mulago National Hospital. The hospital is located in Naguru Hill, Nakawa, in Kampala. Both hospitals have a capacity of approximately 3,500 beds. The two labor wards admit 80–100 women each day; 70–80 babies are delivered by spontaneous vaginal delivery and 20–30 babies are delivered by cesarean section. Of these, 15% require neonatal resuscitation each day. The two hospital were selected because they have the highest number of deliveries in Uganda per day in Uganda. In addition, despite many nurses and midwives being trained using the HBB program, neonatal mortality remains high (27/1,000 live births) in both hospitals [26], which is similar to the national neonatal mortality rate in Uganda. Therefore, identifying and bridging the gap in knowledge and skills in regarding neonatal resuscitation will support a national reduction in neonatal mortality.

Demographic Characteristics

We investigated participants' mean age, duration since last HBB training, and duration at their work place (Table 1). Of the 75 participants, 52% were aged 36 years or younger; 66.7% had been in their work place for ≤ 4 years; and 50.7% had received HBB training within the last 11 months before the study. The majority of participants (74.7%) worked in the labor ward, followed by the neonatal care unit (20%) and operating theater (5.3%). Most participants were midwives (84%), three (4%) were nurses, and nine (12%) were nurse/midwives. All participants were women.

Results

Overall, 92% of participants had high retention of neonatal resuscitation knowledge (80% and above), with only 8% having low knowledge retention (Figure 1).

Figure 1. Participants' knowledge retention after helping babies breathe training

In total, 44 participants were observed for skills retention (Table 2). Of these, the majority (68.2%) did not check equipment and select the correct mask and 45.5% did not apply the mask to make a firm seal. The majority of observed participants (72.7%) did not ventilate at a rate of 40 breaths per minute, 18.2% did not look for chest movement. In addition, 9.1% did not reapply the mask and reposition the head to improve ventilation when the chest did not move, 22.7% did not clear secretions and open the mouth to improve ventilation when the chest did not move, and 31.2% did not squeeze the bag harder to improve ventilation. Overall, none of the nurses or midwives was able to correctly perform all seven resuscitation steps consistent with WHO guidelines [27].

Table 3 shows the state/availability of neonatal resuscitation equipment for the 44 observed resuscitations conducted by participants. We observed that there was no suction device in 27.3% of the cases, 59.1% did not have heat source/pre-warmed towels, 50% did not have appropriately sized self-inflating bag and mask, 72.7% did not have a clock/watch to count heart rate and determine the length of time that ventilation was required, and 36.4% did not document resuscitation was performed. Generally, some of the necessary resuscitation equipment was not available or was in poor working condition at the time of resuscitation.

We examined relationships between participants' sociodemographic characteristics and knowledge (Table 4). Of the 75 participants, 69 had high knowledge levels (score of $\geq 80\%$) and six had a low knowledge level. Participants with high knowledge levels were relatively evenly distributed across the two age groups, with 50.7% aged ≤ 36 years. We found that 53.6% of those with high knowledge had received HBB training within the last 11 months, and 66.7% had been in their work place ≤ 4 years. High knowledge scores were observed for most midwives, all three nurses, and eight of the nine nurse/midwives. In addition, all participants working in the operating theater had high knowledge, along with most participants who worked in the labor wards and neonatal units. There were no statistically significant differences in knowledge retention by sociodemographic characteristics.

Discussion

The first 24 hours of life are crucial for a newborn's survival. Nurses' and midwives' knowledge and skills, and the state/availability of neonatal resuscitation equipment are paramount for newborn survival. This study showed that half of participating nurses and midwives had received HBB training more than 11 months before this study. This may be related to lack of regular training in the healthcare system, and lack of policy to regulate training programs and monitor employee competences. This finding was consistent with a previous study in a developing country [23] that asserted knowledge and skills retention diminished over time. This highlights the need for regular training, especially when dealing with neonates on their first day of life. Similar studies conducted in Uganda support the need for regular coaching and mentoring at intervals of 6 weeks, 3 months, and 6 months after the initial HBB training to promote

knowledge and skills retention [14, 15, 23]. Correspondingly, training every 6 months or more often enhances knowledge and psychomotor performance among nurses and midwives [23, 29].

This study revealed that participating nurses and midwives had high levels of knowledge, which may be attributable to participants' HBB training. Despite high levels of knowledge, participants generally demonstrated poor psychomotor skills in relation to neonatal resuscitation. This may be explained by loss of skills because of the long duration since their last HBB training. Moreover, it was obvious that the nurses/midwives were over burdened with tasks associated with caring for the mother and resuscitating the neonate. This finding was also consistent with those who reported that participants could remember most of the things they studied within the last 3 months after HBB training [30, 31]. Additionally, a study conducted in Uganda affirmed that in order to support retention of complex clinical skills (e.g., newborn resuscitation), frequent training should be implemented to improve practical skills [15].

Evaluation of the state/availability of equipment revealed neonatal resuscitation equipment in the studied hospitals was inadequate and in poor working condition. This may be attributed to discrepancies between managerial supplies and actual demand at the ward level. Moreover, there was a lack of general supervision to ensure availability of equipment in good working condition at all times. Our finding regarding the lack of equipment was similar to a study conducted in health facilities in which indicated that only 15% of the health facilities in Uganda they studied had neonatal resuscitation equipment [32]. This suggests nurses' and midwives' ability to resuscitate neonates is impaired by lack of equipment [32]. It is important to note that approximately 6% of neonates require resuscitation with bag and mask [18, 24], and the lack of this equipment hinders resuscitation and contributes to poor neonatal outcomes [24, 33].

Implications for Nursing Practice

The findings of this study highlight a gross skill deficiency, which without appropriate intervention will lead to increased neonatal mortality. Nurses and midwives form the bulk of the healthcare workforce in Uganda and are directly responsible for maternal delivery and neonatal resuscitation. Their deficiency in neonatal resuscitation skills during the critical period of life for newborn babies is reflected in Uganda's high neonatal mortality rates. It is therefore imperative that all health facilities provide continuous professional HBB training (at least biannually) to enhance resuscitation skills.

Given the high fertility rates in low-income countries such as Uganda, a corresponding increase in birth rate is expected, which implies the need for advance planning for a sufficient supply of neonatal resuscitation equipment. Therefore, there is a need for regional- and institution-based supervision to ensure the competence of nurses and midwives in neonatal resuscitation, as well as the availability and functionality of required equipment.

Limitations

The knowledge and skills check tools used in this study were developed by the American Academy of Pediatrics and did not allow room for modification, which hindered their adaptation to the study setting. The sample size was also small, which limits generalization of the findings outside this study setting. Moreover, most nurses and midwives who had been trained in HBB had been transferred from the study units. This highlights a need for a study involving all nurses and midwives working in labor wards, operating theaters and special/neonatal care units in Uganda.

Conclusions

Neonatal mortality in Uganda has been challenging, and will remain a problem until strategies to effectively ameliorate the situation are implemented. These include promulgation of regulatory policies for neonatal resuscitation, and building nurses' and midwives' skills for active intervention during neonatal resuscitation.

Recommendations

There is need to employ more nurses and midwives in various hospital units/departments to improve staffing and enhance neonatal resuscitation in Uganda. Deploying HBB-trained nurses and midwives to other departments should be avoided.

Periodic HBB training/refresher courses for nurses and midwives should be encouraged.

Hospital administration should ensure regular inventory and purchase of neonatal resuscitation equipment to ensure good neonatal outcomes.

An expansion of this study throughout Uganda is necessary to assess nurses' and midwives' skills for neonatal resuscitation and identify appropriate training intervals in Uganda.

List Of Abbreviations

HBB – Helping Babies Breathe

WHO – World Health Organization

UNICEF – United Nations International Children Emergency Fund

Declaration

Ethics approval and consent to participate

Ethics approval was obtained from Uganda Christian University and Mulago National Referral Hospital Research and Ethics Committee. Individual participants consented to participate in the study.

Consent for publication

The American Academy of Pediatrics granted permission to use the instruments for data collection was granted by the American Academy of Pediatricians.

Availability of data and material

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

Competing interests

The authors declare that they had no competing interests.

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No funding was obtained for this study.

Authors' Contributions

MN initiated the study as a Master of Nursing student. KD supported the development of the research proposal and EEN supported collection of data, analysis and discussion of major findings. EFA supported the process of discussing major findings, updating references, and writing the manuscript for publication.

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Tables

Table 1. Participants' sociodemographic characteristics (N=75)

Variable	Category	n	%
Age, years	≤36	39	52.0
Duration of last HBB training	>36	36	48.0
Duration in work place, years	≤12 months	38	50.7
Professional qualification	>12 months	37	49.3
Work station	≤4	50	66.7
Gender	>4	25	33.3
	Nurse	3	4.0
	Midwife	63	84.0
	Nurse/midwife	9	12.0
	Labor ward	56	74.7
	Operation theater	4	5.3
	Neonatal unit	15	20.0
	Male	0	0.0
	Female	75	100

Table 2. Evaluation of skills retention among nurses and midwives (n=44)

Skill observed	Done n (%)	Not done n (%)
Check equipment and select the correct mask	14 (31.8)	30 (68.2)
Test function of bag and mask, make sure mask fit the baby's face		
Apply the mask to make a firm seal (Extend the head, place mask on the chin, then over the mouth and nose)	24 (54.5)	20 (45.5)
Ventilate at 40 breaths per minute (The rate should not be less than 30 or more than 50 breaths per minute)	12 (27.3)	32 (72.7)
Look for chest movement	36 (81.8)	8 (18.2)
Check that every ventilation breath produces chest movement		
Improve ventilation if the chest does not move: Head – reapply mask and reposition head	40 (90.9)	4 (9.1)
Improve ventilation if the chest does not move: Mouth – clear secretions and open the mouth	34 (77.3)	10 (22.7)
Improve ventilation if the chest does not move: Bag – squeeze the bag harder	30 (68.2)	14 (31.2)

Table 3. Evaluation of the state and availability of neonatal resuscitation equipment during each resuscitation (N=44)

Item observed	Present n (%)	Absent n (%)
Heat source and pre-warmed towels to dry baby	18 (40.9)	26 (59.1)
Suction device	32 (72.7)	12 (27.3)
Self-inflating bag and mask of appropriate size for normal and small babies	22 (50.0)	22 (50.0)
Clock or watch to measure heart rate and length of time ventilation was required	12 (27.3)	32 (72.7)
Documentation that resuscitation was required, progress, and outcome	28 (63.6)	16 (36.4)

Note. We used the World Health Organization equipment checklist with some modifications [28].

Due to technical limitations, Table 4 is only available as a download in the supplemental files section.

Figures

Figure 1

Participants’ knowledge retention after helping babies breathe training

Supplementary Files

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- [Table4.pdf](#)