

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 as one of 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 access to functional 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 two hospital 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 term 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 implement regulatory policies for neonatal resuscitation, building nurses and midwives skills for active interventions during neonatal resuscitation as well as regular refresher courses to enhance skills. **Key words:** helping babies breathe (HBB), neonatal resuscitation, knowledge, skills and equipment

Background

In many cases, neonatal resuscitation is a primary requirement for life, especially for neonates with birth asphyxia (Gichogo, Murila, Matiang'i, Ndege, & Bosire, 2018; Pejovic et al., 2018; Wall et al., 2009). Neonatal resuscitation is particularly important as the first few days following birth are deemed the most vulnerable (Babaei & Dehghan, 2018; Owusu, Lim, Makaje, Wobil, & SameAe, 2018; UNICEF, 2015). 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 (Global News, 2017; UNICEF, 2018b). 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 (Omar Kigenyi, Getachew B Tefera, Elizabeth Nabiwemba, & Christopher G Orach, 2013). 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 (UNICEF, 2018a).

Major causes of neonatal mortality in low- and middle-income countries, especially during the first week of life, include asphyxia, infections, and prematurity (Ersdal, Mduma, Svensen, & Perlman, 2012; Hatupopi, 2016). However, in a study conducted in Eastern Uganda to understand why newborns die, it was found that birth asphyxia was the second leading cause of death among newborns (Waiswa, Kallander, Peterson, Tomson, & Pariyo, 2010). Similarly, birth asphyxia is one of the major causes of death among neonates in Uganda (Evans et al., 2018; Kananura, Kiwanuka, Ekirapa-Kiracho, & Waiswa, 2017). Around 60% of all neonatal deaths result from preventable and treatable conditions that can be managed at a low cost (Little, Keenan, Singhal, & Niermeyer, 2014; UNICEF, 2014). It is therefore imperative for health care workers to have the required knowledge and skills about neonatal resuscitation in order to reduce mortalities related to birth asphyxia (Shikuku, Milimo, Ayebare, Gisore, & Nalwadda, 2018). 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 .

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 (Kananura et al., 2017; Kim et al., 2013). Key components of reducing deaths due to asphyxia 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 (Kim et al., 2013). To improve knowledge and skills in neonatal resuscitation amongst nurses and midwives, the global community introduced helping babies breathe (HBB) training in low-resource countries (Little et al., 2014). 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. Hole, Olmsted, Kiromera, and Chamberlain (2011) reported that use of an evidence-based training program for nurses and midwives reduced neonatal mortality in Malawi. In addition, Tanzania reported a 47% reduction in early neonatal mortality from all causes following implementation of HBB (Arlington et al., 2017; Msemo et al., 2013). It is pertinent to note that skills retention relating to neonatal resuscitation diminishes over time (Carlo et al., 2009). 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 due to asphyxia. Another major contributor is inadequate neonatal resuscitation equipment (Chikuse, Chirwa, Maluwa, & Odland, 2012; Kananura et al., 2017). On the other hand, lack of neonatal resuscitation equipment and training are not main worries in Afghanistan, emphasis is required in the area of knowledge and skills retention (Kim et al., 2013).

As the Ugandan neonatal mortality remains high, the need to assess HBB knowledge and skills becomes imperative. This study therefore evaluated knowledge and skills retention following HBB training among

nurses and midwives, and functionality/availability of neonatal resuscitation equipment in two major hospitals in Central Uganda.

Methods

A quantitative descriptive study with a cross sectional design was used to evaluate knowledge, skills retention and the functionality/availability of neonatal resuscitation equipment. We recruited 75 HBB-trained nurses and midwives working in the labor wards, neonatal care units, and operating theaters of the two hospitals using a total population sampling technique. Informed consent to participate in this study was obtained from all included nurses and midwives. Informed verbal consent was obtained from mothers who were in second stage of labour in order for their babies to be observed in case a resuscitation was required.

The inclusion criteria were nurses and midwives with previous HBB training since the introduction of HBB in Uganda in 2012 to 2015. Data were collected using questionnaires and observation checklists according to the knowledge and skills check for OSCE A and B respectively. A participant observation method was used. Participants were observed in their usual work environment starting 23rd October to 23rd December 2016 for a period of one month in each hospital. The principle investigator (PI) worked with the nurses and midwives in a natural work environment and her main role was to assist the nurses or midwives during assessment and delivery. However, during the resuscitation period the role of the PI was to observe the procedure. In the resuscitation area, a midwife trained in HBB with resuscitation kits was contracted by the PI to be available and be ready to take over the resuscitation in case the resuscitating midwife failed to carry out the correct procedure. The additional resuscitation kits were used in case of a deficiency in the equipment. Of the 75 nurses and midwives, only 44 who had had neonates that required resuscitation were observed during the study.

At the end of the observation period, self-administered questionnaires were distributed to participants. The American Academy of Pediatrics knowledge and skills check tools were used as instruments for data collection. A World Health Organization (WHO) checklist for neonatal resuscitation equipment was used to evaluate the functionality/availability of neonatal resuscitation equipment in the two hospitals. For the knowledge assessment, nurses and midwives were expected to correctly answer 80% of the questions (14 out of 17) (American Academy of Pediatrics, 2011b). Knowledge and skills retention were evaluated based on the Helping Babies Breathe first edition guidelines. Evaluation of skills retention was based on participants successfully completing a bag/mask ventilation performance evaluation (correctly performing all seven steps or 100%) (American Academy of Pediatrics, 2011a). The PI used a stop watch to assess ventilation rate. Equipment were considered to be present if they were on the resuscitation table with in the resuscitation room.

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 statistics namely percentages and tables. Analysis of skills retention was done using frequencies and percentages of

whether a step was done or not done. Each of the seven steps were checked as either done or not done. Ethics approval from the Uganda Christian University and the research and ethics committees of the two 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 (in two hospitals) 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 addition, despite many nurses and midwives being trained using the HBB program, neonatal mortality remains high (27/1,000 live births) in Uganda (O. Kigenyi, G. B. Tefera, E. Nabiwemba, & C. G. Orach, 2013). These two hospitals are the highest level neonatal health facilities in the country as well as a teaching facilities and this informs the choice of the study setting. Therefore, identifying and bridging the gap in knowledge and skills regarding neonatal resuscitation in these hospitals will support a national reduction in neonatal mortality.

Results

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%). More than half (50.7%) of the participants had worked in their current work station for a period of less than one year. Most participants were midwives (84%), three (4%) were nurses, and nine (12%) were nurse/midwives. All participants were women.

Table 1
Participants' Profile (N = 75)

Variable	Category	n	%
Age, years	≤ 36	39	52.0
Number of HBB training	> 36	36	48.0
Last HBB training	Once	75	100.0
Time lapse from last training	More than once	0	0.0
Work experience (years)	≤ 12 months	38	50.7
Duration in current work station (months)	> 12 months	37	49.3
Professional qualification	24–36 months	22	29.3
Work station	12–23 months	15	20.0
Gender	0–11 months	38	50.7
	≤4	50	66.7
	>4	25	33.3
	≤ 6 months	20	26.7
	7–12 months	18	24
	13–18 months	22	29.3
	> 19 months	15	20
	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	100.0

Overall, 92% of participants had high retention of neonatal resuscitation knowledge (80% and above) (American Academy of Pediatrics, 2011), with only 8% having low knowledge retention (Fig. 1). It was obvious that irrespective of the time lapse since last training, majority of the participants had high knowledge.

In total, 44 participants were observed for skills retention and each participant was observed once for a period of 0–30 minutes per resuscitation (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 but were either ventilating at a slower or faster rate, 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, 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 (WHO, 2012).

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 Test function of bag and mask, make sure mask fit the baby's face	14 (31.8)	30 (68.2)
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 Check that every ventilation breath produces chest movement	36 (81.8)	8 (18.2)
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 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.

Table 3

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

Item observed	Present n (%)	Absent n (%)
Self-inflating bag and mask of appropriate size for normal and small babies	22 (50.0)	22 (50.0)
Heat source and pre-warmed towels to dry baby	18 (40.9)	26 (59.1)
Suction device	32 (72.7)	12 (27.3)
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 (WHO, n.d.).		

We examined relationships between participants' profile 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.

Table 4
Relationship between knowledge level and sociodemographic characteristics

Variable	Low knowledge, n (%)	High knowledge, n (%)	χ^2	p-value
Age, years	4 (66.7)	35 (50.7)	0.562	0.453
≤ 36	2 (33.3)	34 (49.3)	3.016	0.082
> 36	1 (16.7)	37 (53.6)	0	1.0
Last HBB training	5 (83.3)	32 (46.4)	0.38	0.827
≤ 11 months	4 (66.7)	46 (66.7)	3.814	0.149
> 11 months	2 (33.3)	23 (33.3)		
Duration in work place, years	0	3 (4.9)		
≤ 4	5 (83.3)	58 (84.1)		
> 4	1 (16.7)	8 (11.6)		
Professional qualification	3 (50.0)	53 (76.8)		
Nurse	0 (0.0)	4 (5.8.4)		
Midwife	3 (50.0)	12 (17.4)		
Nurse/midwife				
Work station				
Labor ward				
Operation theater				
Neonatal unit				

Discussion

The first 24 hours of life are very critical for a newborn's survival. Nurses' and midwives' knowledge and skills, and the functionality/availability of neonatal resuscitation equipment are vital 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. Although this study did not assess knowledge and skills over time, such as the studies conducted by (Carlo et al., 2009; Draiko, Yamarat, Panza, & Draleru, 2019) in developing countries, it is obvious that 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 and Zambia 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 (Carlo et al., 2009; Evans et al., 2018; Kananura et al., 2017). Correspondingly, training every 6 months or more often enhances knowledge and skills' performance among nurses and midwives (Carlo et al., 2009; Tabangin, Josyula, Taylor, Vasquez, & Kamath-Rayne, 2018). Additionally, it was obvious in the study that most nurses and midwives had worked in their current work station for less than 12 months. This may be secondary to frequent transfers or frequent rotation of nurses and midwives from their work station.

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 skills' performance in relation to neonatal resuscitation. This may be explained by loss of skills because of the long duration since their last HBB training. This finding was consistent with those reported by Musafili, Essén, Baribwira, Rukundo, and Persson (2013) and Reisman et al. (2016),

who found that participants could remember most of the things they studied 3 months after HBB training. Additionally, a study conducted in Uganda Evans et al. (2018) asserted that to support retention of complex clinical skills (e.g., newborn resuscitation), training at least every six months should be implemented to improve practical skills (Skidmore & Urquhart, 2001).

Evaluation of the functionality/availability of equipment revealed neonatal resuscitation equipment in the studied hospitals in reference to maternal and child health services provision 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 report by Mbonye et al. (2012), which indicated that of the study sites in which they conducted their study, only 15% of them had had neonatal resuscitation equipment. This suggests nurses' and midwives' ability to resuscitate neonates is impaired by lack of equipment (Mbonye et al., 2012). It is important to note that approximately 6% of neonates require resuscitation with bag and mask (Chikuse et al., 2012; Kim et al., 2013), and the lack of this equipment hinders resuscitation and contributes to poor neonatal outcomes (Chikuse et al., 2012; Enweronu-Laryea et al., 2015).

Implications for Nursing Practice

The findings of this study highlight a gross skill deficiency, inadequate equipment, supplies, and some non-functional equipment 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 neonatal mortality rates in low-income countries such as Uganda, the need for nurses and midwives skills in preventing neonatal mortality as well as availability/functional neonatal resuscitation equipment becomes imperative. 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 their work station. This highlights a need to determine the most effective way to provide more frequent training especially for those nurses and midwives working in labor wards, operating theaters and

special/neonatal care units, and to ensure adequate supplies and functionality of available neonatal resuscitation equipment.

Conclusions

Given the high neonatal mortality rate in Uganda, the need to improve resuscitation skills among nurses and midwives and functionality/availability of supplies becomes a panacea. There is a need to implement regulatory policies for neonatal resuscitation, and building nurses' and midwives' skills for active intervention during neonatal resuscitation.

Recommendations

Periodic (every six months) HBB training/refresher courses for nurses and midwives should be encouraged. Additionally, hospital administration should ensure regular or weekly inventory and purchase of neonatal resuscitation equipment to ensure good neonatal outcomes. There also a need for adaptation and expansion of this study throughout Uganda to assess nurses' and midwives' skills for neonatal resuscitation and identify appropriate training intervals in Uganda.

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. Mothers whose babies were observed consented verbally before the observation was done.

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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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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Abbreviations

HBB

Helping Babies Breathe

WHO

World Health Organization

UNICEF

United Nations International Children Emergency Fund

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Figures

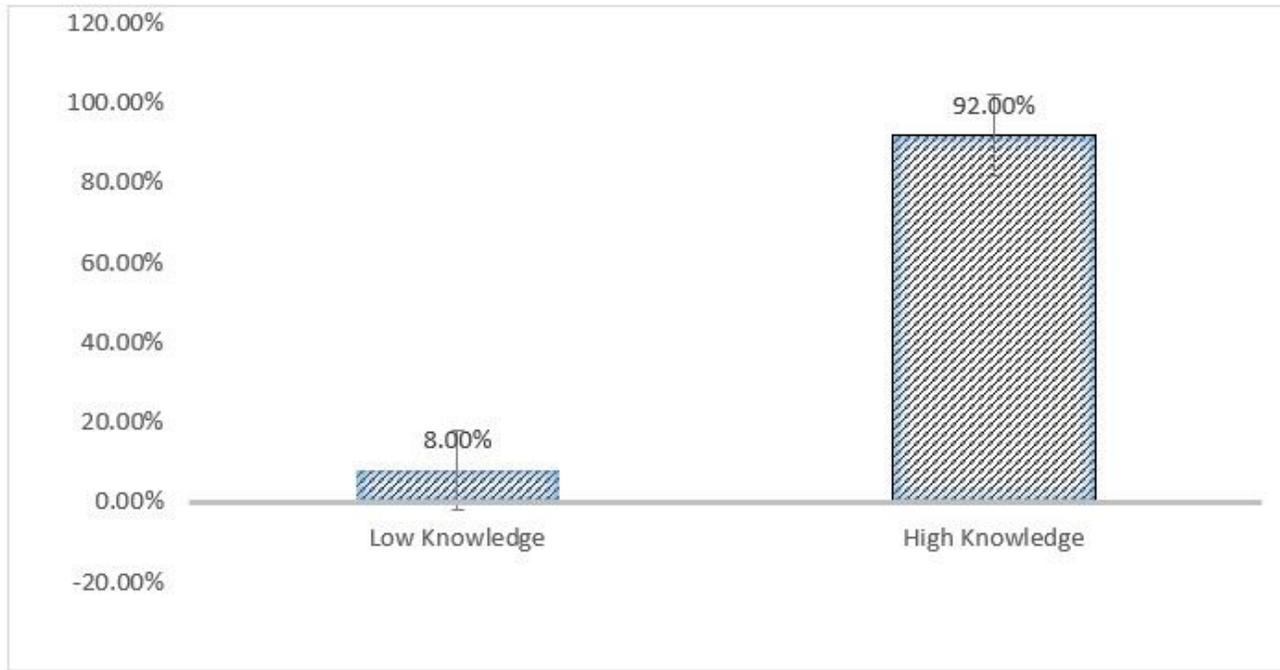


Figure 1

Participants' knowledge retention after helping babies breathe training