

## Assessing Knowledge and Skills after Implementing Helping Babies Breathe among Semi-Skilled Birth Attendants

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**Abstract:** Deficient resuscitation influences significantly neonatal mortality globally. Effective neonatal resuscitation has a potential to prevent perinatal mortalities related to birth asphyxia. This study aimed at assessing knowledge and skills after implementing a simple Helping Babies Breathe training of neonatal resuscitation to improve practice of semi-skilled birth attendants, and reduce infant mortality at the community.

A descriptive non-experimental design was used to elicit information on knowledge and practice of one hundred and ten (110) community health extension workers and hands-on skills checklist was used to measure their neonatal skill abilities.

The study findings showed that majority 91.8% of respondents had a good knowledge and skills of neonatal resuscitation immediately after the training. The mean post-test score was 11.6 with Std. D of 2.37 ( $p < 0.05$ ). This showed an overall improvement in knowledge, skill and practice. This percentage dropped to 25.5% at eight (8) weeks after the initial training. There is a significant relationship between their practice scores immediately after the training and eight weeks after ( $p < 0.001$ ). The study found that majority of respondents had improved knowledge with good practices skills but could not retain the knowledge and practice ultimately.

**Key Words:** Neonate, Helping Babies Breathe, Resuscitation

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### I. Background

Globally, 2.9 million newborns die each year, out of which 700,000 resulted from intrapartum-related complications<sup>1</sup>. The first minute after the birth of a baby is referred to as the Golden minute which is the crucial period to begin neonatal resuscitation for about 10 million asphyxiated babies delivered every year<sup>2</sup>. Helping Babies Breathe (HBB), was developed by the American Academy of Paediatrics, and intended to train birth attendants in developing countries on the essential skills of neonatal resuscitation<sup>3</sup>. It was based on evidence from a neonatal assessment study done by ILCOR (International Liaison Committee on Resuscitation), which found that in many countries only one birth attendant is present to provide care to both the mother and the newborn with

no knowledge of neonatal resuscitation<sup>4</sup>. The educational materials of HBB consist of a well-tested pictorial representation of the resuscitation protocol, learner workbooks, facilitator flip charts, neonatal simulators and the required equipment like reusable ventilation bag-and-mask devices and bulb suction devices<sup>3</sup>.

Even though infant mortality remained high in Africa<sup>5</sup>, and for resuscitation to be successful, it requires careful understanding by the health-care personnel working in the maternity and newborn units to have adequate skills for prompt neonatal resuscitation. While adequate knowledge and awareness about neonatal resuscitation help in early diagnosis, proper management and reduction of adverse consequences should not be neglected too<sup>6</sup>. Competency in neonatal resuscitation among health workers is important in every delivery room to ensure the safety and health of newborn infants. Training in resuscitation has been shown to reduce many intrapartum-related neonatal deaths by 30%<sup>7</sup>. Health workers are the essential personnel in the provision of neonatal resuscitation and it has been found that staff usually have inadequate training and knowledge in low-resource settings, and needed additional guidance and support<sup>8</sup>. Despite reduction in neonatal mortality rate globally, there are still obvious disparities in neonatal mortality existing across regions and countries<sup>9</sup>. Neonatal mortality was highest in sub-Saharan Africa and South Asia, with each estimated at 27 deaths per 1,000 live births<sup>10</sup>.

Many developed countries have well-established neonatal resuscitation programs aimed at equipping their health personnel with skills for neonatal resuscitation<sup>11</sup>. A child born in sub-Saharan Africa or in South Asia is nine times more likely to die in the first month than a child born in a high-income country. Across countries, the risk of dying in the first month of life was about 50 times higher in the highest mortality country than in the lowest mortality country<sup>9</sup>.

Over the years, the indication on the viability and possible influence of community-based intervention and delivery schemes has improved greatly. Many of the interventions to prevent child deaths could be provided to whole populations through the community-based approaches and procedures. Efforts for implementing and scaling up these interventions are slow in most developing countries and where interventions exist, monitoring of them is poor and effective evaluation inadequate. Evaluation of the efficiency of child survival interventions is critical to create the impetus to present and increase their coverage within health systems<sup>12</sup>.

According to a study conducted in Tanzania on the assessment of the HBB program, it was found that early neonatal mortality was reduced by 47%<sup>13</sup>. This study also revealed that HBB program is a low-cost intervention<sup>14</sup>, although the implementation strategies were not assessed in relation to the retention among health workers. It also showed the proportion of health workers who were competent in simulated routine care while competency in neonatal resuscitation scenarios increased after HBB training, and their knowledge still remained seven (7) months after training. It was discovered that the improvement did not translate into clinical proficiency<sup>15</sup>. In another evaluation study in Ethiopia, it was shown that HBB training enhanced the knowledge of health workers immediately after neonatal resuscitation training and removing the knowledge difference that was present prior to their training<sup>16</sup>. This is in contrast to a study conducted in Rwanda where competency in neonatal resuscitation dropped 3 months after training to an unsatisfactory level, indicating that training alone was not sufficient to retain knowledge and skills of health workers in neonatal resuscitation<sup>17</sup>.

In training birth attendants in low- and middle-income countries, basic neonatal resuscitation is an important intervention to improve the rates of neonatal mortality<sup>18</sup>. Helping Babies Breathe (HBB) is a new evidence based neonatal resuscitation education program designed for low-income settings<sup>19</sup>. This program was developed by the American Academy of Paediatrics (AAP). The program highlights hands-on peer-to-peer learning and often used with low-cost manikins that can simulate respiration and an umbilical pulse. The program also highlights skilled presence at every

birth and swift evaluation of each neonate. Participants are educated on aseptic technique, hypothermia prevention, how to provide stimulation and assisted ventilation within 60 seconds which is referred to as the “The Golden Minute”. Helping Babies Breathe was launched in 2010 following pilot studies in Africa and Asia<sup>20</sup>, and it is now being used worldwide<sup>3</sup>.

To deliver an effective resuscitation, health care providers should receive detailed evidence and make use of their practical skills, competently<sup>21</sup>. Moreover, those who perform resuscitation are expected to be competent and have the essential knowledge and skills. These skills could be acquired through training during academic courses<sup>22</sup>. Though, neonates differ considerably from adults, neonatal resuscitation requires different levels of knowledge and skills. It is needed occasionally and depends on resolving respiratory problems rather than cardiac episodes<sup>23</sup>. Explicit neonatal resuscitation is a critical task, as very slight evidence is available about the factors influencing health care providers’ performance and knowledge<sup>24</sup>. Lack of such evidence may hold competence training programs challenging for care providers to achieve effective proficient. Competent neonatal resuscitation is a critical intervention for survival of infants in need of respiratory or cardiac support<sup>25</sup>. In a report on perinatal care in South African district hospitals, it was stated that insufficient neonatal resuscitation influenced neonatal morbidity and mortality<sup>26</sup>. The report highlighted lack of staff, inadequately trained staff, limited equipment for resuscitation and the lack of well-equipped transport facilities as factors contributing to inadequate neonatal resuscitation<sup>26</sup>. Effective resuscitation is a proficiency that needs to be acquired and practised in an appropriate environment and the significance of resuscitation training on the reduction of intrapartum-related neonatal deaths in health care facilities can be decreased by 30% and early neonatal deaths by 38%<sup>27</sup>.

According to Pelman et al, neonatal asphyxia happens when there is failure to initiate spontaneous breathing and about 10% of newborn babies could have this problem at birth<sup>28</sup>. Competence on neonatal resuscitation is crucial to help babies who failed to initiate spontaneous breathing at birth or those who breathe poorly<sup>29</sup>.

Nigeria has one of the highest neonatal mortality rates in the world<sup>30</sup> and neonatal resuscitation training was not targeted to the correct health provider. As a result of this, problems related to asphyxia related death occur in newborns<sup>31</sup>. According to UNICEF report of 2018, it was reported that neonatal mortality rate per 1000 live birth in 2017 for Nigeria was 33%, and 27% in Sub-Saharan Africa<sup>32</sup>. In Nigeria, Community Health Extension Workers, Traditional Birth Attendants and other birth attendants assist in majority of births more often than doctors in rural and community PHCs<sup>31</sup>. Therefore, there is need to fill the practice gap and empower health workers by putting in efforts to focus on this disparity of birth asphyxia and its connection to reduced skill provided. The aim of this study is to assess knowledge and skills after implementing a simple HBB training of neonatal resuscitation, to improve practice of semi-skilled birth attendants with a view to reducing infant mortality at the community.

## **II. Methods**

This study was part of a larger research study that was conducted to test and evaluate an existing Neonatal Resuscitation Model for the training of semi-skilled birth attendants in low-resource setting in Nigeria. This study was conducted at Primary Health Care centre in Ibadan. The centre provides level III health care services and is publicly funded by the Local Government. Primary Health care centres provide labour and delivery, antenatal care, maternal and child care welfare and immunization services. This was a sub-set of another study conducted to assess the baseline knowledge of community health extension workers before the implementation of a simplified neonatal resuscitation protocol.

The knowledge and skills of community health extension workers were assessed with the standard tools included in the HBB package, which had been used in other settings and were validated. A questionnaire was used to assess their knowledge on the neonatal resuscitation protocol of HBB. An observation checklist which included preparation for birth, evaluating crying, clearing the airways and stimulating breathing, evaluating breathing, ventilating with bag and mask, improving ventilation and evaluating breathing and heart rate were the tools used to evaluate the skills of health workers.

The study employed a descriptive non-experimental design to collect data with the questionnaire and observation checklist. The evaluation was conducted by all the research assistants trained in neonatal resuscitation using case-situation based response demonstration approach. A total of 110 participants were purposely selected for the study and a written test with 32 questions were given to them which were derived from Helping Babies Breathe of the American Heart Association / American Academy of Paediatrics (AHA/AAP). Information on their age, sex, years of experience, level of education, PHC Centre, previous training in neonatal resuscitation, knowledge of newborn care and neonatal resuscitation were asked. The questionnaire was divided into 3 sections.

The health workers' skills to prepare and assess for routine newborn care and perform a scenario requiring bag-and-mask ventilation were assessed. Effective completion of each item required correct overall performance ( $\geq 80\%$ ), as well as the completion of main assessments and interventions such as recognizing baby not breathing/crying and providing bag-and-mask ventilation. Assessment using these tools was completed before the HBB training was done, immediately after the training, and again at eight (8) weeks after completion of the training.

Direct observations of all the participants were conducted using a scheduled checklist adapted from skilled birth attendants' neonatal resuscitation protocol of the American Academy of Paediatrics. Data analysis was done using SPSS version 20 Chicago software. All numeric values were expressed as exact number (n) or percentage (%). Descriptive statistics was calculated for all variables, including means with associated standard deviation, and summary of the proportions. The eight (8) weeks observation point was compared with the immediate post observation.

The study was approved by both the University of KwaZulu-Natal (UKZN) Biomedical Research Ethics Committee, where the researcher is a student and Oyo State Ethical committee in Nigeria. All participants were asked to provide a written informed consent prior to participation in the study and were informed that they could withdraw from the study at any time, without any form of discrimination.

### III. Results

**Table I: Demographic characteristics**

	n	%	$\chi^2$	p-value
<b>Age (Year)</b>				
<40	17	15.5		0.043
40-49	62	56.4		
$\geq 50$	31	28.2		
<b>Designation</b>				
Senior CHEWs	87	79.1		0.000
Junior CHEWs	23	20.9		

Educational level			
Secondary	5	4.5	0.000
Technical	63	57.3	
Others	42	38.2	
<b>Total</b>	110	100	

All participants completed the training, observed for immediate practice and also involved eight (8) weeks practice observation. All respondents were trained in neonatal resuscitation, participated in the immediate post training test and observed at their different PHC centres eight (8) weeks after training, giving a response rate of 100%. Although, they were described in another sub-study, where they had poor pre-test score.

This study showed that over half of respondents were in the age group of 40-49 years ( $p > 0.005$ ). Majority were senior CHEWs out of which over half had technical education and significant number of them had undergone diploma and certificate courses to earn some other qualifications ( $p < 0.005$ ), which indicated that they were literate with at least the lowest approved level of education in Nigeria (Table I).

**Table II: Knowledge of Neonatal Resuscitation by Respondents**

	Yes (%)	No (%)	p-value
Clear the airway before drying for a baby born with meconium stained liquor	94 (85.5)	16 (14.5)	0.000
A baby is quite, limp, not crying and not responding to steps to stimulate breathing. What should you do next?	101 (91.8)	9 (8.2)	
A baby chest is not moving with bag and mask ventilation. What should you do?	103 (93.6)	7 (6.4)	
An appropriate ways to stimulate a baby that is not breathing.	109 (99.1)	1 (0.9)	
What should be a baby heart rate?	102 (92.7)	8 (7.3)	

Majority of respondents 101 (91.8%) could recognize when a baby did not cry and not responding to stimulation, 85.5% could clear the airways when there was meconium stained liquor before drying the baby. Almost all 99.1% had knowledge of appropriate ways to stimulate a baby that was not breathing. Only 6.4% and 7.3% respectively did not know what to do when the chest was not moving while on bag and mask ventilation and what baby heart rate should be (Table II).

**Table III:** Cumulative knowledge score

Knowledge score of neonatal resuscitation			
	n	%	p-value
<b>Good</b>	106	96.4	<b>0.010</b>
<b>Poor</b>	4	3.6	
<b>Total</b>	110	100	

Almost all the respondents (96.4%) had a good knowledge of neonatal resuscitation after training was done (p=0.010). Cumulative knowledge score showed that majority of them had improved knowledge of neonatal resuscitation (Table 3). There was a significant improvement in the resuscitation knowledge as test scores improved overall with mean test score of 11.6 and Std D of 2.37(TablesIII&IV).

**Table IV:** Comparison of knowledge score before and after the training

Knowledge	Mean	Media	Std D	t-value
Pre-test	2.1	1.0	3.50	2.614
Post-test	11.6	13.0	2.37	

df = 109 \* significant (< 0.05)

**Table V:** Respondents' designation with cumulative Knowledge score

Designation	Knowledge of neonatal resuscitation			x <sup>2</sup>	p-value
	Good (%)	Poor (%)	Total (%)		
<b>Senior CHEWs</b>	84 (76.4)	3 (2.7)	87 (79.1)	13.178	0.101
<b>Junior CHEWs</b>	22 (20.8)	1 (0.9)	23 (21.7)		

The study also revealed that majority (76.4%) of senior CHEWs had good knowledge of neonatal resuscitation compared to the junior CHEWs with 20.8% score of knowledge. Although the total number of junior CHEWs were very insignificant, their knowledge of neonatal resuscitation was significantly higher than senior CHEWs (Table V).

**Table VI:** Area wise observation score, immediately and 8 weeks after training

Observation	Practice 1 (immediately after training)		Practice 2 (8 weeks after training)		p-value
	D (%)	ND (%)	D (%)	ND (%)	
Prepares for birth	<b>107 (97.4)</b>	<b>3 (2.7)</b>	<b>28 (25.5)</b>	<b>82 (74.5)</b>	0.000

Recognizes baby is not crying	<b>107 (97.4)</b>	<b>3 (2.7)</b>	<b>14 (12.7)</b>	<b>96 (87.3)</b>	
Keep warm, positions head, clears airway	<b>95 (86.4)</b>	<b>15 (13.6)</b>	<b>7 (6.4)</b>	<b>103 (93.6)</b>	
Stimulates breathing by rubbing the back	<b>105 (95.5)</b>	<b>5 (4.5)</b>	<b>6 (5.5)</b>	<b>104 (94.5)</b>	
Cuts cord and moves to area for ventilation	<b>110 (100)</b>	<b>0</b>	<b>4 (3.6)</b>	<b>106 (96.4)</b>	
Starts ventilation within the Golden Minute	<b>110 (100)</b>	<b>0</b>	<b>24 (21.8)</b>	<b>86 (78.2)</b>	
Looks for chest movement	<b>110 (100)</b>	<b>0</b>	<b>5(4.5)</b>	<b>105 (95.5)</b>	
Repositions head, clears secretions, opens mouth slightly, squeeze bag harder	<b>110 (100)</b>	<b>0</b>	<b>15 (13.6)</b>	<b>95 (86.4)</b>	
Stops ventilation; monitors baby and communicates with mother	<b>109 (99.1)</b>	<b>1 (0.9)</b>	<b>11 (10.0)</b>	<b>99 90.0)</b>	

\*\*\*Std dev of diff = 2.9; Mean diff = 3.3; degrees of freedom = 109

The differences between respondents' practice and skills as observed immediately after the training and eight (8) weeks. Post-observation after the training showed that they were able to practice each step of resuscitation very well. Participants were able to perform ventilation very well and check for the rise and fall of the chest. During the eight (8) weeks observation period, it was discovered that they were unable to remember the different steps and skills in neonatal resuscitation ( $p < 0.005$ ). It was found that knowledge and practice of neonatal resuscitation was not retained subsequently after the initial training (Table VI).

#### **IV. Discussion**

Adequate knowledge and skills of health providers are very important for successful neonatal outcome and training programmes. These are significant approaches in promoting health care services. Training birth attendants in low-income countries is a significant intervention to reduce infant mortality rate. Resuscitation knowledge among CHEWs in Ibadan increased initially as a result of the training. The result of this study also revealed that majority of respondents were middle aged adults who were mature to care for newborns and have also spent quality years in their profession. The study also found out that knowledge score was high immediately after the initial training. This is similar to a study by Seto et al in Honduras<sup>33</sup>, where it was shown that, immediately after training in HBB in a rural hospital, assessments of cognitive and psychomotor performances of resuscitation improved and health care personnels were able to perform. Also, it was similar to Musafili et al's<sup>17</sup> study which found out that HBB increased acquisition rates of skills and knowledge after training. The finding is however contrary to the findings from a study in Ghana, where it was found that almost all the participants 98.1% in the study had insufficient knowledge of NR with mean score of knowledge of 23.0 after the initial training<sup>34</sup>. Also, it was contrary to the findings of a study conducted in Ethiopia, where it was reported that the overall knowledge and skills of health care professionals who participated in the study were inadequate<sup>35</sup>. In a study conducted in Afghanistan by Kim et al to assess knowledge of NR among doctors and midwives, it was reported that there were high levels of knowledge among them<sup>36</sup>. This was made possible as reported that almost all health facilities had essential equipment for newborn resuscitation. Majority of providers had been trained on neonatal resuscitation and they had good knowledge, skills and confident in their ability to perform newborn

resuscitation, which was in contrast to the present study. A significant improvement was established in the knowledge of an appropriate way to stimulate infants that are not breathing immediately after the training. Similar to this study are the findings reported by Ogunlesi et al in their study on “Neonatal Resuscitation: knowledge and practice of nurses in Western Nigeria”, which observed high levels of knowledge and skills among the participants immediately after the training<sup>37</sup>. But contrary to this study, Ogunlesi found out that there were higher levels of knowledge among those who had practiced it before compared to those who had not<sup>37</sup>. Also in contrast to the findings of a study conducted in Ethiopia, which revealed that providers have inadequate knowledge and skill in identifying and managing neonates<sup>38</sup>. This is consistent with findings in another study in Ethiopia on quality of care for prevention and management of common maternal and newborn complications, where over half (55%) of professionals who provided intrapartum care in hospitals had sufficient knowledge on essential newborn care with only 18% having ever resuscitated a newborn infant<sup>39</sup>.

Asphyxiated babies should be ventilated within the first minute after birth which is also referred to “The Golden Minute”. Any delay in commencing ventilation increases the risk of mortality and long term neurological consequence<sup>40</sup>. In this present study, it was found that there was no difference in knowledge of those that had had the training before and those who did not have the training. This study revealed that the knowledge and skills of participants reduced drastically after some weeks. This practical understanding is very critical to effective resuscitation practice. This is similar to a study conducted in Tanzania by Arlington et al (2017)<sup>41</sup>, where it was reported that skills dropped off after the initial training. Therefore, the number of practice required to retain basic resuscitation skills was very significant in education knowledge. This is similar to the present study which found out that respondents could not retain skills practised during the initial training. In a report by ILCOR, it was recommended that more frequent practice is needed after the initial training in neonatal resuscitation, although, there is a little evidence upon which to base this recommendation<sup>42</sup>. Consistent training may probably have positive outcome in reducing adverse health events especially in low-resource settings as seen in the study conducted by O’Hare et al to determine the effectiveness of training nurses and its impact on the outcome of neonates delivered in Kampala, Uganda<sup>43</sup>. This study found that the team dedicated to training basic neonatal resuscitation in the delivery room of a teaching hospital reduced the incidence of and mortality from asphyxia thereby, improving the outcome of mortality of term babies. Similar to this study are the findings in the study by Carlo et al to assess the impact of educational intervention of neonatal resuscitation program, where they found out that after the administration of educational intervention, the knowledge in all areas had significantly increased. This implied that the intervention of training had probability to improve knowledge, skill and efficiency of nurses on neonatal resuscitation immediately after the initial training even though retention of knowledge and performance skills decreased significantly by six (6) months post-training<sup>44</sup>.

## **V. Conclusions**

Neonatal resuscitation training significantly improved knowledge and skills. There were high rates of knowledge and skills adoption among semi-skilled birth attendants at the initial early stage. However, there was notable fall-off in skills over time; skills declined even more than knowledge ultimately. It was clear from the findings of this study that almost all do not have adequate knowledge about NR regardless of their cadre and years of practicing at the PHCs.

## VI. Recommendation

In as much as training is associated with improved knowledge, there should be an appropriate opportunities for community health workers to be trained in this life savings skill. There should be a useful application of intervention to contribute to the diminishing skills. An ongoing skills practice and monitoring of birth attendants in the community with more re-testing or refresher trainings which are needed to maintain neonatal resuscitation skills should be put in place to refine the existing model to improve their practice and skills in neonatal resuscitation.

### Conflict of interest:

None

## References

- [1]. Lawn, JE, Blencowe, H, Oza, S, et al (2014). Every newborn study group. Every newborn: progress, priorities, and potential beyond survival. *Lancet*. 384(9938):189–205.
- [2]. Lee, AC, Kozuki, N, Blencowe, H, et al (2013). Intrapartum-related neonatal encephalopathy incidence and impairment at regional and global levels for 2010 with trends from 1990. *Paediatric Res*. 74(Suppl 1):50–72.
- [3]. Singhal, N, Lockyer, J, Fidler, H (2012). Helping babies breathe: global neonatal resuscitation program development and formative educational evaluation. *Resuscitation*.83(1):90–6.
- [4]. Kattwinkel, J (2008). Neonatal resuscitation guidelines for ILCOR and NRP: evaluating the evidence and developing a consensus. *J Perinatol*. 28(Suppl 3):S27–9.
- [5]. United Nations, “MDG 4: Reduce child mortality”. 2015. Retrieved from <http://gh.one.un.org/content/unct/ghana/en/home/global-agenda-inghana/millennium-development-goals/mdg-4-reduce-childmortality>.
- [6]. Boo, NY, Pong, KM (2001). Neonatal resuscitation training program in Malaysia: results of the first 2 years. *J Paediatr Child Health*. 37:118-24.
- [7]. Lee, AC, Cousens, S, Wall, SN, et al (2011). Neonatal resuscitation and immediate newborn assessment and stimulation for the prevention of neonatal deaths: a systematic review, meta-analysis and Delphi estimation of mortality effect. *BMC Public Health*. 11(Suppl 3):S12
- [8]. Murila, F, Obimbo, MM, Musoke, R (2012). Assessment of knowledge on neonatal resuscitation amongst health care providers in Kenya. *Pan Afr Med J*. 11:78.
- [9]. United Nations Inter-agency Group for Child Mortality Estimation, Levels and Trends in Child Mortality: Report 2018. Available from <http://www.un.org/en/development/desa/populations/publications/mortality/child-mortality-report-2018>
- [10]. Davanzo, R (2004). Newborns in adverse conditions: issues, challenges, and interventions. *J Midwifery Womens Health*. 49:29-35.
- [11]. Eriksson, L, Mälqvist, M, Persson, L, Ewald, U, Wallin, L (2009). Evidence-based practice in neonatal health: knowledge among primary health care staff in northern Viet Nam. *Hum Resour Health*. 7:368
- [12]. Bhutta, ZA, Belgaumi, A, Abdur, R, Karrar, M, Mouane, M (2006). Child health and survival in the Eastern Mediterranean region. *BMJ*.333:839-842. Available from: [https://www.researchgate.net/publication/6743058\\_Child\\_health\\_and\\_survival\\_in\\_the\\_Eastern\\_Mediterranean\\_region](https://www.researchgate.net/publication/6743058_Child_health_and_survival_in_the_Eastern_Mediterranean_region) [accessed Apr 05 2019].
- [13]. Msemu, G, Massawe, A, Mmbando, D, et al (2013). Newborn mortality and fresh stillbirth rates in Tanzania after helping babies breathe training. *Pediatrics*. 131(2):e353–60.
- [14]. Vossius, C, Lotto, E, Lyanga, S, et al (2014). Cost-effectiveness of the "helping babies breathe" program in a missionary hospital in rural Tanzania. *PLoS One*.9(7).
- [15]. Erdsdal, HL, Vossius, C, Bayo, E, et al (2013). A one-day "helping babies breathe" course improves simulated performance but not clinical management of neonates. *Resuscitation*.84(10):1422–7.
- [16]. Hoban, R, Bucher, S, Neuman, I, Chen, M, Tesfaye, N, Spector, JM (2013). 'Helping babies breathe' training in sub-saharan Africa: educational impact and learner impressions. *J Trop Pediatr*. 59(3):180–6.

- [17]. Musafili, A, Essen, B, Baribwira, C, Rukundo, A, Persson, LA (2013). Evaluating helping babies breathe: training for healthcare workers at hospitals in Rwanda. *Acta Paediatr.* 102(1):e34–8.
- [18]. Lee, AC, Cousens, S, Wall, SN et al (2011). Neonatal resuscitation and immediate newborn assessment and stimulation for the prevention of neonatal deaths: a systematic review, meta-analysis and Delphi estimation of mortality effect. *BMC Public Health* 11(Suppl 3):S12.)
- [19]. American Academy of Pediatrics. American Academy of Pediatrics Launches New Global Health Initiative Helping Babies Breathe. Available from <http://www.aap.org/advocacy/releases/june0210breathe.htm>
- [20]. Helping Babies Breathe. Available from <http://www.healthynewbornnetwork.org/partner/helping-babies-breathe/>
- [21]. Jukkala AM, Henly SJ (2007). Readiness for neonatal resuscitation: measuring knowledge, experience, and comfort level. *Applied Nursing Research* 20:78–85.
- [22]. Perinatal service BC. Standards for Neonatal Resuscitation. Provincial *Perinatal Guidelines*. 2014. Available from: <http://www.perinatalservicesbc.ca/>
- [23]. Fiedor ML (2004). Pediatric simulation: A valuable tool for pediatric medical Education. *Critical Care Medicine* 32(2 Suppl):S72-74.
- [24]. Davis PG, Dawson JA (2012). New concepts in neonatal resuscitation. *Current Opinion in Pediatrics* 24(2):147–153.
- [25]. Gardner SL, Carter BS, Enzman-Hines M, Hernandez JA (2011). *Gardner's handbook of neonatal intensive care*. 7<sup>th</sup> ed. St. Louis: Mosby Elsevier.
- [26]. Pattinson RC (2011). Saving babies 2008-2009: *Seventh report on perinatal care in South Africa*. Pretoria: Tshepesa Press.
- [27]. Bhutta ZA, Das JK, Bahl R, et al (2014). Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet* serial online 384:347–370. Available from: [http://dx.doi.org/10.1016/S0140-6736\(14\)60792-3](http://dx.doi.org/10.1016/S0140-6736(14)60792-3)
- [28]. Perlman J, Wyllie J, Kattwinkel J et al (2010). Neonatal Resuscitation Chapter Collaborators: Neonatal resuscitation: 2010 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Pediatrics*. 126 (5): e1319-e1344.
- [29]. Ersdal H, Singhal N (2013). Resuscitation in resource-limited settings. *Semin Fetal Neonatal Med.* 18 (6): 373-378.
- [30]. World Bank 2015. Mortality rate, neonatal (per 1,000 live births). Retrieved from <http://data.worldbank.org/indicator/>
- [31]. Uwakah, U, Merritt, S (2016). Providing neonatal resuscitation training in rural Eastern, Nigeria. Training birth attendants to improve neonatal resuscitation knowledge and skill ability. *GSTF Journal of Nursing and Health Care (JNHC)*: Vol.4 No.1
- [32]. United Nations Inter-agency Group for Child Mortality Estimation, Level and Trend in child mortality report 2018. Retrieved from <https://www.un.org/en/development/desa/>
- [33]. Seto, TL, Tabangin, ME, Josyula, S et al (2015). Educational outcomes of Helping Babies Breathe training at a community hospital in Honduras. *Perspect Med Educ* 4(5):225–32.
- [34]. Alhassan, A, Fuseini, A, Osman, W, Adam, AB (2019). Knowledge and experience of neonatal resuscitation among Midwives in Tamale, Ghana. *Hindawi Nursing Research and Practice* Vol. 2019, pp8. Available from <https://doi.org/10.1155/2019/3652608>
- [35]. Gebreegziabher, E, Aregawi, A, Getinet H (2014). Knowledge and skills of neonatal resuscitation of health professionals at a University Teaching Hospital of Northwest Ethiopia. *World Journal of Emergency Medicine* vol. 5, no. 3, p. 196.
- [36]. Kim, YM, Ansari, N, Kols A et al (2013). Assessing the capacity for newborn resuscitation and factors associated with providers' knowledge and skills: A cross-sectional study in Afghanistan. *BMC Pediatrics* vol. 13, no. 1.
- [37]. Ogunlesi, T, Dedeke, O, Adekanmbi, F, Fetuga, B, Okeniyi. A (2008). Neonatal resuscitation: Knowledge and practice of nurses in western Nigeria," *South African Journal of Child Health* vol. 2, no. 1, pp. 23–25.

- [38]. Mirkuzie AH, Sisay, MM, Reta, AM, Bedane, MM (2014). Current evidence on emergency obstetric and new born care services in Addis Ababa Ethiopia. *BMC Pregnancy and Childbirth*14:354. Available from <https://doi.org/10.1186/1471-2393-14-354>
- [39]. Getachew, A, Ricca, J, Cantor, D (2011). Quality of Care for Prevention and Management of Common Maternal and Newborn Complications: A Study of Ethiopia's Hospitals. Jhpiego Brown's Wharf 1615 Thames Street Baltimore, Maryland, USA. [www.jhpiego.org](http://www.jhpiego.org)
- [40]. Msemo, G, Massawe, A, Mmbando, D et al (2013). Newborn mortality and fresh stillbirth rates in Tanzania after helping babies breathe training. *Pediatrics*. 131 (2): e353-e360.
- [41]. Arlington, L, Kairuki, A, Isangula, K et al (2017). Implementation of 'Helping Babies Breathe': A 3-year experience in Tanzania. *Pediatrics*139(5):e20162132.
- [42]. Kattwinkel, J, Niermeyer, S, Nadkarni, V, et al (1999). ILCOR Advisory Statement: Resuscitation of the newly born infant. An advisory statement from the Paediatric working group of the International Liaison Committee on resuscitation. *Journal of Circulation*1927-1938. Retrieved from <https://doi.org/10.1161/01.CIR.99.14.1927>
- [43]. O'Hare BA, Nakakeeto M, Southall DP (2006). A pilot study to determine if nurses trained in basic neonatal resuscitation would impact the outcome of neonates delivered in Kampala, Uganda. *Journal of Tropical Paediatrics* 52(5): p.376-9.
- [44]. Carlo WA, Wright LL, Chomba E et al (2009). Educational Impact of the Neonatal Resuscitation Programme in Low-risk Delivery Centers in a Developing Country. *Journal of Pediatrics*154(4):504-508).