Helping Babies Breathe: Neonatal Resuscitative Teaching to Midwives in Ghana, West Africa

Olivia Meyers and Hannah Matthews

Mentor: Dr. Chris Sloan, Ph.D., CNS, CPN

Point Loma Nazarene University, School of Nursing

6 April 2019

Abstract

The American Academy of Pediatrics designed Helping Babies Breathe (HBB), an educational program for low-resource areas. This project implemented a modified HBB program to teach neonatal resuscitation skills to four midwives in rural Ghana. The midwives averaged pre-test scores of (a) 39.2%, (b) 37.5% and post test scores of (a) 71.4%, (b) 83.7%. This train-the-trainer framework has resulted in one midwife continuing the teaching to hospitals in the region.

Chapter 1

Introduction

In this project the two authors and nursing students along with their professor Dr. Chris Sloan, Ph.D., RN, CNS, CPN and other peers traveled to Ghana, West Africa through the study abroad program of Point Loma Nazarene University, School of Nursing. We gained experience working in a rural hospital and returned the following year to the same rural town in Ghana. We did this in order to continue building relationships with hospital staff from the previous year and to implement a teaching program in this local hospital. This project aimed to fortify neonatal resuscitation skills in midwives of this hospital. We will discuss further the issues regarding neonatal mortality rate worldwide and in Ghana, a literature review regarding the Helping Babies Breathe (HBB) program, our methods of implementation of a modified version of said program, and results.

Background

The World Health Organization (WHO) set a Sustainable Development Goal of ending preventable deaths of newborns and children under five years of age to 12 deaths per 1000 live births and reducing under-five mortality to 25 per 1000 live births (SDG 3: Health, 2016). The neonatal mortality rate (NMR) decreased throughout the world from 37 deaths per 1,000 live births in 1990 to 18 in 2017. This is a decrease of 51% (Demographic Indicators, 2018). However, large disparities in neonatal mortality continue to persist across developing regions and countries with limited resources (Demographic Indicators, 2018).

Ghana, a country on the coast of West Africa, has a population of 27.4 million people (Mortality Rate, n.d.). The NMR in Ghana is 24 out of 1,000 live births, as estimated by UNICEF and The World Bank (Mortality Rate, 2017). It has been found that only 71% of children under five-years-old births have been registered at birth. Therefore, this data may not account for the true impact that neonatal mortality and under-five mortality have had on the

population (Demographic Indicators, 2018). The under-five mortality rate in Ghana is 49 deaths out of 1,000 live births (Demographic Indicators, 2018). The neonatal mortality rate in resource-limited countries comprises almost half of the number of deaths ages five and under (Arlington, et al., 2017). This is also true in Ghana, where the neonatal mortality rate (24/1,000) comprises half of the under-five mortality rate (49/1,000) (Mortality Rate, 2017). One of the major causes of neonatal death n Ghana iis birth asphyxia (Arlington et al, 2017; Causes of Neonatal Mortality, 2015) (Appendix A). Birth asphyxia occurs when a lack of blood and oxygen is able to be delivered to the brain and body before the baby is born, during birth, or after the baby has been delivered (Birth Asphyxia, n.d.). Because of the large percentage of deaths that occur due to birth asphyxia, addressing this widespread issue has the potential to significantly impact the neonatal mortality rate in Ghana as well as to the rest of the developing world.

Year 1

The authors' first experience in Ghana occured in May of 2017 for 30 days. This initial trip included being invited to a hospital in Southern Ghana by the hospital's one doctor. While visiting the hospital this first year, the group of eight nursing students had the opportunity to shadow, observe, and work alongside nurses, midwives, and the doctor throughout various wards in the rural hospital. Wards visited included the pediatric ward, men's and women's adult wards, pharmacy, and the maternity ward. In addition, the group was invited to observe the surgeries performed, one of which was a caesarean section. At this hospital, over the course of four weeks, two incidents involving infants experiencing apnea occurred.

The first surgery our group observed was a caesarean section where the newborn had a complicated transition to extrauterine life. When the newborn was delivered, the baby let out a single cry. However, no cries after that were heard from the newborn. The newborn was passed

to two midwives waiting near a smaller table in the operating theater who then began resuscitation techniques in order to allow the newborn to breathe. The midwives squeezed the ribs of the newborn with their hands to jostle the fluid from the lungs. When this was performed, forced and gurgly grunts were heard from the newborn. However, he was unable to breathe or cry. The midwives held the newborn upside down while hitting the feet and blew air into the mouth forcefully with a small cloth over the newborn's mouth. When mouth-to-mouth resuscitation was started, the air filled the newborn's stomach, indicating ineffective breaths delivered to the newborn. About five minutes had gone by and the cyanotic baby was still not breathing spontaneously or receiving adequate breaths from the midwives present. After seven minutes the newborn began to cry and perfuse appropriately. While this resuscitation led to the newborn surviving, the techniques used to resuscitate were questionable and not effective.

Another adverse event at the hospital witnessed by the authors during the first summer in Ghana involved an infant who was about 48 hours old. While arriving to the maternity ward of the hospital, we noticed a nurse in the corner at a procedure table who was removing an IV from an infant. The infant, upon examination was deceased. It was unknown to us what had occurred to lead to the newborn's death. It is hypothesized that the newborn suffered respiratory arrest during the postpartum period. Midwives stated that resuscitation efforts were performed but were unsuccessful and the newborn expired. The hospital's doctor came into the maternity ward to round on the patients on the unit. During the doctor's rounds, the nurses and midwives did not mention the deceased infant to the doctor.

The mother of the deceased baby had given birth to twins two days before the incident. The baby boy's sister was lying swaddled next to her mother. The doctor began to discuss the newborn baby girl, read on the chart that she had a twin, and realized her twin was not there. He

asked the nurse where the baby brother was, and the nurse answered that he had not survived the night. The explanation given to the doctor by the midwives for the events preceding the infant's passing was that the baby had not been breathing in the early morning, so the midwives began to resuscitate using cardiopulmonary resuscitation. They were unsure of the underlying cause and were not aware of any maternal or infant risk factors. The twins were premature, however it is unknown what the exact gestation was as it was not charted. The baby boy had been the smaller twin of the two. Prematurity could have contributed to the infant's complications, but it was unknown what other complicating factors were present in the situation. It is unclear why the nurses did not alert the doctor of the incident so that he could take control or assist in the emergency. While the midwives and nurses did know and understand what situations call for resuscitative attempts they did not demonstrate effective techniques.

Due to the lack of resources, monitors are not available to be used on patients at the hospital. Vital signs are generally taken after a baby is a few hours old and are taken a few times per day for the mothers. It is likely that the lack of resources, lack of proper monitoring, and lack of proper resuscitation techniques led to this infant's death.

After this incident the hospital's doctor requested that our group of visiting nursing students hold a cardiopulmonary resuscitation (CPR) class to educate nurses and midwives about appropriate circumstances and techniques when performing CPR on adults, children, and infants. This class was held for one hour due to time constraints and pillows were used as "dummies" to practice on. However, we wished we had had more time to work with the nurses and midwives to reach a deeper level of understanding and competence regarding the subject of resuscitation. After this experience we spent the following school year preparing to return to this hospital specifically and further educate these midwives and nurses on specifically neonatal resuscitation.

We decided to use the Helping Babies Breathe program as our framework for the teaching. Our preparations also included obtaining funding from Sigma Theta Tau International and supply donations from the Ssubi foundation, a non-profit.

Chapter 2

Review of the Literature

In response to the World Health Organization's (WHO) Sustainable Development Goal to lower the worldwide neonatal mortality rate (NMR) to less than 12 per 1,000 live births by the year 2030 (Msemo et al., 2013), the American Academy of Pediatrics (AAP) created a program called Helping Babies Breathe. Helping Babies Breathe is an evidence-based educational program designed for low-resource areas. Through this program birth attendants are taught how to assess and treat newborns in the first moments following birth. Some techniques used in this program include a step-by-step algorithm combined with demonstration and practice techniques. HBB has been implemented in more than 77 low-resource countries since its inception and implementation in 2010 (Arlington et al., 2017; Chaudhury et al., 2016). The following chapter will appraise the extant literature regarding the implemented HBB programs in areas such as Nepal, Tanzania, Ghana, and Kenya. Additionally, the studies evaluating the effectiveness of the HBB program will be explored and discussed in order to determine the most effective methods available in the implementation of this simple yet transformative program. .

Developed by the American Academy of Pediatrics (AAP) in 1987, the Neonatal Resuscitation Program (NRP) has been the evidence-based gold standard for resuscitating newborns for the past 32 years (NRP History, n.d.). This program utilizes an algorithm with steps of care based on the signs and symptoms of apnea and birth asphyxia that newborns are displaying, along with advanced newborn care such as continuous positive airway pressure

(CPAP), supplemental oxygen, intubation, and life-saving medications including epinephrine (NRP: What Hospital-Based…, 2015). However, the NRP curriculum targets health providers in first-world countries where advanced life support measures and supplies are readily available. Similarly, HBB was designed to standardize actions appropriate for resuscitating newborns while also taking into account the limited resources of less developed countries (Niermeyer, 2015). The information in HBB is condensed and targets basic resuscitation skills since only 1% of babies born worldwide require advanced resuscitation, such as chest compressions and medication (Niermeyer, 2015). The following chapter will explore the current literature regarding teaching methods, cost analysis, implementation timelines, and outcomes including the retention of the knowledge and skill set of healthcare providers.

Alternative Programs

The AAP was not the only organization to create a program in response to the WHO's Sustainable Development Goal. Both HBB and ENCC were developed in 2010. In order to decrease infant mortality, the WHO developed the Essential Newborn Care Course (ENCC) with similar goals as HBB in training birth attendants in resource-limited areas to provide adequate newborn care. Both ENCC and HBB provide evidence-based information and trainings regarding the care of newborns. The ENCC course covers instruction such as delivery, postpartum, and newborn care for birth attendants (Essential Newborn Care Course: Trainers Guide, 2010) while the AAP created HBB to specifically address resuscitation of the newborn after delivery (Guide for Implementation of HBB, 2011). The AAP additionally developed separate programs called Helping Babies Survive, Essential Care for Every Baby, Essential Care for Small Babies, and Improving Care for Mothers and Babies (Our Programs, n.d.). HBB and ENCC curriculum teach

the same points, but HBB provides the information in separate courses, while ENCC provides a comprehensive review of all subjects in one full course.

There are many reasons why the HBB program by the AAP was better suited for the needs of the hospital in Ghana where our modified program was implemented. The ENCC Trainer's Guide states that it requires about four to five days, or eight to ten half-days to complete the course, overall amounting between 28 and 32 hours (Essential Newborn Care Course: Trainers Guide, 2010). Additionally, it was decided that the ENCC course encompassed too many teaching aspects and subjects. The ENCC educated participants, not only on neonatal resuscitation, but also breastfeeding, kangaroo care, administering injections, caring for a premature infant and alternative methods of feeding (Essential Newborn Care Course: Trainers Guide, 2010). Another reason why the ENCC would not have been effectively implemented is a portion of the training is taught using CDs and videos and the hospital in which the HBB course was implemented did not have access to video players at the time. ENCC created by the WHO is a highly effective program that can be effectively implemented in resource-limited areas. However, specifically for the area where we sought to educate, ENCC would not have been the most efficient choice of resuscitation programs. Additionally, the HBB Guide for Implementation (2011) states that the HBB curriculum can be used as the resuscitation piece of the ENCC curriculum taught.

Duration of Helping Babies Breathe Education

The HBB Planning and Implementation Guide suggests a one to two-day training program (6-24 hours) based on the availability of resources budget limitations (Guide for Implementation of HBB, 2011). While one might assume that longer trainings would yield the best outcomes, the HBB Program is unique in that it is designed to maximize the learning style

and ability of the community the trainings are designed to reach. The American Academy of Pediatrics created a comprehensive program to cover the vital information needed to resuscitate newborns in a reduced amount of time. The purpose of the abbreviated format is to promote the stewardship of resources available to developing countries (Arlington et al., 2017).

Though the enactment of the HBB occurred in several countries, the implementation of the program has varied in terms of the number of days spent educating and training the healthcare providers both initially and long-term. The majority of studies report following the HBB recommended guideline that call to use 16-24 hours total for the initial trainings (Guide for Implementation of HBB, 2011). Eblovi et al., (2017) completed a 16 hour training over two days in rural Ghana. This is in line with the guidelines of AAP. Similarly, Arlington et al. (2017) trained midwives in Tanzania in one day. However, midwives reported that they wished the training had taken place over a longer period of time (Arlington et al., 2017). In their study, Msemo et al. (2013) conducted their training program over two days, aligning with the HBB guidelines. Some studies, however, had to modify the HBB program to better suit the needs of their community members. For example, Bang et al. (2016) spent three days training midwives and birth attendants in India and Kenya respectively. In addition, Gomez, et al., (2018) taught midwives utilizing a "low dose, high frequency model," that took place over two) four-day sessions. Similarly, a study conducted in Zanzibar, Tanzania (Wilson, et al., 2017) adopted a successful three-day initial training with its midwives. It appears through these studies that regardless of the amount of time or number of days of initial trainings, all midwives and birth attendants trained received the same HBB curriculum and hands-on practice. Additionally, all participants were evaluated using the same HBB OSCE A and OSCE B post tests after initial training. The percentage of skill retention will be discussed further later in this chapter.

Teaching Methods

Hands-On Practice

A significant aspect of the Helping Babies Breathe model lies in the hands-on teaching between the trainer and the trainee (Guide for Implementation of HBB, 2011). All articles reviewed regarding HBB implementation in rural countries implemented hands-on practice as an integral part of the training. Active participation allows for the acceleration of learning and development of the practical application of skill (Rasmussen, 2015). Gomez et. al (2018) implemented a "low-dose, high frequency" model in Ghana, where the researchers had short sessions of hands-on practice over a long period of time. The article discusses the maintenance of skills retained over time by midwives from continual hands-on practice with the NeoNatalie simulator (Gomez et al., 2018). An article by Bang, et al. (2018) implemented HBB in India and Kenya. In this study, midwives were monitored practicing their hands-on skills daily with randomized skills checks once per month by their Master Trainers.

Teaching Cascade

At the core of the HBB curriculum lies the concept of the teaching cascade. The teaching cascade holds the idea that the student of the original curriculum can become the teacher to future students to whom they will relay the teaching. For example, in a study by Msemo et al. (2013), 40 providers were chosen from eight different hospitals to be Master Trainers and were taught HBB with a two-day class. In following nine months, those 40 Master Trainers taught their hospital staff with one-day HBB classes along with the main implementation coordinator of the study.

Similarly, Wilson et al. (2017) explains how the "train-the-trainer" design was implemented in a study. A certified Master Trainer from the AAP trained providers in Zanzibar

to be Master Trainers. The AAP-certified Master Trainer then observed and supported those Master Trainers in training their own staff with the HBB curriculum. To further increase sustainability, a post-class focus group was held with the participants to become aware of the aspects of the training that could be improved upon within the HBB curriculum and methods of teaching (Wilson, et al., 2017). Gomez, et al. (2018) also first trained experienced midwives who then taught their own staff the same curriculum.

This concept of the cascade of teaching provides HBB with sustainability over time (Wilson et al., 2017). Often relief and aid efforts have been brought to struggling countries that act as short-term bandaids rather than providing the tools for long-term solutions. Corbett and Fikkert (2009) describe this issue as similar to treating a patient's symptoms rather than the concealed sickness underneath or misdiagnosing the causal sickness and prescribing the wrong medicine. When only temporary solutions are applied to deep-rooted issues, more harm than benefits could be done to the situation. Rather than only bringing supplies or donating money, HBB helps bridge the knowledge gap by providing a self-sustaining, continual cycle of teaching. Through this, HBB not only provides resources and knowledge but empowers birth attendants to spread this education and skills to others, creating a domino effect.

Commented [1]: I do like this part, but the rest is a bit off topic.

Commented [2]: I do like this part, but the rest is a bit off topic.

Pre and Post-Test

Additionally, all studies reviewed stated that participants' resuscitation skills were evaluated using the Objective Structured Clinical Evaluation (OCSE) A and OSCE B, which were designed for HBB by the AAP, prior to the curriculum and at every re-training (See Appendices B and C). This allows for assessment of pre-skills in order to cater to the learning needs of the trainees. OSCE A and OSCE B provide a step-by-step check-off for the skills necessary for evaluating and resuscitating a newborn. These OSCE's are used in all

implementations of HBB and were developed by AAP from the NRP megacode protocol (Bang, et al., 2016). All studies reviewed which implemented HBB utilized the NeoNatalie simulator, allowing for more accurate and consistent results. The University of Minnesota published literature about effective teaching methods to adult learners (Rasmussen, 2015). One teaching method of note included experiential learning, whereby students become actively engaged in participation of the curriculum. This includes placing students in situations they have to problem-solve such as case-studies and implementing their knowledge. This interactive form of learning has been shown to have a greater impact on the learning of students through increased retention rates compared with simply lecture-style teaching. The intent behind our utilization of the NeoNatalie simulator was to allow the midwives to apply their knowledge and skills through hands-on practice to supplement knowledge gained from lecture and discussion-based learning.

Cost Analysis

Important considerations when implementing a program that reaches across the globe is whether or not the success, change, and rate of effectiveness and improvement is worth the cost of implementation. Current research focuses on the cost analysis of the Helping Babies Breathe program. Chaudhury et al. (2016) examined the budget expense data of a two-month implementation of the HBB program, as well as a follow up, in Tanzania. This study found that the HBB program was relatively low-cost and had the potential to reap high rewards and create a lasting impact on low resource areas (Chaudhury et al., 2016). This study examined a large area of Tanzania specifically chosen because it encapsulates both urban and rural areas (Chaudhury et al., 2016). This study states that their funding came from outside sources. The most expensive aspect of the implementation was the initial training (Chaudhury et al., 2016). It was found that the average cost was about $602 per health facility trained (Chaudhury et al., 2016).

This program can be considered low-cost due to the fact that much of the educational supplies can be found for free online through the American Academy of Pediatrics website (Helping Babies Breathe Educational Materials, n.d.). This includes the OSCE A and OSCE B pre- and post-tests, posters, and algorithm. All educational materials are available in various languages, most notably Spanish, French, and Swahili, and use models and photos of various cultures and ethnicities including African, Asian, and Caucasian (Helping Babies Breathe Educational Materials, n.d.). In addition, through Laerdal Global Health, HBB sells the Neonatalie simulator doll in either dark or light skin so as to appeal to multiple cultures (see Appendix D). The NeoNatalie kit includes bulb suction syringes, an infant Ambu bag and mask, a baby hat, and directions for use, all costing approximately $85 USD.

Retention of Skills and Knowledge Over Time

Many HBB implementations around the world have reported a dramatic increase in resuscitative skills immediately following the initial HBB class (Ashish, et al. 2017). In the study conducted by Eblovi et al. (2017), the mean post-test score of the midwives immediately following the initial HBB training was 94.9%. This finding is in line with the AAP's assertion that the HBB hands-on training program produces immediate effects of increased resuscitative skill in trained birth attendants (HBB Overview, n.d.). Bang et al (2016) found that 99% of birth attendants passed the HBB initial post-test despite that 76% of the participants had never received resuscitative training in the past (Bang, et al., 2016). This demonstrates how the HBB program is easy to learn and understand, making it effective and accessible to all health workers worldwide. However, in this same study by Bang et al (2016), the researchers saw a decrease in skills over time despite daily practice (Bang et al., 2016).

Arlington, et al. (2017) and Wilson et al. (2017) found that midwives' resuscitative skills decreased over time despite how effective the original course may have been. In the study by Eblovi et al. (2017), the midwives' skills decreased about 13.7% over the four months following initial training. Similarly, Bang et al. (2016) found that the midwives' OSCE post-test scores after six months decreased from 99% to 81%. One implementation by Ashish et al. (2017) in Nepal saw that after six months midwives' skills were retained from their post-test scores directly following the course. This retention of skill was primarily attributed, by the researchers, to the fact that during this implementation, over half the midwives had daily bag-and-mask practice time (Ashish et al., 2017).

While it is still unknown how best to prevent birth attendants' resuscitative skills from decreasing over time, many efforts have been made to supplement trainees' skills. Some studies used daily practice (Ashish et al. 2017; Bang et al., 2016) while one study even used camera surveillance to watch birth attendants (Ashish et al., 2012). Many have tested out follow-up training or refresher courses, which have been effective in slowing the decline of skills (Eblovi et al., 2017). The study by Eblovi et al. (2017) in a rural Ghana conducted two refresher courses. One refresher course occurred four months after the initial training and the second occurred one year after the initial HBB course. Bang et al (2016) also used refresher courses, improving post-test scores from 81% back to 99%.

While the literature available regarding HBB is consistent about refresher courses needed in order for long-term sustainability of HBB skills, there is no definitive number of or frequency of refresher courses recommended for maximum knowledge retention over time. All literature reviewed regarding retention of skills from HBB agrees that refresher courses should be conducted but none indicate specifics. Some articles retrained healthcare providers six months

after initial HBB trainings (Bang et al., 2016; Bellad et al., 2016), while others re-trained providers one year after initial training but re-tested the providers four months after initial training (Eblovi et al., 2017). The post-test scores in the study by Bang et al. (2016) decreased to 81% from their initial post-test scores of 99%, and the results of the study by Eblovi et al. (2017) decreased from an initial 94% to also 81% by the first four-month re-testing of the OSCE skills tests. However, both collective scores rose back to nearly their starting scores after the re-trainings at six months (Bang et al., 2016) and twelve months (Eblovi et al., 2017).

Kamath-Rayne et al. (2018) discussed the second edition of HBB and modifications that have come from the experiences of the first five years of implementation in various countries. One modification includes implementing a low-dose, high frequency practice but does not specify a particular plan for the number and frequency of retrainings. Additional research identifying best practices for the rate at which refresher trainings should be conducted is needed for more consistent and high-quality trainings of these healthcare providers.

In this chapter, a review of the current literature regarding the HBB curriculum, the origins of HBB, and its implementations in limited-resource areas around the world have been presented. A variety of literature exists regarding neonatal resuscitation and HBB implementations thus far, all of which show immediate positive results but uncertain long-term results. The current literature will inform and influence future educational implementations of HBB, one of which will be outlined in subsequent chapters.

Chapter 3

Methodology

The events during the first visit to Ghana and the small rural hospital were what motivated and inspired a return visit during the summer of 2018. We prepared for our second

visit to Ghana by researching worldwide neonatal mortality, and sought out funding and donations for supplies in order to teach the midwives at this rural hospital a step-by-step process of resuscitating newborns experiencing birth asphyxia. Point Loma Nazarene University (PLNU) alumni Jason and Olivia Kroening-Roche from Rural Health Collaborative, a non-profit organization that has collaborated with PLNU in the past (Our Mission, n.d.), recommended a program for the Ghana Nursing study abroad group to implement called Helping Babies Breathe. Additionally, we partnered with a non-profit organization called the Ssubi Foundation, whose mission is to help provide sustainable solutions such as farming and agriculture, provide hospital supplies, and build new hospitals in countries such as Uganda (Mission and Vision, n.d.). The Ssubi Foundation collects supplies from several hospitals in Southern California that, while outdated by policies in the United States, are still able to be utilized by healthcare providers in other countries (Our Hospital, n.d.). The Ssubi Foundation donated bulb suction syringes, tape measures, stethoscopes, and two infant-sized ambu bags. We also brought several Helping Babies Breathe posters and supplies, including the NeoNatalie simulator doll (see appendix C). Our group consisted of twelve nursing students and nursing professor Dr. Chris Sloan, Ph.D, RN, CNS, CPN. We approached the hospital's main doctor and asked for permission to conduct a neonatal resuscitation class utilizing the Helping Babies Breathe framework to teach the midwives. The class consisted of two two-hour classes. The doctor heartily agreed and gave us a room and an audience of four participants who were all midwives. We conducted pre and post tests, introduced the curriculum, discussed the material, provided opportunities for hands-on simulation practice, and collected demographic data on the participants. The trainings were held in English, which all midwives present were proficient in. The four participants were all midwives at this hospital in the rural town of Southern Ghana. The midwives differed in age and

number of years of experience as midwives. This hospital serves a rural town of people who largely make money from selling items at the weekly market. Common diagnoses seen at this hospital include human immunodeficiency virus (HIV), malaria, and sickle-cell anemia.

Day 1 Teaching

Pre-Testing

During the first HBB teaching session, we began by introducing ourselves and explaining why we are passionate about the subject of neonatal resuscitation. We stated that the class would be collaborative; we wanted to teach as well as learn from them. We explained the Helping Babies Breathe initiative and its success in many other countries. We then began pre-testing the five midwives who were present. In conducting pre-tests for each midwife, we utilized the HBB Objective Structured Clinical Evaluations (OSCE's) A and B. The OSCE A test consists of a situation with a term newborn who had a fairly uncomplicated birth, requiring minimal intervention such as suctioning and stimulating the newborn (OSCEs A and B, 2011) OSCE B places the participant in the situation of a newborn requiring advanced resuscitative techniques such as positive pressure ventilation.

Assessments and Drying

The first topic discussed was quickly assessing and drying the newborn after it has been delivered. This is the first step according to Helping Babies Breathe algorithm through the American Academy of Pediatrics (Implementation Guide HBB, 2011). We explained the importance of drying the newborn as an important initial step in resuscitation to prevent cold stress and stimulate breathing (Implementation Guide HBB, 2011). We highlighted that while swaddling the newborn to use a fresh towel or blanket separate from the one used to dry newborn. For each step in the process we talked through the evidence-based reasoning behind

each action. After explaining the first step in the algorithm each midwife practiced drying the NeoNatalie (Appendix C) doll provided.

After drying, we explained the importance of immediate assessment of the newborn's breathing status. For this assessment of the midwives' knowledge, we referred to a large poster featuring one newborn with a vigorous cry and one who was limp and cyanotic. We asked the midwives to point out what they noticed about the two babies and what the signs and symptoms indicated. The midwives pointed out that the baby experiencing birth asphyxia showed no visible indications of crying, was limp, and cyanotic. Next we asked them for other signs and symptoms of birth asphyxia they had seen in the past. The midwives stated signs of fetal distress included the newborn being cyanotic, pale, yellow-colored, having visible sputum in its airways, limp positioning, and breathing shallowly or gasping. At this time we also played sound clips of a baby's healthy cry versus a gasping cry to distinguish between the two. The midwives were able to successfully recognize and distinguish a healthy cry between a grunting and gasping cry. We utilized the HBB algorithm to illustrate which step to move on to based on the newborn's presenting symptoms (Appendix G). If the newborn had a strong cry, a well-perfused color, and was flexed and grimacing, we taught the midwives to position the baby skin to skin with its mother and to move down the green, or healthy, side of the algorithm.

Skin-to-Skin

Next, we introduced the importance of prolonged skin-to-skin contact between the mother and the newborn to ensure the best possible development of the newborn. In the United States skin-to-skin time is highly encouraged by health care staff but is not a regular practice in this rural hospital. The midwives stated that they currently practiced placing the newborn skin-to-skin with the mother immediately after the newborn was delivered, but the practice is not

continued during the postpartum period. We introduced the benefits of prolonged skin-to-skin time between a mother and her newborn. The midwives were excited to hear that practicing skin-to-skin promotes breastfeeding, attachment between the mother and the newborn, and promotes temperature regulation (Beiranvand, Valizadeh, Hosseinabadi, and Pourina, 2014). Each midwife practiced holding NeoNatalie against their own chest in the way they would encourage a mother to hold her baby after birth.

Golden Minute

A large portion of HBB focuses on the concept of the Golden Minute. HBB states that a newborn has the best long-term outcome if it is adequately breathing within the first minute of extrauterine life (Implementation Guide HBB, 2011). We began teaching about the Golden Minute by asking everyone who attended the class, including the four midwives, to hold their breath for one minute. The purpose of this exercise was to simulate the newborn's experience during the period between birth and regular spontaneous breathing. The outcome of this initial exercise led to discussing three simple, non-invasive steps to opening and clearing the airway of the newborn.

Positioning

A simple technique to use when a midwife notices a newborn is not breathing after birth is to open the airway through positioning (Implementation Guide HBB, 2011). We taught the midwives how to gently tilt the newborn's chin upward to allow for an open airway to increase oxygenation. We demonstrated the use of a small pillow or rolled towel placed under the baby's shoulders to create this open positioning. Each midwife to demonstrated this step with the NeoNatalie simulator doll.

Suction

The next technique in clearing the newborn's airway involves bulb-suctioning (HBB Facilitator Flipchart, 2016). This step is used when the newborn's airway is obstructed with amniotic fluid, meconium, or mucus. We recommended lying the baby flat on its back and turning its head to one side to allow for fluid to collect in the baby's cheek, decreasing the risk of aspiration (HBB Facilitator Flipchart, 2016). Then the midwives were taught to suction the mouth first before suctioning the nares and to empty the suctioned fluid onto a clean towel between each suction. In addition, we explained the importance of gentle suctioning in the baby's mouth or nares. Suctioning the newborn roughly could injure the newborn, cause a decreased heart rate, and prevent regular breathing (HBB Facilitator Flipchart, 2016). Each midwife then practiced this step with Neonatalie.

Stimulate

If upon assessment the midwives assessed that the baby was not breathing after suctioning, they were instructed to move on to stimulation according to the HBB algorithm (Implementation Guide HBB, 2011). HBB teaches that stimulating the newborn should be a gentle process of rubbing the newborn's back (Implementation Guide HBB, 2011). We supported this step with explaining that stimulation was gentle enough not to harm the baby but would, in many cases, be sufficient to arouse a baby to cry or breathe properly. Each midwife was then asked to practice this gentle stimulation on NeoNatalie (Appendix C).

Each midwife spent one-on-one time with the NeoNatalie (Appendix C) doll to practice the four steps of the algorithm taught thus far. After time practicing, we followed up to state that reassessment of the newborn's breathing after stimulation to determine if the baby had begun breathing or crying was necessary. Lastly we taught that continual assessment of the newborn's breathing status and perfusion is crucial to decrease the risk of long-term negative outcomes.

Day 2 Teaching

We began the second HBB class by reviewing the HBB algorithm (Appendix G) and reviewed the less-invasive steps from the first day of the class. Our first subject of the day involved the steps to take if the newborn is not breathing on its own even after efforts such as drying, suctioning, and stimulating have already been performed. In this instance, the lack of spontaneous breathing calls for the nurse to begin mechanical ventilation with the use of an Ambu-bag (Implementation Guide HBB, 2011).

Ventilation

The nurses and midwives at this rural hospital, as we mentioned before, were primarily accustomed to using mouth-to mouth resuscitation when a baby was in need of ventilation. In our teaching we emphasized that mouth-to-mouth ventilation is not safe for the baby or for the midwife delivering breaths due to the risk of infection to both the newborn and the midwife as well as the risk of lung injury to the newborn (Implementation Guide HBB, 2011). We demonstrated correct use of the neonatal Ambu-bag on the NeoNatalie (Appendix C) doll. We explained that the midwife should tilt the newborn's chin to open up the airway and assess the infant for chest rise, indicating effective ventilation. If there is no chest rise observed, the midwife should re-apply the Ambu-bag seal, reposition the airway, and continue adjusting until adequate chest rise is achieved. After demonstrating effective ventilation with the infant-sized Ambu-bag and fully explaining the reasoning behind every step, every midwife practiced ventilating with the Ambu-bag on NeoNatalie (Appendix C). Each midwife practiced until they achieved adequate chest rise and felt confident using the infant sized Ambu-bag.

Heart Rate

The Helping Babies Breathe curriculum encourages frequent reassessment of the newborn's heart rate during ventilation efforts. We taught the midwives to assess whether or not the newborn was breathing independently and had a normal heart rate of more than 100 beats per minute after the first minute of ventilation with the Ambu-bag, and then every three to five minutes that ventilation is continued (HBB Facilitator Flipchart, 2016). Teamwork between the midwives was encouraged especially during advanced resuscitative efforts such as ventilation and assessing heart rate. Multiple midwives collaborating in various roles to achieve effective breathing and oxygenation within the Golden Minute allows the midwife performing positive pressure ventilation to focus on achieving an adequate seal and chest rise at 40 breaths per minute.

Discontinuing Care

The hospital where this teaching program was implemented is in a rural area of Ghana and therefore has limited access to extensive resuscitative measure, such as using long term ventilation machines or expensive medications. Therefore, we educated the midwives about how to determine when to discontinue resuscitative care on a newborn. This was a difficult but important topic to end our teaching with. The HBB Flipchart (2016) educates that after ten minutes of mechanical ventilation a newborn will likely suffer brain damage regardless of how effective the ventilation is if the heart rate is not adequately perfusing blood. We educated that a midwife, after twenty minutes of Ambu-bag ventilation, should discussion the cessation of care with the doctor, if he is present, as well as other midwives and the family members.

Post Testing

At the conclusion of the class discussions and hands-on practice with NeoNatalie, post-tests using the OSCE A and OSCE B examination tools were administered again. These post-

tests were identical to the examination tools used to assess the participants' baseline skill and knowledge levels at the beginning of the course. Each midwife was evaluated for the post-test alone without the other midwives in the room. While not completing their post-test evaluation, the other participants worked with a second administrator to answer a post-curriculum survey regarding their thoughts and feelings surrounding the HBB teaching.

Survey

At the end of the HBB course, each midwife participated in a survey about their opinions and views on the teaching as well as basic demographic data. They were interviewed privately and their responses recorded. Questions included on the survey are gender, number of years as a nurse, number of years as a midwife, aspects of the class they found helpful, aspects they did not find helpful, their confidence level on a scale of 0-10, aspects they still find challenging, and if they feel that they could then teach the HBB curriculum to other nurses.

Chapter 4

Results

The purpose of this educational implementation of a modified HBB curriculum was to bridge the knowledge gap in neonatal resuscitative skills of midwives in a rural hospital in Southern Ghana, assess the immediate effectiveness of the teaching, and implement the teaching cascade in empowering a midwife to continue the curriculum to other midwives in Ghana. This chapter discusses the pre- and post-test results of the four midwives using the Objective Structured Clinical Examination (OSCE) A and B tools in scoring the participants, the demographics of the participants, a post-curriculum survey, challenges of the implementation, and an update on the continuation of the project.

Two pre-tests were used to evaluate the baseline knowledge and skills of the four midwives, OSCE A (see Appendix A) and B (see Appendix B). OSCE A is a case scenario of a term birth requiring minimal intervention. OSCE B presents a case scenario of a preterm newborn requiring more advanced resuscitation efforts. Because this rural hospital does not have the resources to sustain premature newborns requiring prolonged advanced life-sustaining measures, the authors modified the OSCE B scenario to be a term newborn that was apneic with secretions in the mouth and the nose instead of a 34 week gestation newborn. Additionally, further modifications to the criteria for OSCE A and B performance included omitting steps such as preparing the area for delivery, hand hygiene, identifying a helper nearby, cutting the umbilical cord, and communicating with the mother after delivery. These steps were assumed to be already implemented and were not included in grading criteria for the pre- and post-tests. Having omitted these factors, the modified OSCE A tool totaled 14 possible points. In the modified OSCE B tool similar points were omitted including communication with the mother after birth, cutting the umbilical cord, and opening the baby's mouth slightly. We omitted the criteria requiring them to open the baby's mouth because the NeoNatalie doll that they used during the assessments mouth could not be opened any further (Appendix C). Additionally, during the administration of the OSCE B pre-test and post-test the administrator stated when the chest was not moving with ventilation in addition to showing that the chest was not moving with ventilation. This was to prompt the midwives to move on to further steps in the algorithm.

Pre and Post Test Scores

The average score for the OSCE A pretest from the four midwives was 0.392 (39.2%) (see Appendix D). The average score for the OSCE B pretest from the four midwives was 0.375 (37.5%). At the end of the two days of teaching the same OSCE A and B were administered. The

average score for the OSCE A post test was 0.714 (71.4%). The average score for the OSCE B post test for the midwives was 0.838 (83.8%). The improvement in the OSCE B test can primarily be attributed to the midwives achieving effective ventilation using the Ambu-bag.

After reviewing the results of pre-test A is was noticed that some commonly missed criteria was drying the newborn, stimulating breathing by rubbing the newborn's back, and assessing the newborn's heart rate and respiratory rate. The stimulation step was not completed by any of the midwives. In the OSCE B pre-test some commonly missed criteria included stimulating the newborn by rubbing its back, achieving a firm seal and adequate chest rise with the Ambu-bag, ventilating at 40 breaths per minute, as well as assessing the newborn's heart rate.

Commonly missed criteria for OSCE A post-test include stimulating the newborn by rubbing it's back and assessing heart rate. However, unlike the pre-test two of the four midwives did stimulate the newborn properly. During the OSCE B post-test only one midwife missed the stimulation criteria but the other three midwives completed this step. Additionally, two of the four midwives did not assess the newborn's heart rate during the post-test B.

Participant Demographics

The demographic information collected regarding the four midwives participating in the curriculum included age, gender, number of years practicing as a nurse, number of years practicing as a midwife, number of years working at that rural hospital, and an estimate of the number of births they attended (see Appendix E). This information was collected using a post-curriculum survey that was administered privately one-on-one with one of the administrators.

Post-Curriculum Survey

A post-curriculum survey assessing the midwives' perspectives on the teaching was administered after the post-tests (see Appendix F). This five-question survey evaluated the

benefits of the teaching and highlighted some aspects of the class that could be improved upon. Questions included in the survey asked what the participants found helpful about the class, what was not helpful, their confidence level in resuscitation on a numerical scale of 0 to 10 with 10 being the most confident. Additional questions included what they found most challenging about the course, and if they felt that they could teach the course to other nurses. Common themes among what the participants felt was helpful about the class included having the opportunity to practice hands-on skills, especially practicing ventilation with the Ambu-Bag. When asked what was not helpful about the class, two participants stated they would have liked more hands-on practice with the simulator doll and two midwives stated that they could not think of anything that was not helpful. The confidence level of the participants, when asked to rate on a scale of 0-10, was 9 out of 10 points after the HBB class for all participants. It is possible this result was due to the limited time of this class. One midwife stated that after the class, one aspect of the curriculum that was still challenging for her was ventilation, one stated that achieving a correct seal on the mask was challenging, and one stated the most challenging aspect was resuscitating alone without help. One participant stated, "All is good. Practice makes perfect." Lastly, when the participants were asked if after the HBB class they felt as though they could then teach the course material to others, all participants stated that yes. All felt as though they could teach the curriculum to other nurses.

Challenges and Limitations

While many aspects of the curriculum were beneficial to the learning of the participants, there were also limitations and challenges faced upon implementation. Limitations included the amount of time spent in the class, the days of the week the classes were held, the small number

of participants, and the inability to determine the definite long-term outcomes of this curriculum in this rural hospital.

A significant limitation of implementing this curriculum was the amount of time allotted to lead the HBB class. We held two classes each two hours long with the four midwives. The HBB implementation guide states that training can be done in as little as six to eight hours for a class with a ratio of six learners to one instructor (Implementation Guide HBB, 2011). We were not able to have this amount of time for the class however we had a small ratio of participants to instructors. This allowed for a significant amount of individual practice time and hands-on training with each participant. As some midwives stated in their post-curriculum surveys, one aspect of the course they would change would be to increase the amount of time for the class to allow for increased time with hands-on practice.

Additionally, one midwife was not able to be present at the HBB class on the first day of teaching, but was present for the second day of teaching. She was not able to be pre-tested with the OSCE A and B, didn't receive the curriculum that was discussed the first day, and was post-tested only. Therefore, her post-test scores were not able to be included in the immediate pre-and post-test data.

Additional challenges involved in this implementation included barriers that occur within a developing country due to limited resources. For example, midwives must complete vaginal deliveries without a doctor present in most cases. Additionally, because of the size of the maternity ward and limited space there is no designated area within the labor room for neonatal resuscitation. If a newborn experiences difficulty breathing the midwives at this hospital have to move the newborn to the resuscitation table in another room of the maternity ward. This poses the problem of taking up moments of the Golden Minute and places the newborn at risk for long

term complications (HBB Facilitator Flip Chart, 2016). Perhaps the biggest challenge of implementing this project at this rural hospital was not having any baseline data about previous births or newborn deaths. The hospital does not keep records regarding specific birth scenarios and complications seen. This proved to be a challenge because long term data will not be able to be compiled regarding the effectiveness of the project implementation.

Chapter 5

Continuation of Curriculum

The backbone supporting this implementation of HBB lies in the teaching cascade, where one participant from the initial HBB course would carry forth the curriculum to implement refresher courses and expand the audience to include other birth attendants. One midwife who participated in our modified implementation of HBB showed great interest in the HBB program and in furthering the education of the midwives at her hospital. She also demonstrated strong leadership qualities among the other midwives such as being eager to learn and participate with the hands-on practice. Additionally she showed leadership skills when she offered to demonstrate effective ventilation using the infant sized Ambu-bag on NeoNatalie in order to teach a fellow midwife who missed the original ventilation teaching. This same midwife also led a long-term HIV treatment initiative to identify, treat, and reduce stigma in patients suffering from HIV in her community. This midwife was approached and asked if she would be willing to take on the HBB course and expand the program. Since the HBB implementation at this rural hospital in Ghana, this midwife has taught the HBB course using the teaching materials we left. She has conducted HBB classes to nurses and midwives at her hospital that were not able to be present for the initial HBB class. Additionally, she has taught multiple HBB courses for nurses

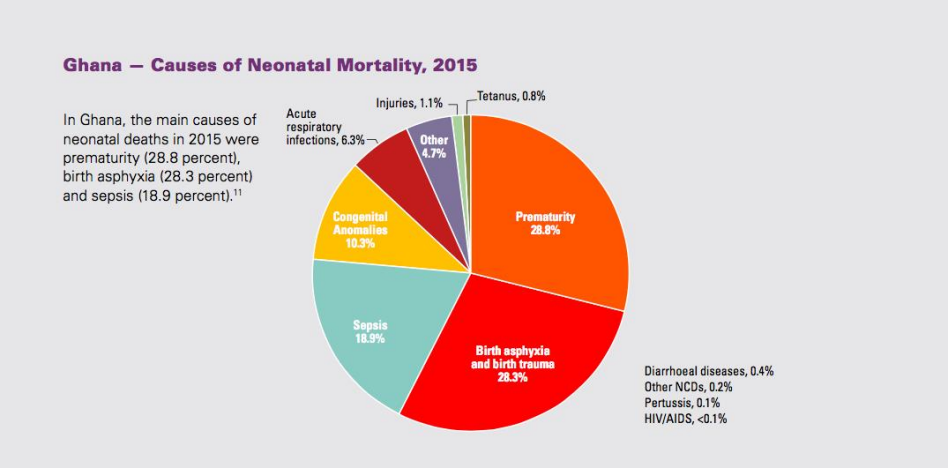
and midwives at the nearby district hospital in her area. She has reported that the total number of participants educated by her so far amount to around 52.

Future Recommendations

Future recommendations of the implementation of HBB courses at this rural hospital in Ghana include holding a refresher course on HBB in order to strengthen the participants' skills. In holding a refresher course with the participants, assessing the knowledge and teaching skills of the midwife who has trained other nurses and midwives will be beneficial to fill any further gaps in knowledge or training needs. The future of this program lies in continued development of skills over time, as the lack thereof could result in atrophied memory and performance. Unfortunately, the long-term outcomes of this implementation are unknown due to the hospital's lack of tracking the specific circumstances of each birth or the hospital's neonatal mortality rate. While challenges such as time constraints and lack of baseline data collected before the HBB course were present, it is recommended to apply these tools and practices during future collaborations with these midwives. Additional prospects with this implementation include future nursing students from Point Loma Nazarene University continuing to build these relationships with staff at this hospital, continuing the HBB course teaching, and implementing a data-tracking system of births and their outcomes to determine the long-term effectiveness of HBB. Further goals include adding more NeoNatalie simulator dolls to the program to facilitate the training of more midwives allowing for additional time with hands-on, active participation in case scenarios. Significant progress has been made toward bridging the gap of knowledge of these midwives through partnering with and learning alongside these midwives in pursuit of a lower neonatal mortality rate and improved newborn outcomes. Ongoing research and improvements within the HBB program and it's many implementations worldwide bring us one

step closer to reaching the WHO's Sustainable Development Goal of a neonatal mortality rate of 12 per 1,000 live births by the year 2030. These collaborative, sustained efforts aim to improve newborn health and wellbeing across the gap of culture, language, and accessibility to knowledge and resources. These efforts that we and others have made strive to improve newborn health to one day lead to strong and healthy lives of infants all over the world.

Appendix A: **Ghana - Causes of Neonatal Mortality** (Country Profile GHA, 2015)



Appendix B: OSCE A

Appendix C: OSCE B

Objective Structured Clinical Evaluations (OSCEs) *can be used to determine whether participants have learned the essential steps to help a baby breathe. They can be used to verify that a participant knows enough to pass the course, or also as an exercise repeated regularly for practice. Most importantly, each completed evaluation should be used as an opportunity for the participant to review and learn.*

Read the case scenario aloud to the participant. Provide the prompts shown in red. Indicate the baby's response to the participant's actions using the neonatal simulator or words if using a mannequin. For example, when the participants evaluate crying, show that the baby is not crying with a simulator. Say that the baby is not crying if using a mannequin. As you observe the participant, tick ☑ *the boxes "Done" or "Not Done" for each activity. Apart from giving these prompts, keep silent during the evaluation. After participants complete the OSCE, ask the 5 questions written below OSCE A. These questions will help the participants reflect on what actions they took and what they can do better the next time. Participants who can recognize their own mistakes will better remember the right steps to take the next time. Comment on the participant's performance only at the end of the case, after he/she has answered these 5 questions.*

HBB 2nd Edition OSCE A--Evaluation A

Instructions to the facilitator: Read the below instructions for the case scenario.

"I am going to read a role play case. Please listen carefully, and then show me the actions you would take. I will indicate the baby's responses, but I will provide no other feedback until the end of the case."

"You are called to assist the delivery of a term baby. There are no complications in the pregnancy. The baby will be born in less than 10 minutes. Introduce yourself and prepare for the birth and care of the baby."

	Done	Not Done
Identifies a helper and reviews an emergency plan	☐	☐
Prepares the area for delivery (warm, well-lighted, clean)	☐	☐
Washes hands.	☐	☐
Prepares an area for ventilation and checks function of bag, mask and suction device	☐ *	☐
Prompt: After 5-7 minutes give baby to participant and say, "There is meconium in the amniotic fluid. The baby is delivered onto the mother's abdomen. Show how you will care for the baby."		
Dries thoroughly.	☐ *	☐
Removes wet cloth.	☐	☐
Prompt: Show the baby is not crying. "There is meconium blocking the mouth."		
Recognizes baby is not crying	☐	☐
Positions head and clears airway.	☐	☐
Stimulates breathing by rubbing the back.	☐ *	☐
Prompt: Show the baby is breathing well (cries)		
Recognizes baby is crying and breathing well	☐	☐
Clamps or ties and cuts the cord	☐	☐
Positions skin-to-skin on mother's chest and puts on the head covering		
Communicates with mother	☐	☐

Use the questions below to help the participant reflect on his or her own performance and then provide feedback.

1. What happened at the birth?
2. Did you follow the Action Plan?
3. What went well and what could have gone better?
4. What did you learn?
5. What will you do differently next time?

SCORING:

Successful completion requires a total score of 9 correct of 12 and "Done" must be ticked for the boxes marked with *.

Number Done Correctly ..... *Facilitator initials* .....

HBB 2nd Edition OSCE B--Evaluation B

Instructions to the facilitator: Read the below instructions for the case scenario.

"I am going to read a role play case. Please listen carefully, and then show me the actions you would take. I will indicate the baby's responses, but I will provide no other feedback until the end of the case."

"You are called to assist at the birth of 34 week (7-1/2 months) gestation baby. You have identified a helper, prepared an area for ventilation, washed your hands, and checked your equipment. The baby is born, and the amniotic fluid is clear. Show how you will care for the baby."

	Done	*Not Done*
Dries throughly	☐	☐
Removes wet cloth.	☐	☐
Prompt: Show the baby is not crying. "You do not see or hear secretions in the baby's mouth or nose."		
Recognizes baby is not crying	☐	☐
Stimulates breathing by rubbing the back.	☐ *	☐
Prompt: Show the baby is not breathing.		
Recognizes baby is not breathing	☐	☐
Cuts cord and moves to area for ventilation OR positions by mother for ventilation.	☐	☐
Ventilates with bag and mask within The Golden Minute (at ____seconds)	☐	☐
Achieves a firm seal as demonstrated by chest movement	☐ *	☐
Time of effective ventilation (chest moving gently at _____ seconds)		
Ventilates at 40 breaths/minute (30-50 acceptable)	☐ *	☐
Evaluates for breathing or chest movement.	☐ *	☐
Prompt: Show the baby is not breathing.		
Recognizes baby is not breathing.	☐	☐
Calls for help.	☐	☐
Continues ventilation.	☐	☐
Prompt: Say, "Please show what to do if the chest is not moving with ventilation."		
After one or more steps to improve ventilation, say "The chest is moving now."		
Reapplies mask	☐ *	☐
Repositions head	☐ *	☐
Clears secretions from the mouth and nose as needed	☐	☐
Opens mouth slightly	☐	☐
Squeezes bag harder	☐	☐
Prompt: Show the baby is not breathing; heart rate is normal.		
Recognizes baby is not breathing but heart rate is normal.	☐	☐
Continues ventilation	☐	☐
Prompt: (After 3 minutes) Show the heart rate is 120 per minute and the baby is breathing.		
Recognizes baby is breathing and heart rate is normal.	☐	☐
Stops ventilation	☐	☐
Provides close observation for the baby and communicates with the mother	☐	☐

Use the questions below to help the participant reflect on his or her own performance and then provide feedback.

1. What happened at the birth?
2. Did you follow the Action Plan?
3. What went well and what could have gone better?
4. What did you learn?
5. What will you do differently next time?

SCORING:

Successful completion requires a total score of 17 correct of 23 and "Done" must be ticked for the boxes marked with *.

Number Done Correctly ..... *Facilitator initials* .....

Appendix D: Neonatalie Simulator


Nitrile Gloves
Medium
100

Appendix E: Pre and Post-Test Scores

Pre-Test Scores

Midwife	OCSE A-Pretest	OSCE B-Pretest
1 (Agatha)	6/14 (0.428)	18/40 (0.45)
2 (Alice)	6/14 (0.428)	14/40 (0.35)
3 (Forgive)	4/14 (0.285)	14/40 (0.35)
4 (Tina)	6/14 (0.428)	14/40 (0.35)

Post Test Scores

Midwife	OSCE A- Posttest	OSCE B-Posttest
1 (Agatha)	12/14 (0.857)	32/40 (0.8)
2 (Alice)	8/14 (0.571)	30/40 (0.75)
3 (Forgive)	10/14 (0.714)	36/40 (0.9)
4 (Tina)	10/14 (0.714)	36/40 (0.9)

Appendix F: Demographics of Participants

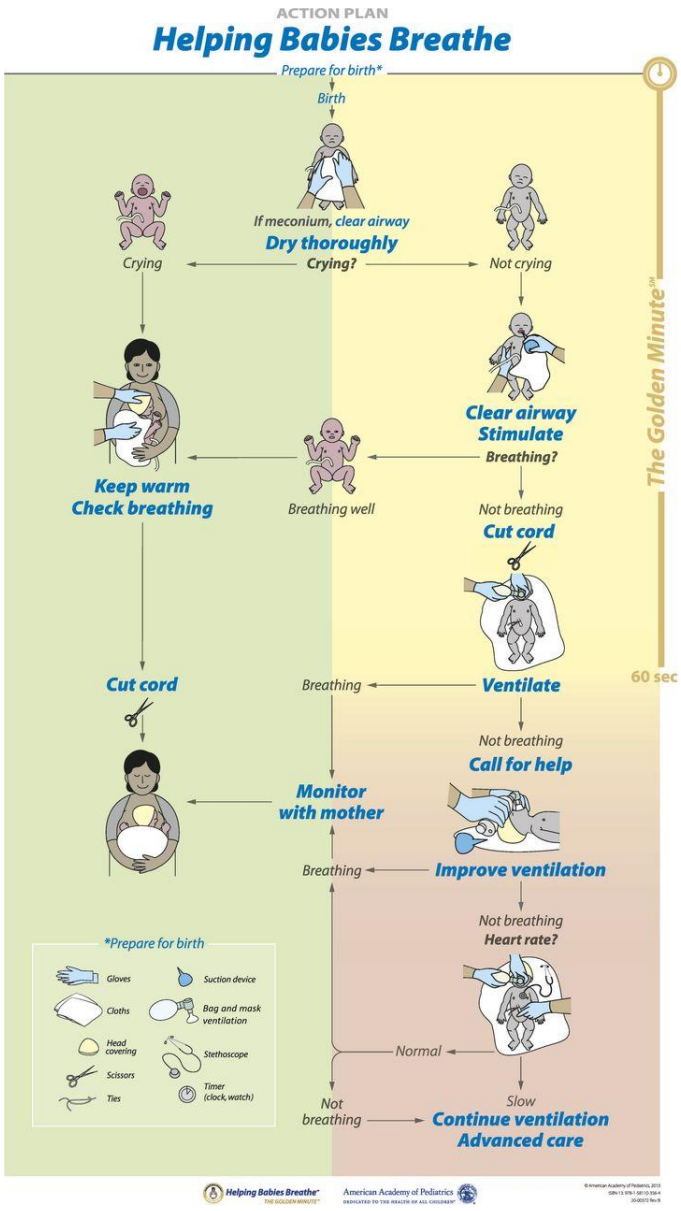
Midwife	Age	Gender	Nursing Experience (Years)	Midwifery Experience (Years)	Experience at Rural Hospital (Years)	Number of Births Attended (Estimated)
1 (Agatha)	62	Female	40	24	1	1000+
2 (Alice)	65	Female	40	20	1	100+
3 (Forgive)	28	Female	3	Still in training	3	10
4 (Tina)	32	Female	18	15	7	150+

Appendix G: Post-Curriculum Survey

Midwife	Helpful	Aspects Not	Confidence	Aspects that	Teach to

	Aspects	Helpful	Level (0-10)	are Still Challenging	Others? (Yes or No)
1 (Agatha)	"Enlightened on how to help babies in first few minutes. How [to assess] heartbeat, respiration, color, and activity, flabby vs crying, suctioning, positioning and [use of] ambu [bag]."	"Not enough practice time. Our lessons were during work time."	9/10	"Working [to resuscitate] by myself."	Yes
2 (Alice)	Ventilation practice	"Perfect."	9/10	Mask adjustment and positioning of newborn.	Yes
3 (Forgive)	"Everything. The ventilation part and resuscitation. The practice times were helpful."	Would have liked more practice	9/10	Ventilation	Yes
4 (Tina)	"You made it easy to understand. Kindness and love. Correct politely."	"Nothing."	9/10	"Nothing because you have taught us a lot. I feel confident even with no doctor present."	Yes

Appendix H: Helping Babies Breathe Algorithm


ACTION PLAN
Helping Babies Breathe
Prepare for birth*
Birth
If meconium, clear airway
Dry thoroughly
Crying?
Crying
Not crying
The Golden Minute
Clear airway
Stimulate
Breathing?
Keep warm
Check breathing
Breathing well
Not breathing
Cut cord
Cut cord
Breathing
Ventilate
60 sec
Not breathing
Call for help
Monitor
with mother
Breathing
Improve ventilation
Not breathing
Heart rate?
*Prepare for birth
Gloves
Suction device
Cloths
Bag and mask ventilation
Head covering
Stethoscope
Scissors
Timer (clock, watch)
Ties
Normal
Not breathing
Slow
Continue ventilation
Advanced care
Helping Babies Breathe
American Academy of Pediatrics

References

Arlington, L., et al. (2017). Implementation of “Helping Babies Breathe”: A 3-Year Experience in Tanzania. *Pediatrics*. 139(5). 1-10.

Ashish, K.C., et al. (2017). Evaluation of Helping Babies Breathe Quality Improvement Cycle (HBB-QIC) on retention of neonatal resuscitation skills six months after training in Nepal. *BMC Pediatrics.* 17(103).

Ashish, K.C. et al. (2012). Implementing a simplified neonatal resuscitation protocol-helping babies breath at birth (HBB)-at a tertiary level hospital in Nepal for an increased perinatal survival. *BMC Pediatrics*. 12(159). 1-8.

Bang, A., et. al. (2016). Helping Babies Breathe (HBB) Training: What Happens to Knowledge and Skills Over Time? *BMC Pregnancy and Childbirth*. 16(364). 1-12.

Beiranvand, S.,Valizadeh F., Hosseinabadi R., Pournia, Y. (2014). The Effects of Skin-to-Skin Contact on Temperature and Breastfeeding Successfulness in Full-Term Newborns after Cesarean Delivery. *International Journal of Pediatrics*. 1-7.

Bellad, R., et al. (2016). A Pre-Post Study of a Multi-Country Scale-Up of Resuscitation Training of Facility Birth Attendants: Does Helping Babies Breathe Training Save Lives? *BMC Pregnancy and Childbirth*. 16(222). 1-10.

Chaudhury, S., et al. (2016). Cost analysis of Large-Scale Implementation of the 'Helping Babies Breathe' Newborn Resuscitation-Training Program in Tanzania. *BMC Health Services Research*. 16(1). 1-10.

Corbett, S., & Fikkert, B. (2014). When Helping Hurts: How to Alleviate Poverty Without Hurting the Poor ... and Yourself. Chicago: Moody.

Eblovi, D., et al. (2017). Retention and Use of Newborn Resuscitation Skills Following a Series

of Helping Babies Breathe Trainings for Midwives in Rural Ghana. *Global Health Action*. 10(1). 1-6.

Essential Newborn Care: Trainer's Guide [PDF]. (2010). World Health Organization. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/70540/WHO_MPS_10.1_Trainers_guide_eng.pdf?sequence=1.

Ghana: Key Demographic Indicators [Chart]. (2017). UNICEF. Retrieved from https://data.unicef.org/country/gha/.

Guide for Implementation of Helping Babies Breathe (HBB): Strengthening Neonatal Resuscitation in Sustainable Programs of Essential Newborn Care [PDF]. (2011). Elk Grove Village, IL: American Academy of Pediatrics.

Gomez et al. (2018). Accelerating Newborn Survival in Ghana through a Low-Dose, High-Frequency Health Worker Training Approach: A Cluster-Randomized Trial. *BMC Pregnancy and Childbirth*. 18(72). 1-11.

HBB Overview. (n.d.). Retrieved from https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/helping-babies-survive/Pages/Helping-Babies-Breathe.aspx.

Helping Babies Breathe (HBB): Facilitator FlipChart [PDF]. (2016). Elk Grove Village, IL: American Academy of Pediatrics.

Helping Babies Breathe Educational Materials. (n.d.). American Academy of Pediatrics. Retrieved from https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/helping-bbies-survive/Pages/Helping-Babies-Breathe.aspx.

Kamath-Rayne, B. D., et al. (2018). Helping Babies Breathe, Second Edition: A Model for

Strengthening Educational Programs to Increase Global Newborn Survival. *Global Health, Science, and Practice*. 6(3). 538-551.

Mission and Vision. (n.d.). Ssubi. Retrieved from https://www.ssubi.org/.

Mortality Rate, Neonatal (Per 1,000 Live Births). (n.d.) Retrieved from https://data.worldbank.org/indicator/sh.dyn.nmrt.

Msemo et al. (2013). Newborn Mortality and Fresh Stillbirth Rates in Tanzania After Helping Babies Breathe Training. *Pediatrics*. 131(2). 353-60.

Neonatal Resuscitation Program (NRP): What Hospital-Based Instructors Need to Know About the 7th Edition [PDF]. (2015). American Academy of Pediatrics. Retrieved from https://www.aap.org/en-us/Documents/nrp_busypeople.pdf.

Neonatal Resuscitation Program (NRP) History. (n.d.). American Academy of Pediatrics. Retrieved from https://www.aap.org/en-us/continuing-medical-education/life-support/NRP/Pages/History.aspx.

Niermeyer, S. (2015). From the Neonatal Resuscitation Program to Helping Babies Breathe: Global Impact of Educational Programs in Neonatal Resuscitation. *Seminars in Fetal and Neonatal Medicine*. 20(5). 300-308.

Our Hospital. (n.d.). Ssubi. Retrieved from https://www.ssubi.org/hospital.

Our Mission. (n.d.). Rural Health Collaborative. Retrieved from https://rhcollaborative.org/about/

Our Programs. (n.d.). Retrieved from https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/helping-babies-survive/Pages/Our-Programs.aspx.

Rasmussen, C. (2015). Adults as Learners: Effective Teaching Strategies [PDF]. Retrieved from https://www.leadingagemn.org/assets/docs/15_.

Workforce_103_CreatingEffectiveOrientationPrograms-CRasmussen.pdf.

Sustainable Development Goal 3: Health. (2016). Retrieved from

https://www.who.int/topics/sustainable-development-goals/targets/en/.

Birth Asphyxia. (n.d.). Retrieved from

https://www.seattlechildrens.org/conditions/airway/birth-asphyxia/.

Wilson et al. (2017). Helping Babies Breathe Implementation in Zanzibar, Tanzania.

International Journal of Nursing Practice. 23(4). 1-7.