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Evaluating the Effectiveness of an Evidence-Based Practice in Neonatal Resuscitation among Birth Asphyxiated Newborns in a Developing Country

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Abstract

Introduction: The World Health Organization emphasizes that neonatal resuscitation performed in the first "golden minute" following birth can influence both immediate and long-term outcomes of newborns, especially asphyxiated ones. The modes of resuscitation, which is an evidenced-based practice, require evaluation to identify their effectiveness.

Objectives: This study evaluated neonatal resuscitation techniques and their effectiveness in the management of asphyxiated neonates during the perinatal period.

Design: Cross-sectional design with observation of delivery and immediate care of 254 newborns in five hospitals from April to June 2022.

Methods: Neonatal resuscitation and demographic characteristics were noted. Data were analyzed descriptively using STATA 17 and Cramer's *V* test of association between APGAR scores and resuscitation modes was done with statistical significance established at $p \leq .05$.

Results: Neonatal resuscitation was primarily performed by midwives (98.4%), with 48.8% of the infants resuscitated after birth. The most common modalities of resuscitation were drying, keeping warm, rubbing the back, and flicking the feet, with 46.0% started on bag and mask ventilation. The success rate of resuscitation was impressive (58.1%), satisfactory (38.7%), and poor (3.2%). There was a strong association of the first minute APGAR score with drying the neonate ($p = .0001$, $\varphi c = 0.619$), keeping the neonate warm, and rubbing the back of the neonate ($p = .0001$, $\varphi c = 0.613$). However, their association with the fifth minute APGAR score was weak ($p = .002$, $\varphi c = 0.222$). Feet flicking has no significant association with the fifth minute APGAR score.

Conclusion: Neonatal resuscitation, which is an evidence-based practice, is more effective in the first minute than in the fifth minute. Regular training of midwives to update their resuscitation skills is important to promote timely and efficient resuscitation of newborns. Further studies into the advancements in resuscitation modes and the use of technology to improve resuscitation beyond the first minute are recommended.

Keywords

neonatal resuscitation, birth asphyxia, evidence-based practices, midwives, perinatal mortality, newborns

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Introduction

Complex physiological changes occur during the transition from intrauterine to extrauterine life. Rapid, intricate, and well-coordinated actions are necessary to ensure the survival of neonates throughout the transition especially breathing (Morton & Brodsky, 2016) (Morton & Brodsky, 2016). If these changes do not occur on their own and rapidly, it means that the neonate will require resuscitation (Swanson & Sinkin, 2015). An evidence-based approach should be implemented to effectively resuscitate asphyxiated newborns (Bang et al., 2016). Evidence indicates that infant mortality rates can be considerably decreased by competent healthcare professionals doing neonatal resuscitation (Alhassan et al., 2019).

Globally, 6–10 million out of the 130 million newborns delivered each year require some form of resuscitation during birth (Saugstad, 2017). About 10% of newborns need assistance to start breathing at delivery (Aziz et al., 2020; Chadha, 2010; Kasdorf et al., 2015; Kattwinkel et al., 2010; Niles et al., 2017), and approximately 1% require substantial resuscitation procedures (Aziz et al., 2020; Kasdorf et al., 2015; Kattwinkel et al., 2010). Much of the burden is in low-income areas where the ability of the health system to do newborn resuscitation is insufficient (Wall et al., 2009).

Interrupted blood flow and gas exchange to the fetus during the perinatal period, known as perinatal asphyxia, can set off a chain reaction of neuronal destruction, resulting in neonatal encephalopathy (NE) and long-term damage (Ahearne et al., 2016). Uwingabire (2017) posited that asphyxia can result in death or long-term debilitating conditions such as brain damage, cerebral palsy, and epilepsy. Globally, birth asphyxia is one of the leading causes of neonatal deaths which accounts for 20.9% of neonatal mortality (Chadha, 2010; Uwingabire, 2017). It is estimated that every year, over 800,000 newborns die as a result of birth asphyxia alone (Bruckner et al., 2021). While the vast majority of newborns exposed to perinatal hypoxia-ischemia will recover rapidly and live fully normal lives, a subset will develop a progressive clinical encephalopathy known as hypoxic-ischemic encephalopathy (HIE) or NE (Ahearne et al., 2016).

Sub-Saharan Africa including Ghana has the world's highest neonatal mortality rate (27 deaths per 1,000 live births), accounting for 43% of all infant deaths with neonatal asphyxia among other neonatal conditions such as infection accounting for most of the deaths (Newborn Mortality, n.d.). A retrospective study in a teaching hospital in Ghana found birth asphyxia to have accounted for 21.7% of all neonatal deaths (Abdul-Mumin et al., 2021). Neonatal mortality is, therefore, a major public health concern in Ghana. Consequently, neonatal resuscitation is an important part of newborn care in Ghana (Bookman et al., 2010).

Review of Literature

Neonatal resuscitation is a process used to sustain newborn infants who are unable to breathe on their own or have insufficient respiratory efforts at birth (Aziz et al., 2020; Chadha, 2010). There has been an emphasis on the necessity of maintaining a patent airway, commencing successful lung inflation, and establishing adequate cardiovascular function in neonates after delivery (Aziz et al., 2020; Perlman et al., 2015). This has prompted the implementation of programs globally such as the Neonatal Resuscitation Program (NRP) and Helping Babies Breath (HBB). NRP focuses on training healthcare professionals who are involved in neonatal resuscitation in hospital settings in the United States (Weiner & Zaichkin, 2016), while HBB concentrates on neonatal resuscitation but mainly focuses on resource constraints settings in the resuscitation of newborns (American Academy of Pediatrics, 2024). The Helping Babies Breathe (HBB) is effective in improving health workers' knowledge and skills in neonatal resuscitation (Bang et al., 2016).

In order to minimize neonatal mortality, the Government of Ghana since 1995 has adopted the WHO Baby-Friendly Hospital Initiative (BFHI) to expand access to key newborn care services. This includes building neonatal resuscitation facilities and training health personnel in neonatal resuscitation techniques (Nii Okai Aryeetey & Antwi, 2013). The Making Every Baby Count Initiative (MEBCI) was also started in 2013 with support from the Children's Investment Fund Foundation (CIFF) to enhance newborn outcomes in accordance with the National Newborn Action Plan and Strategy (Kassick et al., 2016). The Ghana Health Service (GHS) has also created a nationwide neonatal resuscitation protocol based on WHO guidelines (Brathwaite et al., 2020; Chinbuah et al., 2020).

Action performed in the first "golden minute" following birth can influence both immediate and long-term outcomes in newborn resuscitation. Appropriate resuscitation techniques which are evidenced-based are critical for newborn infant survival (Yaregal Melesse & Enyew Ashagrie, 2022). Individuals and coordinated teams will facilitate efficient newborn care (Aziz et al., 2020; Bojanić et al., 2023). Anticipation and planning are critical in providing a timely and successful response to newborns in need of resuscitation. Identification of infants in need of resuscitation, airway clearance, and stimulation strategies are critical first stages for their survival (Aziz et al., 2020; Bojanić et al., 2023).

A rise in heart rate is the most essential signal of successful ventilation and response to resuscitative measures (Aziz et al., 2020). Aziz et al. (2020) stated further that pulse oximetry is used to guide oxygen therapy and achieve oxygen saturation targets. Also, if there is a poor heart rate response to ventilation, following adequate ventilation corrective procedures, chest compressions, and endotracheal intubation would have to be initiated.

Despite the importance of resuscitation for the survival of the neonate, evidence suggests that some healthcare providers lack the necessary knowledge and skills in resuscitating the

newborn. In Indonesia, the knowledge of health workers involved in neonatal resuscitation was found to be low (Utomo et al., 2023). In Ethiopia, the knowledge and skills of birth attendants have been identified as not consistent with recommended practices (Gebreegziabher et al., 2014). Again in Ethiopia, 9.8% of newborn caregivers were knowledgeable in neonatal resuscitation (Sintayehu et al., 2020a). In Northern Ghana, 98.1% of midwives who mainly perform neonatal resuscitation had inadequate knowledge of neonatal resuscitation, and 55% lacked appropriate skills in performing neonatal resuscitation (Alhassan et al., 2019). All these studies focused on the knowledge and skills of resuscitation professionals but not an evaluation of the resuscitation process (Brathwaite et al., 2020).

Studies (Brathwaite et al., 2020; Enweronu-Laryea et al., 2009; Kassick et al., 2016) have evaluated neonatal strategies, novel neonatal care assessment tools among trained delivery attendants, and the effectiveness of a strategy for teaching neonatal resuscitation in Ghana. Others have examined knowledge and experiences of neonatal resuscitation among midwives and the impact of hospital-based neonatal resuscitation programs in Ghana (Alhassan et al., 2019; Bookman et al., 2010). There is little empirical study on the effectiveness of neonatal resuscitation and the methods they employ in resuscitating infants with asphyxia in Ghana. This study, therefore, sought to examine the modes of resuscitation in birth asphyxia and their effectiveness in a developing country. This is important because prevailing findings would help shape policy interventions regarding the implementation of evidence-based neonatal resuscitation in newborn care.

Methods

Design

A cross-sectional study design using quantitative methods and observation of the resuscitation of newborns by midwives was employed to achieve the objectives of the study. The cross-sectional design was selected to obtain data at a point which is the perinatal period. Observation of the resuscitation process was done to obtain evidence of resuscitation and how it was performed. The research was carried out in the delivery rooms of five hospitals. All the hospitals chosen provided general and specialized services to the public, including maternal and child healthcare.

The total number of live births for all the selected hospitals in January 2022 was 1,094 (Ghana Health Service, 2022) which was used to compute the sample size.

Research Questions

What are the various modes of resuscitation employed in addressing birth asphyxia, and how effective are these interventions?

Sample

A sample size of 293 was determined using the Yamane's formula (Yamane, 1967). A total of 293 people were recruited for the study from five hospitals. The recruitment period lasted from April to June 2022. Pregnant women were recruited after their 36th week of pregnancy when they attended the antenatal clinics of the designated hospitals through convenient sampling when they affirmed that they would deliver in the same hospital. At the ANC clinic, both written and verbal consent were obtained after the study was explained to them. They were given codes inscribed on the back of their maternal health record book as identification so that they would be included in the study when they came to the labor ward to deliver. When patients arrived in the delivery room, anyone with the code was reminded of the study, and research assistants re-enrolled them by putting their codes on the questionnaire to begin the data collection process. By the end of June 2022, 254 people out of the 293 sampled had given birth in the selected health facilities, accounting for 87% of the calculated sample size. The 39 women who were recruited but not included in the computed sample size could have given birth in other hospitals.

Data Collection

The study used a structured questionnaire to collect primary and secondary data from the participants. The questionnaire was developed after a thorough review of literature (Abdo et al., 2019; Ahmed et al., 2021; Bayih et al., 2020, 2021; Chinbuah et al., 2020; Woday et al., 2019) and the Helping Babies Breath Action Plan. The questionnaire included both open-ended and closed-ended questions. The questionnaire was divided into four sections (A, B, C, and D). Section A included demographic questions about the study participants (newborn mothers). Section B included questions on maternal risk factors, such as gestational age and maternal height, which were obtained from the maternal health records book. Section C evaluated birth-related factors. Section D included questions about the resuscitation methods used by birth attendants to resuscitate asphyxiated infants, and this data was obtained through observation of the delivery and resuscitation process. The questionnaire was given to three midwifery lecturers and one neonatal nurse specialist who scrutinized it for face validity, and their comments were used to modify the questionnaire. Pretesting was then done at a facility located in the study area but not included in the study settings using 30 women who constituted about 10% of the calculated sample size. No modification was made to the questionnaire after the pretesting. The research assistants observed the delivery from the beginning of the second stage through the completion of the third stage of labor, as well as the baby's immediate care. The information gathered was utilized to fill out parts C and D of the questionnaire.

Perinatal asphyxia was identified when a newborn's APGAR score was less than 7 out of 10 after birth (Njie et al., 2023). Low birth weight occurs when the birth weight is less than 2.5 kg, and the usual birth weight is 2.5 kg or over (WHO, 2023).

Resuscitation modes were measured by the Helping Babies Breath (HBB) Action Plan by the American Academy of Paediatrics (2016). The HBB action plan, as shown in Figure 1, was used because in Ghana, it is the acceptable standard of providing immediate care for newborns including resuscitation of asphyxiated newborns (Chinbuah et al., 2020).

Inclusion/Exclusion Criteria

We included pregnant women in labor who attended the antenatal clinic throughout their pregnancy in selected facilities, gave birth at the designated hospitals during the study period, and consented to the study after their 36th week of pregnancy. Those who were admitted to the labor ward in the first stage of labor with their maternal health records and voluntarily consented to the study were also included in the study. Excluded from the study were pregnant women who delivered outside the five selected health facilities included in the study, babies who had congenital malformations, and mothers who came to the delivery ward in the second stage of labor.

Statistical Analysis

Stata software version 17.0 was used to analyze the data. Descriptive statistics was used to analyze information on the demographics of study participants, modes of resuscitation employed by health professionals, and the condition of the neonate after resuscitation given in frequencies and percentages. Cramer's V test was employed to examine the association between the first and fifth APGAR against resuscitation mode. The statistical significance level was established at $p \leq .05$ (95% CI).

Results

Sample Characteristics

Data was analyzed for 254 respondents who represent 87% of the calculated sample size. Table 1 shows the age, height, and weight of the mothers as well as the birth weight of the babies.

Research Question Results

Resuscitation Modes Used for the Asphyxiated Neonates. In the current study, midwives (98.4%) resuscitated 48.8% of the infants because they had lower APGAR scores indicating birth asphyxia requiring resuscitation. All the neonates were dried thoroughly, kept warm by placing them in skin-to-skin contact on their mothers' chests, and their backs were rubbed. Feet flicking occurred in 93.0% of the instances, with chest rubbing occurring in 98.4% of the cases. Only 46.0% of asphyxiated infants required "bag and mask" ventilation for resuscitation (Table 2).

According to postresuscitation findings, 96.0% of resuscitated babies cried shortly after resuscitation. Most of the resuscitated neonates (84.7%) had heart rates ranging from 120 to 160 beats per minute. Overall, 58.1% of the neonates were in an impressive condition after resuscitation.

Association Between the First and Fifth APGAR Against Resuscitated Mode. Based on the Cramer's V test as shown in Table 3, there is a substantially strong correlation between the first minute APGAR and drying the neonate, keeping the baby warm, and back rubbing ($p = .0001$). However, there is a relatively weak relationship between the first minute APGAR and cry following stimulation. The fifth minute APGAR had a considerably poor relationship with neonate drying, providing warm temperature, and rubbing the back. However, no link was found between the fifth minute APGAR, feet flicked, and cry following stimulation.

Discussion

This study examined the modes of resuscitation in birth asphyxia and the effectiveness of these modes among midwives. Successful neonatal resuscitation can be achieved if evidence-based practices are implemented (Shikuku et al., 2018) to prevent potential perinatal mortalities linked with birth asphyxia. Midwives performed most of the resuscitation of the infants in the current study. This finding is consistent with previous studies in Kenya (Shikuku et al., 2018), Ethiopia (Sintayehu et al., 2020b), Nepal (KC et al., 2017), and Ghana (Brathwaite et al., 2020; Chinbuah et al., 2020; Eblovi et al., 2017). These findings call for continuous neonatal resuscitation training targeted at midwives and nurses involved in the delivery and perinatal and neonatal care. Aziz et al. (2020) emphasized team training, including anticipation, preparation, briefing, and debriefing, as crucial elements of newborn resuscitation.

The backs of all the neonates who were asphyxiated were rubbed, a warm temperature was provided in the form of skin-to-skin contact between mother and baby, and wrapping with warm cloths, and the neonates were made dry. These modes of resuscitation employed by healthcare providers in this study are consistent with the Helping Baby Breath Action Plan (Bang et al., 2016) and the 2015 American Heart Association Guidelines for Neonatal Resuscitation in neonates (Aziz et al., 2020; Bruckner et al., 2021) which have been proven by research to be effective. Also, the survival of neonates is linked to removing wet clothing and keeping the baby warm (Lunze et al., 2014; Sharma, 2017). Indeed, the current study found a statistically significant

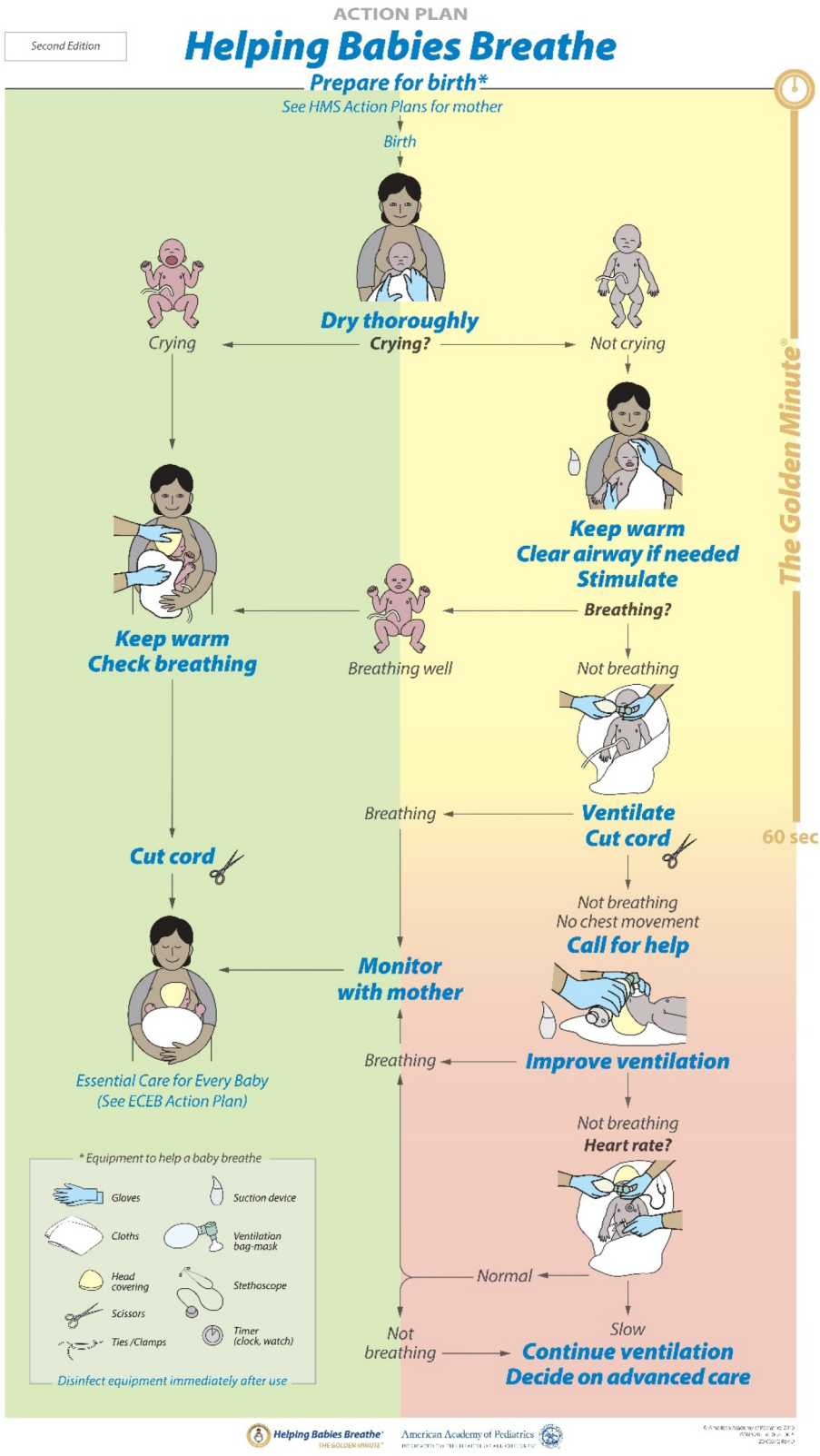

Figure 1. Helping babies breath action plan.

Table 1. Biographical Data of Respondents.

Parameter	Mean	*SD*	Range
Age of mothers of neonates (years)	28.51	6.28	16–49
Height of mothers of neonates (cm)	155.11	4.48	149–171
Weight of mothers of neonates (kg)	61.86	7.46	47.0–106.0
Birth weight of neonates (kg)	2.84	0.46	1.2–4.0

Table 2. Resuscitation Modes, Professional Performing Resuscitation, and Condition of Asphyxiated Baby After Resuscitation.

Variable	Frequency	%
Neonates resuscitated		
Yes	124	48.8
No	130	51.2
Professional who did the resuscitation ($N = 124$)		
Midwife	122	98.4
Doctor	2	1.6
Warmth provided		
Yes	124	100
No	0	0
Neonate dried thoroughly		
Yes	124	100
No	0	0
Back rubbed		
Yes	124	100
No	0	0
Feet flicked		
Yes	116	93.5
No	8	6.5
Chest rubbing		
Adequate	122	98.4
Inadequate	2	1.6
Bag and mask		
Yes	57	46.0
No	67	54.0
Condition of asphyxiated Neonates after resuscitation		
Neonates cried after resuscitation		
Yes	119	96.0
No	5	4.0
Heart rate		
Less than 120 b/min	19	15.3
120–160 b/min	105	84.7
Condition after resuscitation		
Impressive	72	58.1
Satisfactory	48	38.7
Poor	4	3.2

Table 3. Cramer's *V* Test of Association Between APGAR Score and Resuscitated Mode.

Association	Cramer's *V*	*p*
First minute APGAR against keeping baby warm	0.619	.0001
First minute APGAR against dry neonate	0.613	.0001
First minute APGAR against back rubbed	0.613	.0001
First minute APGAR against feet flicked	0.204	.005
First minute APGAR against cry after stimulation	0.204	.005
Fifth minute APGAR against keeping baby warm	0.222	.002
Fifth minute APGAR against dry neonate	0.222	.002
Fifth minute APGAR against back rubbed	0.222	.002
Fifth minute APGAR against feet flicked	0.057	.668
Fifth minute APGAR against cry after resuscitation	0.057	.668

link between the first minute APGAR and drying of neonates, warm temperature provision, and back rubbing ($p = .0001$). The findings re-emphasize the importance of the "golden minute" in the improvement of neonatal outcomes (Yaregal Melesse & Enyew Ashagrie, 2022). Despite research pointing to the benefits of providing warmth to the neonate, particularly in situations of asphyxia, Shikuku et al. (2018), discovered that only 71.0% of asphyxiated neonate cases were given a consistent warm environment. These modes of resuscitation are effective and therefore delivery attendants should be provided with consistent training and constant reminder of these evidence-based practices.

In this study, a considerable number (46%) of asphyxiated infants required "bag and mask" resuscitation. This finding is comparable with other studies in which bag and mask ventilation (BMV) was commenced in 65.6% of asphyxiated babies in Ethiopia (Weldearegay et al., 2020) and 100% of the infants who did not respond positively to stimulation and airway maintenance in Kenya (Shikuku et al., 2018). Advanced resuscitative initiatives such as endotracheal intubation and ventilator support with oxygen saturation monitoring were not seen in this study. This could be due to lack of equipment, appropriate training, or both. Further studies into the reasons that accounted for the absence of these evidence-based newborn care activities should be conducted for stakeholders to consider addressing them.

According to the findings, 96.0% of the infants who were resuscitated cried shortly after stimulation. The majority of the stimulated neonates (84.7%) had heart rates between 120 and 160 beats per minute, with 15.3% having heart rates less than 120 beats per minute. Overall, 58.1% of the neonates were in impressive conditions after resuscitation, 38.7% had satisfactory presentation, and 3.2% had poor outcomes. These findings are consistent with a systematic review and meta-analysis with Delphi estimation conducted from 1980 to 2010 that in low- and middle-income countries, implementing evidence-based neonatal resuscitation programs reduces neonatal mortality from birth asphyxia by 30% (Lee et al., 2011). The findings are also confirming a study in Nepal (Chalise et al., 2022) and a systematic review (Patel et al., 2017) that neonatal resuscitation

programs are effective in improving newborn health and reducing mortality. These findings are impressive, suggesting that the evidence-based resuscitation modes employed by the healthcare professionals in this study were generally successful.

Strengths and Limitations

The study was conducted in clinical settings, providing insights into the actual practices of midwives during neonatal resuscitation. The use of direct observation during resuscitation procedures adds credibility to the findings, as it captures real-time actions and responses rather than relying solely on self-reported data. The study included a substantial sample size (254 respondents) with five hospitals across the city, enhancing the reliability and generalizability of the findings within the city of Kumasi in Ghana and beyond. The study utilized a well-structured questionnaire that covered various aspects of neonatal resuscitation, including demographic information, maternal risk factors, and detailed information about the resuscitation modes employed. The study demonstrated ethical considerations by obtaining both verbal and written informed consent, ensuring participant confidentiality, and obtaining necessary approvals from relevant ethical committees making the study more valid.

On the other hand, the observational nature of the study introduces the possibility of observation bias, where the presence of observers may influence the behavior of healthcare providers during neonatal resuscitation. Healthcare providers being aware of the observation might have influenced them to adhere more closely to recommended practices, potentially introducing social desirability bias. The study primarily focused on basic neonatal resuscitation techniques. The absence of exploration into the reasons behind the lack of advanced measures, such as endotracheal intubation and ventilator support, leaves important questions unanswered. The cross-sectional design provides a snapshot of practices at a specific point in time, limiting the ability to establish causation or evaluate changes over time. Despite these limitations, the study contributes valuable insights into neonatal resuscitation practices, emphasizing the importance of evidence-based interventions for improving immediate outcomes in newborn care. Future research could build upon these findings and address the identified limitations for a more comprehensive understanding of neonatal resuscitation practices.

Implications of the Study

The study underscores the importance of continuous training and education for midwives involved in neonatal resuscitation. Regular training sessions can help reinforce evidence-based practices and ensure that healthcare providers are well-prepared to handle asphyxiated newborns.

The study highlights the critical importance of interventions within the first "golden minute" following birth. Healthcare providers should be trained to act swiftly and efficiently during this period, focusing on essential tasks such as drying the neonate, providing warmth, and rubbing the back.

The study indicates that a substantial number of infants required "bag and mask" ventilation for resuscitation. This underscores the need for healthcare facilities to ensure the availability of appropriate equipment and to provide training to healthcare providers in the effective use of bag and mask ventilation.

The study identifies areas where certain advanced resuscitative measures and technological advances, such as endotracheal intubation, ventilator support, and pulse oximetry, to guide oxygen therapy, were not utilized. Healthcare facilities should engage in continuous quality improvement initiatives and incorporate relevant technologies to address gaps in the implementation of evidence-based practices.

The study highlights the need for further research to explore the reasons behind the absence of certain advanced resuscitative measures. Understanding the barriers to implementing these measures can guide targeted interventions and improvements in neonatal care.

Healthcare facilities should establish systems for continuous monitoring and evaluation of neonatal resuscitation practices. Regular assessments can identify areas for improvement, measure the effectiveness of training programs, and ensure the ongoing adherence to evidence-based guidelines.

Conclusion

Neonatal resuscitation is crucial, and adherence to current evidence-based recommendations leads to improved results. This study found that the success of neonatal resuscitation was largely determined by the neonates' heart rate and cry. Given the high neonatal mortality rate in Ghana and other developing countries, the study emphasizes the need for policy interventions that promote evidence-based neonatal resuscitation practices. The study highlights that neonatal resuscitation in the first "golden minute" is more effective than in the fifth minute. This underscores the importance of timely and efficient interventions. The study also reinforces the effectiveness of evidence-based practices such as drying the neonate, keeping the neonate warm, and rubbing the back, emphasizing their role in improving immediate outcomes. The findings also suggest that certain advanced resuscitative measures, such as endotracheal intubation and ventilator support, were not used in the studied setting as well as SPO_2 values determination which is an important indicator of oxygenation. Therefore, ongoing research, quality improvement initiatives, and the incorporation of future technologies are necessary to improve neonatal resuscitation methods.

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Author Contributions

LBO: conceptualization, methodology, formal analysis, supervision, investigation, writing—original draft preparation, and writing—review and editing. JSI: methodology, validation, data curation, visualization, writing—original draft preparation, and writing—review and editing. EOO: formal analysis, software, visualization, and writing—original draft preparation. SAH: formal analysis, software, data curation, and writing—review and editing. SKA: conceptualization, project administration, methodology, investigation, and writing—review and editing. JBM: conceptualization, resources, methodology, investigation, and writing—review and editing. PN: conceptualization, funding acquisition, methodology, investigation, and writing—review and editing. CKD: methodology, validation, and writing—original draft preparation. AE: investigation, visualization, and writing—review and editing. AFZS: investigation, visualization, supervision, and writing—review and editing. All authors have read and approved the final version of the manuscript.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

The Committee on Human Research, Publication, and Ethics, at the School of Medicine and Dentistry, Kwame Nkrumah University of Science and Technology (KNUST), approved our study (CHRPE/AP/399/22) on July 27, 2022.

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Informed Consent

Informed consent for publication was not obtained because it was not applicable to this study.

Participant Consent

Identifying information, such as names, images, or specific locations, has been anonymized to ensure participant safety and privacy.

Patient Consent

All participants provided written and verbal informed consent prior to enrollment in the study.

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Supplemental Material

Supplemental material for this article is available online.

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