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Research Article

Factors affecting the incidence of birth asphyxia before and after the helping babies breathe training first in Grobogan, Central Java

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ABSTRACT

Introduction: This study aims to examine the association between factors affecting birth asphyxia and its incidence a year before and after HBB first training conducted in Grobogan, Central Java. **Methods:** This research was an analytical observational preliminary study with a cross-sectional design. Birth records data collected from 30 primary health care from January to December 2020 in Grobogan, Central Java. Data analyzed with a computer statistical analysis program using $\chi 2$ test and Fisher's exact test. **Result:** Based on 191 medical records from infants born during the year before and 186 medical records from infants born during the year after HBB training, there was an 11.5% decrease in the incidence of birth asphyxia compared before and after the training. Results of the $\chi 2$ test showed a significant association between the HBB training with the incidence of birth asphyxia ($p = 0.014$). Before the HBB training, prematurity has a significant association with the prevalence of birth asphyxia ($p < 0.001$). Furthermore, there is no associated factor that has a significant association with the prevalence of birth asphyxia after the training ($p > 0.05$). **Conclusion:** There is a significant decrease in the incidence of birth asphyxia compared between the year after and 1 year before HBB training. Meanwhile, prematurity has a significant association with the incidence before HBB training.

Keywords: *birth asphyxia, Grobogan, helping babies breathe, neonatal period, training*

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Introduction

The neonatal period is the first 4 weeks of an infant's life. This period is the most critical and vulnerable time for a child's survival. Majority of child deaths occur in this period [1]. About 47% of child deaths under 5 years old occur in the neonatal period. One of the intrapartum complications, that is, birth asphyxia or breathing difficulty in newborn, is the second leading cause of the neonatal mortality in the world. Birth asphyxia accounts for 24% of all neonatal deaths globally [2]. In birth asphyxia, a newborn fails to initiate or maintain spontaneous breathing after the delivery. This condition potentially causes disruption in gas exchange and develops into the state of hypoxia (interruption of oxygen availability), hypoxemia, hypercarbia or hypercapnia, and acidosis. Birth asphyxia often leads to multiorgan failure and also death of the newborn [3]. Multiple factors that cause the disruption of the placental blood flow during pregnancy or delivery can cause birth asphyxia. According to the American College of Obstetricians and Gynecologists (ACOG) and the American Academy of Pediatrics (AAP), all of these following criteria need to be considered in diagnosing birth asphyxia: (1) pH < 7.00 in umbilical artery blood sample if obtained (profound metabolic or mixed acidemia), (2) persistence of an APGAR (appearance, pulse, grimace, activity, respiration) score of 0–3 for longer than 5 minutes after the baby is born, (3) neonatal neurologic sequelae (seizure, coma, and hypotonia), and (4) multiorgan system dysfunction (cardiovascular, hematology, respiration, and urinary system) [4].

Almost 99% of neonatal deaths every year happen in middle- to low-income countries. The main factor contributing to this issue is the lack of trained health workers and facilities especially in stabilization and resuscitation in newborn [5]. Indonesia is one of the top 10 countries with the highest number of neonatal mortalities in 2019 globally [6]. The result of *Survei Demografi dan Kesehatan* Indonesia in 2017 showed that neonatal mortality in Indonesia is 15:1,000 birth [7]. Birth asphyxia is also the second leading cause of child deaths in Indonesia. In 2019, 5,464 cases or 27% of all neonatal mortality were caused by birth asphyxia [7].

In response to the large number of neonatal morbidity and mortality caused by birth asphyxia, the AAP in collaboration with the World Health Organization (WHO) and other global partners initiated a neonatal resuscitation program called the Helping Babies Breathe (HBB) in 2010 [8]. This program is a skill-based educational program to teach initial neonatal resuscitation techniques mainly for the resource-limited settings. HBB is a training that teaches the essential skills of basic neonatal caring in healthy babies and assisting babies that do not breathe after delivery. The HBB training focuses on improving the birth attendants' knowledge and skill to perform appropriate and adequate neonatal resuscitation in the critical first minute after birth (the golden minute) that potentially prevent perinatal morbidity and mortality caused by intrapartum-related asphyxia [9]. This training uses the approach called training of trainers in the form of simulation-based curriculum training [10].

The HBB training has been conducted in more than 80 countries in the world. Several studies showed that this training has a significant impact in reducing the number of birth asphyxia. By using a simple technique in neonatal resuscitation, the materials in HBB training have great potential to be applied in all medical facility settings. Multiple approaches are used in the training, such as graphic icons outlining simple care paths and illustrations, the key elements of skills in the form of learner workbook, facilitator flip chart, and action plan to evaluate and guide in decision making or management of the newborn. A neonatal simulator (NeoNatalie) is used in the training and allows trainers to manipulate cardinal evaluation signs (crying, breathing, and heart rate) [11].

In 2013, Perkumpulan Perinatologi Indonesia conducted the first HBB training in Indonesia. The training is mainly addressed to midwives in health care who handle the delivery of a baby. Several reports stated that midwives' confidence level in doing resuscitation was increased following the training. The participants were also confident applying the material of HBB training in real situation because of the

simple yet life-saving and notable resuscitation steps. The training also utilizes simple and easy-to-get resuscitation tools, so it can be applied in all healthcare settings [12].

The authors are indeed interested in researching the prevalence differences of birth asphyxia before and after HBB training and its associated factors because in recent years. However, according to the AAP reports, there was no single research published about the impact and effectiveness of HBB training in Indonesia health care center. Therefore, the objective of this research was to examine the association between factors affecting birth asphyxia and its incidence a year before and after HBB first training conducted in Grobogan, Central Java.

Methods

Research design

This study includes an analytical study using a cross-sectional approach and analyzes neonatal birth records from 30 primary health care in Grobogan, Central Java, and records by the public health service of Grobogan. This research was approved by the Health Research Ethics Committee of Faculty of Medicine, Diponegoro University, Semarang, Indonesia.

Data collection

Data collection and analysis were carried out from April to May 2021 based on birth records from January to December 2020. Sampling was carried out by a consecutive sampling method from medical records of infants diagnosed with birth asphyxia a year before and after the HBB training first conducted in Grobogan. Neonate who met the research criteria was included in this study until minimum sample size is fulfilled. The exclusion criterion used in this study was the birth of neonate was not in health facilities. The independent variable in this study was the HBB training. The dependent variable in this study was the prevalence of birth asphyxia before and after the HBB training. This study examines the association between factors associated with birth asphyxia, such as prematurity, preeclampsia, and antepartum hemorrhage, and the resuscitation equipment in the health care with the prevalence of birth asphyxia before and after the HBB training.

Data and statistical analysis

Data were analyzed with a computer statistical analysis program. Data analysis includes descriptive analysis and hypothesis testing. Proportion and percentage were used in descriptive analysis. χ^2 test was used for the hypothesis testing, and a significant association between each variable is determined if $p < 0.05$.

Limitations

One limitation in this research is the diagnosis criteria from ACOG and AAP for birth asphyxia that were used in the inclusion criteria for choosing the samples. This research only uses the APGAR score criteria and the need for resuscitation with a bag-valve mask for the ventilation. Other diagnosis criteria such as arterial pH < 7 in the umbilical of newborn, neurological manifestation in neonate, and multiorgan dysfunction were not included due to limitations in capability of diagnosis and information from the health facilities.

Result

This research involves 191 birth records a year before the HBB training and 186 birth records a year after the first training conducted in Grobogan, Central Java. Table 1 show that 109 neonates were diagnosed with birth asphyxia, where 66 (34.6%) cases occurred a year before the training and 43 (23.1%) cases after the training. The research subjects' characteristics were shown in Table 1. Based on the data, the majority of infants were male, including 100 (52.4%) before training and 101 (54.3%) after training. A year before the training, there were 45 (23.6%) infants with low birth weight or less than 2,500 g, and 39 (20.4%) infants were born preterm (<37 weeks). Meanwhile, a year after the training, there were 46 (24.7%) infants with low birth weight, and 36 (19.4%) infants were born preterm. The maternal data show a 9.6% increase in percentage of mother in high-risk pregnancy age (<20 or >35 years old) a year after the training compared with that in a year before the training. The majority

of mother's education in the subjects were junior high school and elementary school, and the most of mothers were unemployed or a housewife, 153 (80.1%) cases before the training and 172 (92.5%) cases after the training.

Table 2 shows the association between the HBB training with the prevalence of birth asphyxia. The prevalence of birth asphyxia decreased 11.5% a year after the first HBB training. Based on the analysis using χ^2 test, there is a significant association between the HBB training and the prevalence of birth asphyxia with the p value 0.014 ($p < 0.05$).

Factors associated with birth asphyxia before and after the HBB training were analyzed using χ^2 test (Table 3 and 4). Before the training, from all the infants diagnosed with birth asphyxia, 23 (34.8%) were born preterm, 4 (6.1%) were born from the mother with a history of preeclampsia, and there was no birth record with the history of antepartum hemorrhage. There were 2 (3%) cases of birth asphyxia with inappropriate resuscitation equipment. χ^2 test and Fisher's exact test were used to analyze the association between preeclampsia and resuscitation equipment for prematurity testing. The prevalence of birth asphyxia were more than 20% cells with expected count below five. From all the factors before the HBB training, prematurity has a significant association with the prevalence of birth asphyxia ($p < 0.001$) (Table 3). After the HBB training, from all the infants diagnosed with birth asphyxia, 9 (20.9%) were born preterm, 2 (4.7%) cases were born from the mother with a history of preeclampsia, and there was no birth record with the history of antepartum hemorrhage. All of the health care recorded in this present study were using the appropriate resuscitation equipment.

Table 1. The subjects characteristic

Variable	Birth asphyxia		*p*
	Yes	No	
Prematurity			
Yes	9 (20.9%)	27 (18.9%)	0.766¥
No	34 (79.1%)	116 (81.1%)	
Preeclampsia			
Yes	2 (4.7%)	0 (0%)	0.052£
No	41 (95.3%)	143 (100%)	
Antepartum hemorrhage			
Yes	0 (0%)	0 (0%)	–
No	43 (100%)	143 (100%)	
Resuscitation equipment			
Appropriate	43 (100%)	143 (100%)	–
Inappropriate	0 (0%)	0 (0%)	

Table 2. Association between the HBB training and prevalence of birth asphyxia

Birth asphyxia	The HBB training		*p*
	Before	After	
Yes	66 (34.6%)	43 (23.1%)	0.014¥*
No	125 (65.4%)	143 (76.9%)	

Table 3. Association between affecting factors with the incidence of birth asphyxia before the HBB training

Variable	Birth asphyxia		*p*
	Yes	No	
Prematurity			
Yes	23 (34.8%)	16 (12.8%)	<0.001¥*
No	43 (65.2%)	109 (87.2%)	
Preeclampsia			
Yes	4 (6.1%)	2 (1.6%)	0.109£
No	62 (93.9%)	123 (98.4%)	
Antepartum hemorrhage			
Yes	0 (0%)	0 (0%)	—
No	66 (100%)	125 (100%)	
Resuscitation equipment			
Appropriate	64 (97%)	125 (100%)	0.118£
Inappropriate	2 (3%)	0 (0%)	

For hypothesis testing for prematurity, χ^2 test and Fisher's exact test were used to analyze the association between preeclampsia and the prevalence of birth asphyxia because there were more than 20% cells with expected count below five. From all the factors after the HBB training, there is no associated factor that has a significant association with the prevalence of birth asphyxia (Tables 4).

Table 4. Association between affecting factors with the incidence of birth asphyxia after the HBB training

Variable	The HBB training			
	Before *n* = 191		After *n* = 186	
	F	**%**	***F***	**%**
Sex				
Male	100	52.4	101	54.3
Female	91	47.6	85	45.7
Birth weight				
Normal	146	76.4	140	75.3
Low birth weight	45	23.6	46	24.7
Neonates diagnosed				
Asphyxia	66	34.6	43	23.1
Another complication	125	65.4	143	76.9
Maternal age				
Risky	37	19.4	54	29
Reproductive	154	80.6	132	71
Gestational age				
≥37 weeks	152	79.6	150	80.6
	39	20.4	36	19.4
Maternal education				
Elementary school	48	25.1	46	24.7
Junior high school	84	44	101	54.3
Senior high school	50	26.2	25	13.4
3-year diploma	1	0.5	1	0.5
Bachelor degree	8	4.2	13	7

Variable	The HBB training			
	Before *n* = 191		After *n* = 186	
	F	**%**	***F***	**%**
Maternal occupation				
Housewife	153	80.1	172	92.5
Farmer	4	2.1	0	0
Merchant	3	1.6	4	2.2
Employee	3	1.6	0	0
Private employee	21	11	8	4.3
Entrepreneur	2	1	0	0
Civil servant	1	0.5	0	0
Nurse	0	0	1	0.5
Teacher	4	2.1	1	0.5

Discussion

Data of the subjects' characteristics (Table 1) in this research show that the majority of the subjects' genders a year before and after the HBB training were male. This finding is in line with the data in Profil Kesehatan Indonesia 2019 that showed a higher proportion of males compared with females in 0–4-year-old age group [7]. From all the subjects, there was 20.4% neonate a year before and 19.4% neonate a year before the training that born preterm or before the gestational age reaches 37 weeks. Preterm birth is a global health problem that associated with morbidity and mortality in neonate. According to the WHO, Indonesia is one of the top 10 countries with the highest number of preterm birth (>15% from total birth) [13]. Globally, the incidence of low birth weight is around 15%––20%. In this research, more than 20% of the subjects were born with low birth weight. Low birth weight can be caused by many factors and include the social economic, demographic, intensity of the mother visiting health centers, and education stage of the mother. Majority of the low birth weight cases occurred in middle- to low-income countries [14-15]. In previous researches, maternal age has a significant association with the incidence of birth asphyxia. Maternal age <20 or >35 years was said to have a higher risk because the reproductive organs and mothers' emotions are less appropriate for pregnancy [16]. The coronavirus disease 2019 pandemic could possibly affect the increase in pregnancy with a high-risk age. According to *Badan Kependudukan dan Keluarga Berencana Nasional* (BKKBN), there was 12% unplanned pregnancy in the period after pandemic. This could be the result of the decreased number of contraception use because of limited access to health facilities, increased duration of people being at home, and increased child marriage after the pandemic. The United Nations Population Fund (UNFPA) and United Nations Children's Fund (UNICEF) published a report called "Adapting to Covid-19: Pivoting The UNFPA-UNICEF Global Program to End Child Marriage to Respond to The Pandemic;" it is stated that there was an increase in marriage of girl under 20 years old due to economic issues, limited access to health facilities, and lack of knowledge about the health of reproductive system and family planning [17-18]. Subject characteristics about the mothers' level of education in this research is in line with the report of *Survei Ekonomi Nasional* 2013 in Grobogan. The report shows that the majority of education level in Grobogan are elementary school and junior high school. It was reported that 39.5% of the population education level is elementary school. This could indicate the low education level in Grobogan. In the results of a previous study conducted by Opitasari in Jakarta, mothers with lower educational level are having higher risk factors for the newborn to have a birth asphyxia.

The medical records from 30 primary health facilities a year after the HBB training show a decrease prevalence in birth asphyxia; this result is in line with authors' major

hypothesis. The HBB training gave a significant increase in knowledge and ability of birth attendant that can result to effective resuscitation, management in high-risk pregnancy, and basic newborns caring. A previous study conducted by Goudar in India shows that knowledge of birth attendants about the importance of the golden minute and initial resuscitation steps increased when comparing test scores before and after the HBB training [19]. Midwives skills associated with resuscitation also increased after the HBB training that was proven by Objective Structured Clinical Evaluation and APGAR 5-min score at birth improvement after resuscitation [19-20].

Prematurity is one of the risk factors for asphyxia neonatorum. In a premature baby, vital organs were not fully developed, and there is limitation in the respiratory system of a preterm baby. Previous study conducted by Purwaningsih shows that prematurity increased the risk of birth asphyxia 4.83 times [21]. In this research, prematurity has a significant effect on the prevalence of birth asphyxia a year before the HBB training; meanwhile, it has no significant effect in a year after the training. Factors that may affect this result are the presence of other risk factors and maternal age. Previous study by Aslam stated that maternal age less than 20 years have a higher risk for developing birth asphyxia. Some management that can be carried out to reduce the morbidity and mortality caused by prematurity are a comprehensive pregnancy check, avoiding risk factor (e.g., smoking), and corticosteroid therapy during antenatal.

Based on theory, preeclampsia is one of the maternal risk factors for birth asphyxia. Preeclampsia is a hypertensive disorder of pregnancy characterized by systemic endothelial dysfunction that results in vasoconstrictor and vasodilator hormone imbalance. Vascular vasoconstriction leads to fetal hypoxia due to the lack of blood supply. Further consequence of this state is the disruption of oxygen and carbon dioxide gas exchange, which then leads to birth asphyxia. In this research, there were eight cases of pregnancy with preeclampsia that occurred a year before and after the HBB training. From all the cases, six neonates were born with birth asphyxia where all of the mothers had other risk factors such as nuchal cord (umbilical cord looping), preterm birth, and severe preeclampsia. The presence of other risk factors and the degree of severity in preeclampsia can affect the fetal prognosis from having birth asphyxia. Based on the medical records in 30 primary health care in Grobogan, there is no significant association between preeclampsia and birth asphyxia. The prevalence of pregnancy with preeclampsia in 30 primary health care facilities is low because pregnancy with preeclampsia is considered a high-risk pregnancy. A mother with preeclampsia is predicted to have an obstetrical problem during pregnancy and delivery and need to be referred to higher level hospitals (secondary or tertiary care) [22].

Another maternal risk factor for birth asphyxia is antepartum hemorrhage. A multivariant analysis conducted by Mulgeta in 2020 shows that antepartum hemorrhage is an independent of birth asphyxia. A mother with a history of antepartum hemorrhage increases the risk (7.17 times) of the newborn for having birth asphyxia [23]. This is due to the reduction of blood flow from the mother to the placenta and causes hypoxemia in the fetus. In Indonesia, bleeding during pregnancy is one of the main causes of mortality and morbidity in the mother as well as neonate. Antepartum hemorrhage is a high-risk pregnancy and needs to be referred to higher level health care as soon as it is diagnosed. From all the data that were collected in this research, there is no single case of birth with the history of antepartum hemorrhage in 30 primary health care facilities in Grobogan. This is line with one of the materials in the HBB training that teaches birth attendants to refer a high-risk pregnancy if it is needed. Each health facilities should have a guideline in terms of consultation and referral system [9,24].

This research found two cases of birth asphyxia that were handled with inappropriate resuscitation equipment a year before the training (Table 3), and all asphyxia newborns were resuscitated with appropriate equipment a year after the HBB training. The previous study by Arlington in 2017 shows an increase of resuscitation equipment from 84% to 92%, especially the bag-valve mask in the health care

that performed a resuscitation in the newborn [20]. In the HBB training program, APP with other global partners, such as US Agency for International Development, Save the Children, Latter-day Saint Charities, Laerdal Global Health, Johnson & Johnson, will provide health care facilities with resuscitation equipment. In this research, there is no significant association between the appropriate resuscitation equipment with the prevalence of birth asphyxia a year before and after the HBB training. Factors that possibly affect the effectiveness of resuscitation other than the equipment are the knowledge and skill of birth attendants, resuscitation technique, duration and intensity of the HBB training, maternal and neonatal risk factor, and the characteristics of birth attendants including age, sex, and working experience [25].

Conclusion

In conclusion, our study demonstrated that there was a decrease in the prevalence of birth asphyxia a year after the HBB training, and there was a significant association between the training and the prevalence of birth asphyxia. The factor associated with birth asphyxia that has significant association with its prevalence is prematurity before the HBB training. Maternal risk factors such as preeclampsia, antepartum hemorrhage, and resuscitation equipment did not have a significant association with the prevalence of birth asphyxia before and after the HBB training. The training will potentially increase the knowledge and ability of the health workers in primary health facilities with limited resources, thereby increasing the effectiveness of interventions for neonates experiencing birth asphyxia. Thus, it will reduce morbidity and mortality rates from birth asphyxia. However, further research should be conducted to determine other factors affecting birth asphyxia and its relationship with the training of helping babies to breath, such as the number of maternal parities, intrapartum infections, condition of the amniotic fluid, and the quality of antenatal care. It is also important to investigate the relationship between the degree of prematurity experienced by neonates in the form of extremely preterm (<28 weeks), very preterm (28 - 32 weeks), and moderate to late preterm (32 - 37 weeks) with the severity and prognosis of asphyxia, and its relationship with the success or effectiveness of the resuscitation intervention provided.

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References

1. Pathirana J, Muñoz FM, Abbing-Karahagopian V, et al. Neonatal death: Case definition & guidelines for data collection, analysis, and presentation of immunization safety data. *Vaccine*. 2016;34(49):6027-6037. doi:10.1016/j.vaccine.2016.03.040.
2. UNICEF, WHO, World Bank, UN. Levels & Trends in Child Mortality: report 2021. UN IGME Rep. 2021;52. https://www.who.int/publications/m/item/levels-and-trends-in-child-mortality-report-2021
3. Moshiro R, Mdoe P, Perlman JM. A Global View of Neonatal Asphyxia and Resuscitation. *Front Pediatr*. 2019;7:489. Published 2019 Nov 26. doi:10.3389/fped.2019.00489.
4. Workineh Y, Semachew A, Ayalew E, Animaw W, Tirfie M, Birhanu M. Prevalence of perinatal asphyxia in East and Central Africa: systematic review and meta-analysis. *Heliyon*. 2020;6(4):e03793. Published 2020 Apr 26. doi:10.1016/j.heliyon.2020.e03793.
5. Vossius C, Lotto E, Lyanga S, et al. Cost-effectiveness of the "helping babies breathe" program in a missionary hospital in rural Tanzania. *PLoS One*. 2014;9(7):e102080. Published 2014 Jul 9. doi:10.1371/journal.pone.0102080.
6. UN IGME Child mortality report 2019 [Internet]. 2019. 52 p. Available from: https://www.unicef.org/media/60561/file/UN-IGME-child-mortality-report-2019.pdf

7. Profil Kesehatan Indonesia 2019 [Indonesia Health Profile 2019]. Kementerian Kesehatan Republik Indonesia. 2020.
8. Odjidja EN. Making every baby count: Reflection on the helping babies breathe program to reduce birth asphyxia in sub-Saharan Africa. SAJCH South African J Child Heal. 2017;11(2):61–3.
9. Jobe AH. Helping babies breathe. J. Pediatr. 2012; 160(5): A6. https://doi.org/10.1016/j.jpeds.2012.03.030
10. Singhal N, Lockyer J, Fidler H, et al. Helping Babies Breathe: global neonatal resuscitation program development and formative educational evaluation. *Resuscitation*. 2012;83(1):90-96. doi:10.1016/j.resuscitation.2011.07.010
11. Bang A, Bellad R, Gisore P, et al. Implementation and evaluation of the Helping Babies Breathe curriculum in three resource limited settings: does Helping Babies Breathe save lives? A study protocol. *BMC Pregnancy Childbirth*. 2014;14:116. Published 2014 Mar 26. doi:10.1186/1471-2393-14-116.
12. Indonesian Perinatology Association. Helping Babies Breath Training. 2022. https://www.perinasia.com/kegiatan/201?title=Pelatihan+Helping+Babies+Breath
13. Born Too Soon: World Health Organization. 2012. http://whqlibdoc.who.int/publications/2012/9789241503433_eng.pdf
14. World Health Organization. Low Birth WeightPolicy Brief. South Asia. 2014;28:66.
15. Islam MM, Ababneh F, Akter T, Khan HR. Prevalence and risk factors for low birth weight in Jordan and its association with under-five mortality: a population-based analysis. *East Mediterr Health J*. 2020;26(10):1273-1284. Published 2020 Oct 13. doi:10.26719/emhj.20.096.
16. Aslam HM, Saleem S, Afzal R, et al. "Risk factors of birth asphyxia". *Ital J Pediatr*. 2014;40:94. Published 2014 Dec 20. doi:10.1186/s13052-014-0094-2.
17. Londero AP, Rossetti E, Pittini C, Cagnacci A, Driul L. Maternal age and the risk of adverse pregnancy outcomes: a retrospective cohort study. *BMC Pregnancy Childbirth*. 2019;19(1):261. Published 2019 Jul 23. doi:10.1186/s12884-019-2400-x.
18. Adapting to Covid-19 : Pivoting The UNFPA-UNICEF Global Programme to End Child Marriage to Respond to The Pandemic. 2020. https://www.unfpa.org/sites/default/files/resource-pdf/Responding_to_COVID-19_Pivoting_the_GPECM_to_the_pandemic.pdf
19. Goudar SS, Somannavar MS, Clark R, et al. Stillbirth and newborn mortality in India after helping babies breathe training. *Pediatrics*. 2013;131(2):e344-e352. doi:10.1542/peds.2012-2112.
20. Arlington L, Kairuki AK, Isangula KG, et al. Implementation of "Helping Babies Breathe": A 3-Year Experience in Tanzania. *Pediatrics*. 2017;139(5):e20162132. doi:10.1542/peds.2016-2132.
21. Purwaningsih Y, Dewi YLR, Indarto D, Murti B. Factors Associated with Newborn Asphyxia at Dr. Harjono Hospital, Ponorogo, East Java. J Matern Child Heal. 2018;03(04):287–93.
22. Manual Rujukan Kehamilan, Persalinan, dan Kelompok kerja Pelayanan Rujukan Ibu dan Anak [Referral Manual for Pregnancy, Childbirth, and Working Group for Mother and Child Referral Services]. 2012;1–73. https://kebijakankesehatanindonesia.net/v13/images/manualrujuk/MANUAL%20RUJUKAN%20KEHAMILAN%20KULON%20RPOGO%20FINAL.pdf
23. Mulugeta T, Sebsibe G, Fenta FA, Sibhat M. Risk Factors of Perinatal Asphyxia Among Newborns Delivered at Public Hospitals in Addis Ababa, Ethiopia: Case-Control Study. *Pediatric Health Med Ther*. 2020;11:297-306. Published 2020 Aug 25. doi:10.2147/PHMT.S260788
24. Wandi W. Implementasi Sistem Rujukan Ibu Hamil Dan Bersalin Oleh Bidan Polindes Di Kecamatan Dampit. J Inf Kesehat Indones. 2017;3(1):71.

25. Joho AA, Kibusi SM, Mwampagatwa I. Predictors of Helping Babies Breathe knowledge and skills among nurses in primary health settings in Dodoma region, Tanzania. BMC Pregnancy Childbirth. 2020;20(1):1–7. https://doi.org/10.1186/s12884-020-2782-9.