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Research Article

Factors Influencing Success Rate of Referral for Asphyxiated Newborns Before and After Helping Babies Breathe (HBB) Training

Ariq Azky Yurico*, Adhie Nur Radityo, Putri Sekar Wiyati, Dimas Tri Anantyo

Diponegoro University, Semarang, Indonesia

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**Corresponding author:*
E-mail:
riqazkyyurico28@gmail.com

ABSTRACT

Introduction: Referral for asphyxia newborns is the process of transferring newborns with difficult breathing conditions from one health facility to another. Emergency management of asphyxia newborns must be handled properly; one of the examples is taught in a Helping Babies Breath (HBB) training. Other factors that influence the determinants of referral are positive-pressure ventilation action, the state of hypothermia, and the duration of referral.

Methods: The research design used in this study was cross-sectional. The samples were collected by purposive sampling from January 2019 to December 2020 from the medical records of Puskesmas Kabupaten Grobogan.

Results: There was no significant association between the success rate of referral for asphyxia newborns and the Helping Babies Breathe (HBB) training (p=0.213). Before the HBB was implemented, there was no significant association between the incident and positive-pressure ventilation action (p = 0.092). Still, there was a significant association between the incidence of hypothermia (p=<0.001) and referral duration (p=0.011). After the HBB was implemented, there was no significant association between the incident with positive-pressure ventilation action (p=0.758) and the duration of the referral (p=0.2). Still, there was a significant association with the incidence of hypothermia (p=0.002).

Conclusion: There is a significant association between the success rate of referral of asphyxia newborns and hypothermia before and after the HBB Program was implemented and the duration of referrals before the HBB Program was implemented.

Keywords: *Duration of referral, Helping Babies Breathe (HBB), Hypothermia, Newborns asphyxia, Positive-pressure ventilation*

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Introduction

The term neonate is used to define newborns from the beginning of birth to the age of day 28, and this period is referred to as the most vulnerable period during the baby's life. Classification of the infant's life period is essential to seek standardization to determine the appropriate intervention and care for the baby [1]. Neonatal care, especially in the first hour of birth, plays a vital role in the survival of the next period in related neonates [2].

Based on data from the World Health Organization (WHO), globally, there were 2.4 million neonatal deaths at the beginning of 2019, which is around 7,000 neonatal deaths every day. Indonesia, in 2019, was ranked seventh in the country with the most cases of neonatal death, with a total of 60,000 cases. Approximately 75% of neonatal deaths occur during the first week of birth, whereas there are approximately 1 million cases of neonatal deaths in the first 24 hours of life. Another study stated that the first day of birth, especially the first hour of birth, is a crucial period for the survival of neonates; this is because this period has the highest risk of intrapartum-related neonatal death (asphyxia-related). In 2019, Indonesia showed low birth weight (7,150 cases, 35.3%), asphyxia (5,464 cases, 27.0%), and acquired abnormalities (2,531 cases, 12.5%) were the three most common causes of neonatal death. Central Java in 2018 had a neonatal mortality rate of 6.1 per 1,000 live births of neonates [3].

Helping Babies Breathe (HBB) is an evidence-based curriculum program in basic care and neonatal resuscitation with simulation-based training methods. The HBB is aimed at increasing the level of knowledge and skills of medical personnel who assist childbirth in low-resource countries [4]. An essential component of the HBB program is the training of birth attendants on the importance of the interventions needed in the first minute of life (the Golden Minute). The HBB program focuses on neonatal assistance interventions in the form of drying neonates, maintaining temperature, providing stimulation so that neonates can breathe, as well as the use of ventilation bags and masks if needed so that neonates who are not breathing at birth are expected to be saved [5].

In 2013, Indonesia held the first HBB training with the Indonesian Perinatology Association (PERINASIA) as a related partner. In the 2013-2014 training, there were 600 birth attendants participated in the HBB training process. The background for choosing Puskesmas Kabupaten Grobogan in this research was that on 26-28 December 2019, Kabupaten Grobogan, with the Dinas Kesehatan Kabupaten Grobogan as a related partner, had the opportunity to implement The HBB training, which the program was attended by 36 participants from the background of birth attendant health workers. Grobogan is also one of the areas in Central Java that has a high neonatal mortality rate; namely, in 2018, there were 11.5 in 1,000 newborn births, and it ranks second after Rembang in neonatal mortality [3].

HBB defines the design of learning materials as aimed at improving participants' understanding and skills by providing supporting facilities. The primary educational material is graphics with action plans, which contain algorithms in image format that contain plans according to the evaluation situation. The algorithm contained the green zone for routine care, the yellow zone for golden minute management, and the red zone for babies who need ventilation and referral to a better place. The golden minute is defined as every baby having to breathe or require ventilation as soon as one minute after birth. Training participants are also provided with a neonate simulator facility, which is made in such a way with a 2-liter water cylinder so that it resembles the condition of a real neonate, which has the weight, body temperature, and tone of a real neonate. This causes the simulator to cry, the sensation of breathing spontaneously, and the pulsation of the umbilical cord to be palpable. Participants work in pairs to carry out resuscitation measures and operate the simulator, so it is hoped that they can increase cooperation. Use a reusable suction device that can be opened for cleaning. Ambu bags are also provided in simpler conditions for efficiency [3].

Through the HBB training program, it is hoped that the understanding and skills of birth attendant health workers can improve in the management of asphyxia. Based on data from the Puskesmas and Maternal Perinatal Audit (AMP) reports in Bandung, after the HBB program training in 2013-2014, there was data on a decrease in newborn mortality due to asphyxia from 23% to 7% in 2014 and 2016.[3]

Based on a study in Tanzania, there was a significant reduction in neonatal mortality after HBB was implemented, from 19 deaths in 1,000 neonatal births to 14.5 deaths per 1,000 neonatal births. Mortality in the early perinatal period also decreased significantly after the HBB was implemented, from 32.2 deaths per 1,000 births to 21.6 deaths per 1,000 live births. At the same time, the number of infant deaths related to asphyxia increased after the HBB was implemented, namely 63 deaths from 107 asphyxia births (58%) to 442 deaths from 552 asphyxia births (80%). It's just that the proportion of babies with asphyxia who died and those who lived decreased significantly after the HBB was implemented, from 86% to 31%. This shows that more babies survived after being diagnosed with asphyxia [6].

The neonatal referral system is a system regarding the transfer of neonates who are considered to have a high risk in the delivery process from a health facility that is considered inadequate in terms of facilities to a health facility that is considered capable of providing better management of the referred baby. High-risk neonates were defined as neonates with a maternal history of diabetes, neonatal asphyxia, neonates with recurrent seizures, neonates with preterm birth, and other diseases [7]. According to a study in the Netherlands before the HBB program was implemented, the prevalence of birth asphyxia was 0.85%, while severe asphyxia was 0.16%. The prevalence was significantly reduced, namely 6% for birth asphyxia and 11% for severe asphyxia. Meanwhile, the referral rate from primary health facilities to secondary facilities during the birth process has increased from 20% to 24% [8],[9].

Other factors influence the success of neonatal referral, namely the initial action of positive pressure ventilation, which is one of the actions to restore the asphyxiated baby's airway, the effect of hypothermia, and the duration of referral [10],[11],[12]. Although there have been many studies on the role of HBB in reducing the incidence of asphyxia in neonates, there has been no research examining differences in the success rate of infant referrals before and after HBB training. The HBB training program has been known to have many benefits in reducing neonatal mortality. Based on this, it is necessary to further investigate the difference in the success rate of referral for asphyxia newborns before and after HBB training, as well as the factors that influence it.

Methods

Study design

This study was an analytical study using a cross-sectional approach that distinguishes between the success rate of referral for asphyxia newborns before and after helping babies breathe (HBB) training and the other factors that influence it.

Settings

This research was conducted at Puskesmas Kabupaten Grobogan. Data collection and analysis were carried out from April to June 2021.

Sampling

Sampling was carried out by a consecutive sampling method from medical records of asphyxia newborns at Puskesmas Kabupaten Grobogan, Central Java. In this method, every neonate that fits the research criteria is included in the study until the minimum sample size is reached. The minimum sample size was determined using hypothesis testing for unpaired two-sample proportions. Based on this formula, the minimum sample size for each group was 15. The inclusion criteria used in this study were infants who experienced asphyxia in Puskesmas Kabupaten Grobogan from January 2019 to December 2020. The exclusion criteria were infants assisted by health assistants who have not received HBB training and there is no data of the infants survived or death during the referral.

Data analysis

The independent variable in this study was the Helping Babies Breathe Training Program

in Kabupaten Grobogan in 2019. The dependent variable in this study was the success rate of referral of asphyxiated newborns. The confounding variables were the number of positive pressure ventilation (PPV) measures, neonatal hypothermia, and duration of referral. Data analysis includes hypothesis testing. Chi-square and Fisher's exact test were used for hypothesis testing.

Ethical considerations

The research protocol was declared to be ethically appropriate by the Health Research Ethics Committee of the Faculty of Medicine, Diponegoro University, Semarang, Indonesia, with the approval number 3052/UN7.5.4.2.1/DL/2021.

Results

This research was conducted at Puskesmas Kabupaten Grobogan from the period of April 2021 to June 2021. The samples were obtained from medical records and were selected by consecutive sampling. There are 30 samples, of which the 15 infants neonates experienced asphyxia in the period before the HBB training was implemented, and 15 asphyxiated neonates after the HBB training was implemented.

Based on the respondents' characteristics on the medical records obtained (Table 1), during the year before the HBB program was implemented, 8 (53.3%) neonates were male, and 7 (46.7%) neonates were female. Based on birth weight, there are 3 (20%) babies born with Low Birth Weight (LBW) conditions, namely babies who have a birth weight of fewer than 2,500 grams. Based on gestational age, there were 4 (26.7%) babies born prematurely, i.e., when the gestational age was <37 weeks. Based on maternal data obtained, as many as 15 (100%) mothers gave birth during their reproductive age period. Based on the mother's education level, there were 1 (6.7%) mother with a junior high school education level, 7 (46.7%) high school, 5 (33.3%) associate's degree, and 2 (13.3%) took the bachelor's degree level.

Table 1. Respondents' characteristics

Variable's	Helping Babies Breathe Training			
	Before n = 15		After n = 15	
	n	%	n	%
Sex				
Male	8	53,3	6	40
Female	7	46,7	9	60
Birth weight				
Normal	12	80	12	80
Low birth weight	3	20	3	20
Maternal Age				
Risk	0	0	0	0
Productive	15	100	15	100
Gestational age				
≥37 weeks	11	73,3	13	86,7
<37 weeks	4	26,7	2	13,3
Mother's education				
Junior high school	1	6,7	2	13,3
Senior high school	7	46,7	4	26,7
Associate's degree	5	33,3	6	40
Bachelor degree	2	13,3	3	20

Based on data obtained one year after the HBB training program was implemented, 6 (40%) neonates were male, and 9 (60%) neonates were female. There were 3 (20%) babies born with low birth weight (LBW) and 2 (13.3%) babies born <37 weeks of gestation. Based on maternal data, it was found that 15 (100%) were of reproductive age. From the maternal education data collected, 2 (13.3%) mothers had a junior high school education background, 4 (26.7%) had high school, 6 (40%) had an associate's degree, and 3 (20%) had a bachelor's degree level.

Table 2 shows the association between the HBB Training Program and the Success Rate of Referral for Asphyxia Newborns; the number of live infants who were successfully referred before the HBB training was carried out was 9 (60%), while afterward, as many as 12 (80%). By using the Fisher's Exact Test, the P-value is 0.213, which shows that there is no significant association between the two.

Table 2. The Association between the HBB Training Program and the Referral Success Rate of Asphyxia Newborns

Referral success	Helping Babies Breath Training		p
	Before	After	
Yes	9 (60%)	12 (80%)	0,213£
No	6 (40%)	3 (20%)	

Description : Significant (p < 0,05); £ *Fisher's exact*

The association between other factors that influence the success rate of referral for babies born with asphyxia is distinguished by period, namely before and after the HBB training was carried out. Table 3 shows other factors that influence the success rate of referral of babies born with asphyxia before the HBB program is implemented, namely positive pressure ventilation action with a P-value of 0.092, the hypothermic state with a p-value of < 0.001, and the duration of referral of 0.001. Table 4 shows other factors that influence the success rate of referral of babies born with asphyxia after the HBB program was implemented, namely positive pressure ventilation with a P-value of 0.758, the hypothermic state with a p-value of 0.002, and the duration of referral 0.200. Using Fisher's exact test, it was found that only hypothermia and duration of referral had a significant effect on the success rate of referral for babies born with asphyxia before the HBB program was implemented. However, in the period after the HBB program was implemented, as described in Table 4, only the incidence of hypothermia affected the referral success rate for babies born with asphyxia with a P-value of 0.002.

Table 3. Association between PPV Action, Hypothermia, and Duration of Referral with Referral Success Rates of Asphyxia Newborns Before the HBB Training Program Is Implemented

Variable's	Newborns alive		p
	Yes	No	
Positive-pressure ventilation action			
Yes	5 (55,6%)	6 (100%)	0,092£
No	4 (44,4%)	0 (0%)	
Hypothermia			
Yes	0 (0%)	6 (100%)	<0,001£*
No	9 (100%)	0 (0%)	
Referral duration			
<6 hours	8 (88,9%)	0 (0%)	0,001£*
>6 hours	1 (11,1%)	6 (100%)	

Description : * Significant (p < 0,05); £ *Fisher's exact*

Table 4. Association between PPV, Hypothermia, and Duration of Referral with the Success Rate of Referral of Asphyxia Newborns After the HBB Training Program is Implemented

Variable's	Newborns alive		p
	Yes	No	
Positive-pressure ventilation action			
Yes	8 (66,7%)	2 (66,7%)	0,758£
No	4 (33,3%)	1 (33,3%)	
Hypothermia			
Yes	0 (0%)	3 (100%)	0,002£*
No	12 (100%)	0 (0%)	
Referral duration			
<6 hours	12 (100%)	2 (66,7%)	0,200£
>6 hours	0 (0%)	1 (33,3%)	

Description : * Significant (p < 0,05); £ Fisher's exact

Discussion

The results of the analysis showed that there was no significant association between the HBB training program and the referral success rate of babies born with asphyxia. The results of this study corresponded with research conducted by Msemo, 2013 which stated that the implementation of the HBB training program on the referral success rate showed insignificant results, but this is still in the process of further research [6].

Various factors may cause an insignificant association. Even though the birth attendants had participated in the HBB training program, where there was an increase in the knowledge of birth attendants who participated in the HBB training program. Based on research, clinical abilities have not corresponded to the knowledge where the data were obtained that birth attendants were still less skilled in using resuscitation equipment in the HBB training algorithm [13].

The results of the bivariate test showed there was no significant association in the two periods before and after the HBB training program was implemented, namely between positive-pressure ventilation action and the referral success rate of babies born with asphyxia. Research indicates that there is an increase in positive-pressure ventilation actions after the implementation of HBB, according to positive-pressure ventilation, which is one of the actions contained in the HBB algorithm.[14] Several factors can cause the results to be inconsistent with the theory, one of which is comorbidities that aggravate the condition of asphyxia newborns, such as infection and preterm birth, which increases the risk of mortality in neonates [13]. Another factor is based on research: after four months of training without repetition, there is a decrease in skills when carrying out positive-pressure ventilation measures. This impact on increasing the risk of failure in the treatment of asphyxia newborns, only in related research, after repeated training regularly, skills in emergency asphyxia newborns have increased again, so it can be concluded that repeated training is needed to increase the success of neonatal asphyxia emergency resuscitation [15].

The results of the bivariate test showed that there was a significant association in the period before and after the HBB training program was implemented, namely between the state of hypothermia and the referral success rate of asphyxiated babies, where newborns who were free from hypothermia had a higher survival rate than newborns who have hypothermic state. According to research, every 1°c decrease in neonate body temperature increases the risk of neonatal mortality by up to 80%. A significant correlation between hypothermia and asphyxia in neonates is due to a state of oxygen deprivation, where oxygen is needed for the oxidation process in the mitochondria in fat tissue to produce heat. Hypoglycemia and enterocolitis, where these comorbidities can increase the risk of mortality in neonates [16]. The prevalence of hypothermia in neonates increases due to several conditions; for example, there is no

physical contact between mother and child during the postpartum process, there are no facilities to warm the baby's body, and born to mothers with obstetric complications, and prematurity [15].

There is a difference in the results of the bivariate test on the referral duration variable to the referral success rate of asphyxia-born babies, where, based on the results of the study a year before the HBB training program was implemented, the association between the two was significant. In contrast, in the period a year after the HBB training program was implemented, the association between the two was not significant.

One possibility that could cause the results of the two periods to be different is the existence of the COVID-19 pandemic. Based on research, the COVID-19 pandemic has had a significant impact on the number of newborn patients admitted to hospitals [17].

Several other possibilities that can cause the results to be inconsistent are variations in other comorbid conditions due to complications of asphyxia, one of which is neurological disorders that have already appeared when the duration is less than six hours. In addition, there requires the presence of trained personnel to carry out correct resuscitation measures, suitable accommodation from the relevant health facilities to the referral site, and quick management at the time of transfer of the referred neonate [10],[12],[18].

The limitation of this research is there is no data collection on other comorbid conditions in neonates and mothers due to incomplete medical records. Other disease states, such as infection, can accompany the condition of asphyxia newborns so that it can cause a bias in the referral success rate; this comorbid condition may arise because it is not visible at the time of birth.

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