

Knowledge Outcome of Helping Babies Breathe Training in Southern Nations, Nationalities and People's Region, Ethiopia: A Pre- and Post-Test Study

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Introduction: Helping Babies Breathe (HBB) training is a key strategy to decrease neonatal mortality. The objectives of this study were to evaluate the effect of HBB on knowledge outcome and to assess the knowledge outcome in relation to different variables in Southern Nations, Nationalities and People's Region (SNNPR), Ethiopia.

Methods: A pre- and post-test study was conducted using data from HBB trainings given for health workers. The training was given for 2.5 days and the knowledge outcome was evaluated using validated 18 questions. The post-test was given immediately after the training. Data were entered into Epi Info 7 and imported to SPSS version 21. The paired sample *t*-test was used to compare pre- and post-test means. The independent sample *t*-test was used to determine the relationship between knowledge outcome with sex, education level, and health facility. One way ANOVA with post hoc test was computed for comparing the knowledge outcome of the training among different professions. The general linear model (GLM) was used to determine the main and interaction effects. The statistical significance was determined at $p < 0.05$.

Results: In this study, we assessed the knowledge outcome of 98 trainees. The trainees' mean knowledge score increased from 64.4% (pre-test) to 80.7% (post-test). The difference was statistically significant with $p < 0.001$. Sex (pre-test $p = 0.003$, post-test $p = 0.005$) and education level (pre-test $p = 0.017$, post-test $p = 0.037$) of the trainees were significantly associated with the knowledge outcome while profession and type of health facility were not significant ($p > 0.05$). The GLM showed that the interaction effects of sex, education level, profession, and type of health facility over the knowledge outcome were non-significant ($p > 0.05$).

Conclusion: The knowledge outcome of trainees significantly improved after the HBB training. It was significantly varied with sex and education level both at pre- and post-test. Therefore, these variables need consideration when arranging HBB trainings.

Keywords: Helping Babies Breathe training, pre-test, post-test, knowledge outcome

Introduction

Helping Babies Breathe (HBB) has become the most important strategy to decrease neonatal mortality as a result of birth asphyxia.¹⁻³ It is an evidence-based curriculum planned to improve the knowledge and skills of neonatal resuscitation in low-resource countries worldwide, where 98% of the total 3 million neonatal deaths occur every year.⁴⁻⁶ Evidence showed that 20% of the intrapartum-related deaths can be prevented by effective neonatal resuscitation.⁷

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The program was launched by the American Academy of Pediatrics (AAP) and its partners. The program is capable of equipping birth-attendants with knowledge and skills of saving lives from birth asphyxia through stimulation and ventilation within the first 60 seconds of life.⁸ Studies showed that health providers are more effective when there is frequent simulation-based education to improve their cognitive, psychomotor, and communication skills during neonatal resuscitation.^{9,10}

Ethiopia is one of the countries with high neonatal mortality accounting for 29 per 1000 live births.¹¹ One of the strategies to decrease this high neonatal mortality is by providing HBB training as neonatal asphyxia is a major attribute of this death.^{12,13} However, studies showed that knowledge outcome of HBB training varies with sex, education level, profession, and setting of the trainees.^{2,4,14–17} Data on the knowledge outcome of HBB training was scarce. Therefore, the objectives of this study were to evaluate the effect of HBB on knowledge outcome of the trainees and to assess its variation with sex, education level, profession, and health facility of the trainees.

Methods

The STROBE guideline for cross-sectional studies was strictly followed for reporting this study. The page numbers of each guideline components reported are presented in [Supplementary File 1](#).

Study design: This study used secondary data of the HBB training given for health professionals at Mizan-Tepi University Teaching Hospital and Sawula General Hospital from August/2018 to August/2019. We applied a pre- and post-test study to investigate the knowledge outcome of HBB training and to assess the knowledge outcome in relation to different variables.

Study Setting and Period: This pre- and post-test study was conducted in the two HBB training centers in SNNPR of Ethiopia. The two centers of training were Mizan-Tepi University Teaching Hospital and Sawula General Hospital which are 585Km and 514km away from Addis Ababa, respectively. This study included HBB trainings which were given in 2018 and 2019. The data were collected from March 5–20, 2020.

Study Population, Inclusion and Exclusion Criteria

The study population was health care workers (Nurses, Midwives, Health officers, and Anesthetists) who took

HBB training in 2018 and 2019. All trainees who completed the training were included. Trainees who took the pre-test and missed the post-test were excluded.

Participants and a Course structure: The training was given by grouping participants into five groups as each group should not exceed 20 trainees irrespective of their education level, profession, sex, and type of health facility. The second edition of HBB training course was given for 2 and half days. The training began with orienting different materials to the trainees followed by providing the pre-test consisting of 18 multiple choice questions. These questions were AAP's previously validated HBB knowledge assessment tool.¹⁸ Then, the trainees completed the course using the action plan (sequences of steps to help the babies breathe), learner work-books, newborn simulators, and bag-mask ventilation equipment. After completion of the training, the post-test was given using the same questions used during the pre-test. At the end, only those trainees who scored $\geq 80\%$ (15 of 18 questions) were certified for the successful completion of the training as per protocol.¹

Study Variables

Dependent and Independent Variables

Knowledge outcome (pre- and post-test result) of the HBB training was the dependent variable while; sex, education level, profession, and health facility of the trainees were the independent variables.

Data Source and Measurement of Variables

Knowledge was measured using AAP's previously validated HBB knowledge assessment tool consisting of 18 multiple choice questions. The score of each participant was converted to 100% and treated as continuous variable. Sex (male and female), education level (diploma and degree), type of health facility (Health Center and Hospital), and profession (Nurse, Midwife, Health Officer, and Anesthetist) were treated as categorical variables. The data were obtained from the reporting documents of HBB trainings deposited at Mizan-Tepi University Educational Development Center (EDC) which is responsible for coordinating the HBB trainings.

Data Collection Procedure

The data were collected through reviewing the report documents of the HBB training by using the data extraction checklists comprising variables of interest. The data extraction checklists were included as [Supplementary File 2](#).

Data analysis: The extracted data were entered into Epi Info 7 and imported to SPSS version 21 for data cleaning and analysis. Descriptive statistics (mean and standard deviation) were computed for both pre- and post-test. The trainees' scores for each time point were used regardless of whether they passed or failed the test. The paired sample *t*-test was used to compare the mean difference between pre- and post-test. An independent sample *t*-test was computed to examine the difference in the knowledge outcome of HBB based on sex, education level, and health facility of the trainees. We used one-way ANOVA with a post hoc test to check the differences in achievement among different professions; Nurses, Midwives, Anesthesia, and Health Officers. Finally, the GLM was used to determine the main and interaction effects of independent variables over knowledge outcome. The statistical significance was determined at $p < 0.05$.

Results

Characteristics of Study Participants

This study included 98 participants. The characteristics of study participants are presented in Table 1. As presented in Table 1, more than half of the trainees were female (67.3%), from the health centers (52%), degree holders (61.2%), and Midwives in profession (56.1%) (Table 1).

Overall Knowledge Outcome of the Training

Trainees' mean knowledge score increased from 64.4% (pre-test) to 80.7% (post-test). The mean knowledge score difference was 16.3 and this difference was statistically significant with $p < 0.001$, CI (13.4–19.2). Out of 98 total trainees, 60 (61.2%) of them scored a pass mark and the rest 38 (38.8%) failed to score the pass mark.

Knowledge Outcome in Relation to Sex, Education Level, Health Facility and Profession of the Trainees

There was noticeable difference between pre- and post-test results of the HBB training based on sex, and education level. However, the difference between pre- and post-test result according to health facility type was virtually negligible (Table 2). The Anesthetists and the health officer had higher mean knowledge score at post-test but all professions scored nearly similar mean knowledge score at pre-test (Figure 1).

The *t*-test result showed that there was statistically a significant mean knowledge difference according to sex (pre-test ($t(96) = 03.07$, $p = 0.003$) and post-test ($t(96) = 2.9$, $p = 0.005$)). Similarly, there was a significant mean

Table 1 Characteristics of Study Participants in SNNPR, Ethiopia

Variables		N (%)
Sex	Male	32 (32.7)
	Female	66 (67.3)
Health facility	Hospital	47 (48)
	Health center	51 (52)
Education level	Degree	60 (61.2)
	Diploma	38 (38.8)
Profession	Nurses	30 (30.6)
	Midwives	55 (56.1)
	Health officers	9 (9.2)
	Anesthetists	4 (4.1)

knowledge difference in relation to education level both at pre-test ($t(96) = 2.4$, $p = 0.017$) and post-test ($t(96) = 2.1$, $p = 0.037$). However, there was no significant difference in knowledge outcome in relation to the type of health facility (Table 3).

The one way ANOVA with post hoc test showed that there was non-significant difference in knowledge outcome among different professions (Table 4).

General Linear Model Analysis Results (Main and Interaction Effects)

The univariate GLM analysis showed that sex ($F(1, 96) = 4.06$, $p = 0.047$) and education level ($F(1, 96) = 4.9$, $p = 0.030$) were significantly associated with the knowledge outcome at pre-test. However, these variables were non-significant at post-test ($p > 0.05$). Furthermore, the multivariate GLM analysis revealed that the interaction between independent variables (sex, education level, profession, and type of health facility) over the knowledge outcome was non-significant ($p > 0.05$) (Tables 5 and 6).

Discussion

This pre- and post-test study aimed to provide insights about the effect of HBB training on the knowledge outcome of the trainees immediately after the training. To the level of the investigators' knowledge, this study was the first study in SNNPR.

The study showed that the overall mean knowledge score of the trainees was significantly improved after the HBB training. Our finding is in line with study findings conducted in developing and developed countries^{2,14–16} and health care workers at hospitals in Rwanda.¹⁹ However, one third of our trainees failed to score the pass mark. The lower baseline knowledge of HBB might

Table 2 Descriptive Statistics of Pre- and Post-Test Results of HBB Training According to Sex, Education Level, and Health Facility in SNNPR, Ethiopia

		Mean	Std. Deviation	Minimum	Maximum
Sex					
1. Male	1. Pre-test	71.9	14.2	44	94
	2. Post-test	86.5	11.7	56	100
2. Female	1. Pre-test	60.8	17.8	27	100
	2. Post-test	77.9	14.8	43	100
Education level					
1 Degree	1. Pre-test	67.7	18.2	27	100
	2. Post-test	83.1	13.9	43	100
2. Diploma	1. Pre-test	59.2	14.9	28	94
	2. Post-test	76.9	14.5	43	100
Health Facility					
1. Hospital	1. Pre-test	64.8	14.3	39	89
	2. Post-test	82.2	13.7	50	100
2. Health Center	1. Pre-test	64.1	20.0	27	100
	2. Post-test	79.4	15.0	43	100

contribute to failure to score the pass mark. Though this deserves further studies, incorporation of HBB contents in pre-service training may increase the knowledge which in turn may reduce the failure rate.

As the independent sample *t*-test showed, the knowledge outcome of the training was significantly varied by sex both at pre-test (MD = 11.0) and post-test (MD = 8.5). Though non-significant at pre-test, other studies also reported that the knowledge outcome of the trainees significantly varied by sex.^{20,21}

Knowledge outcome of HBB training significantly varied with education level of trainees both at pre-test (MD = 8.5) and post-test (MD = 6.2). This finding is comparable with other studies conducted on different nursing professionals.^{22,23} In the current study, the degree holder trainees had better knowledge outcome compared to

diploma holders at both pre- and post-test. The high mean knowledge score by degree holders might be due to the depth and years of study in pre-service training. In addition to the HBB training, upgrading diploma holders with formal education and continuous professional development may narrow the gap in knowledge outcome. However, this should be cautiously interpreted as all potential confounders were not controlled.

The one way ANOVA analysis showed that the knowledge outcome was not significantly varied with different professions. Absence of significant knowledge outcome variation with different professions might be due to the updated nature of the HBB training contents. As the updated contents of HBB training were not covered by pre-service training, all trainees may have similar exposure irrespective of their professions. On the contrary, a study finding in Honduras hospital revealed that knowledge outcome varied between nurses and physicians. The study in Honduras hospital revealed that Physicians showed higher mean knowledge score than nurses at pre-test. But, both professions showed a significant improvement at post-test. A high score in the pre-test among physicians might be attributed to previous resuscitation training with simulation in Honduras hospital.¹⁴

Overall, the knowledge outcome of trainees significantly improved after the HBB training. The improvement

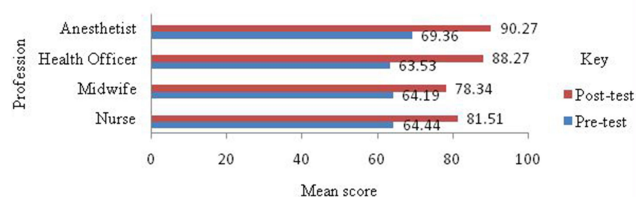
**Figure 1** The Knowledge outcome according to profession of the trainees in SNNPR, Ethiopia.

Table 3 The Knowledge Outcome in Relation to Sex, Education Level, and Health Facility in SNNPR, Ethiopia

	Levine's Test for Equality of Variances			t-Test for Equality of Means				
	F	Sig.	t	df	Sig (2- Tailed)	Mean Difference	95% CI	
							Lower	Upper
1. Sex								
Pre-test	0.8	364	3.1	96	0.003*	11.0	3.9	18.2
Post-test	1.9	0.176	2.9	96	0.005*	8.5	2.6	14.5
2. Education level								
1. Pre-test	2.7	0.106	2.4	96	0.017*	8.5	1.5	15.5
2. Post-test	0.3	0.576	2.1	96	0.037*	6.2	0.4	12.0
3. Health Facility								
1. Pre-test	8.1	0.005	0.2	90.5	0.848	0.7	-6.4	7.6
2. Post-test	0.9	0.345	1.0	96	0.333	2.8	-2.9	8.6

Note: *Significant at $p < 0.05$.

Abbreviations: MD, mean difference; CI, confidence interval; df, degree of freedom.

Table 4 Post Hoc Tests-Multiple Comparisons Among Mean Score of Different Professions in SNNPR, Ethiopia

Dependent Variables	(I) Profession of Trainee	(J) Profession of Trainee	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Pre-test	Nurse	Midwife	0.3	3.6	1.000	-9.3	9.8
		Health Officer	0.9	6.1	0.999	-15.05	16.9
		Anesthesia	-4.9	8.5	0.938	-27.3	17.4
	Midwife	Nurse	-0.3	3.6	1.000	-9.8	9.3
		Health Officer	0.7	5.7	0.999	-14.4	15.8
		Anesthesia	-5.2	8.3	0.924	-26.9	16.6
	Health Officer	Nurse	-0.9	6.1	0.999	-16.9	15.1
		Midwife	-0.7	5.7	0.999	-15.8	14.4
Post-test	Nurse	Anesthesia	-5.8	9.6	0.930	-31.1	19.4
	Anesthesia	Nurse	4.9	8.5	0.938	-17.4	27.2
		Midwife	5.2	8.3	0.924	-16.6	26.9
		Health Officer	5.8	9.6	0.930	-19.4	31.1
	Midwife	Nurse	3.2	3.2	0.750	-5.2	11.5
		Health Officer	-6.8	5.3	0.583	-20.7	7.2
		Anesthesia	-8.8	7.4	0.642	-28.3	10.8
	Health Officer	Nurse	-3.2	3.2	0.750	-11.5	5.2
		Health Officer	-9.9	5.0	0.206	-23.1	3.3
		Anesthesia	-11.9	7.2	0.358	-30.9	7.1
	Anesthesia	Nurse	6.8	5.3	0.583	-7.2	20.7
		Midwife	9.9	5.0	0.206	-3.3	23.1
		Anesthesia	-2.0	8.4	0.995	-24.1	20.1
	Anesthesia	Nurse	8.8	7.4	0.642	-10.8	28.3
		Midwife	11.9	7.2	0.358	-7.1	30.9
		Health Officer	2.0	8.4	0.995	-20.1	24.1

Table 5 GLM Analyses Result of the Test Between-Subjects Effects

Variables		Sum of Squares	df	Mean Square	F	Sig.
Sex	Pre-test	1036.3	1	1036.3	4.1	0.047**
	Post-test	165.9	1	165.9	0.9	0.360
Health Facility	Pre-test	108.1	1	108.1	0.4	0.517
	Post-test	163.9	1	163.9	0.8	0.362
Education level	Pre-test	1248.8	1	1248.8	4.9	0.030**
	Post-test	435.3	1	435.3	2.2	0.140
Profession	Pre-test	1258.9	3	419.6	1.6	0.186
	Post-test	451.7	3	150.6	0.8	0.514
Sex* Health Facility	Pre-test	55.6	1	55.6	0.2	0.642
	Post-test	60.8	1	60.8	0.3	0.579
Sex* Education level	Pre-test	309.5	1	309.5	1.2	0.274
	Post-test	18.6	1	18.6	0.1	0.758
Sex * Profession	Pre-test	305.1	3	101.7	0.4	0.755
	Post-test	11.8	3	3.9	0.0	0.996
Health Facility * Education level	Pre-test	60.9	1	60.9	0.2	0.627
	Post-test	0.0	1	0.0	0.0	0.991
Health Facility * Profession	Pre-test	339.5	2	169.7	0.7	0.517
	Post-test	354.1	2	177.1	0.9	0.408
Education level * Profession	Pre-test	535.4	2	267.7	1.1	0.356
	Post-test	53.5	2	26.7	0.1	0.872
Sex* Health Facility * Education level	Pre-test	190.9	1	190.9	0.8	0.390
	Post-test	14.4	1	14.4	0.1	0.787
Sex * Health Facility * Profession	Pre-test	718.6	2	359.3	1.4	0.251
	Post-test	378.5	2	189.2	1.0	0.384
Sex * Education level * Profession	Pre-test	461.6	1	461.6	1.8	0.183
	Post-test	326.9	1	326.856	1.7	0.200

Notes: *Interaction between variables. **Significant at $P < 0.05$.

Table 6 GLM Analysis Result of Multivariate Tests

Variables	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Sex	1.0	2.0	2.0	75.0	0.139	0.1
Education level	0.9	2.5	2.0	75.0	0.092	0.1
Health Facility	1.0	0.4	2.0	75.0	0.653	0.0
Profession	0.9	1.7	6.0	150.0	0.132	0.1
Sex * education level	1.0	0.7	2.0	75.0	0.519	0.0
Sex * Health Facility	1.0	0.171	2.0	75.0	0.843	0.0
Sex*Profession	1.0	0.228	6.0	150.0	0.967	0.0
Education level * Health Facility	1.0	0.165	2.0	75.0	0.848	0.0
Education level * Profession	1.0	0.574	4.0	150.0	0.682	0.0
Health Facility * Profession	1.0	0.5	4.0	150.0	0.733	0.0
Sex * education level * Health Facility	1.0	0.8	2.0	75.0	0.469	0.0
Sex* Health Facility Profession	0.9	1.0	4.0	150.0	0.409	0.0

Note: *Interaction between variables.

varied with sex and education level both at pre- and post-test. However, GLM result showed that the variation due to sex and education level was not statistically significant at post-test. This may indicate that the HBB training might have narrowed the knowledge difference due to these variables at post-test. In addition, the GLM analysis result showed that the simultaneous effects of sex, education level, profession, and type of health facility on knowledge outcome were not statistically significant.

Strengths and Limitations of the Study

This study is the first study on the knowledge outcome of HBB training in SNNPR. It used validated and standardized tools to assess the knowledge outcome of HBB training.¹⁸ The results of this study may not be representative to all regions in Ethiopia due to non-probability sampling methods applied in this study. The knowledge outcome difference due to variables like years of clinical experience, and previous related training were not assessed because these variables were not recorded in the reporting document of the HBB training registration book. In this study, we evaluated the immediate knowledge outcome of HBB training. Knowledge retention, clinical behavior and newborn outcomes were not studied. Therefore, future studies on the effect of HBB training in this study area should focus on the long-term effect of the training. Prior studies showed that knowledge and skill retention after training usually decline with time elapse.^{3,15,24} However, there are several strategies to retain knowledge and skill such as refresher training, adding videos during HBB training.^{3,15,24,25}

Conclusion

The knowledge outcome of trainees significantly improved after the HBB training. The knowledge outcome significantly varied with sex and education level both at pre- and post-test therefore, programmers and stake holders should consider these variables when arranging HBB trainings. In spite of a significant improvement in knowledge outcome, one third of the trainees failed to score the pass mark and this deserves further studies.

Abbreviations

AAP, American Academy of Pediatrics; ANOVA, Analysis of Variances; HBB, Helping Babies Breathe;

EDC, Educational Development Center; GLM, General Linear Model.

Data Sharing Statement

All the datasets used and/or analyzed during the current study are available from primary author (Lalisa Chewaka) on a reasonable request (lalisachewaka@gmail.com).

Ethics Approval and Informed Consent

Permission letter was obtained from Mizan-Tepi University College of Health Sciences, Academic and Research Directorate with Ref No.: MTU/CHS/981/12. Permission was also obtained from EDC Office to access data of HBB trainings. No identifiable data was accessed in this research. As we used secondary data, the consent to participate was not applicable.

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Author Contributions

All authors made substantial contributions to conception and design, acquisition, analysis, and interpretation of data. All authors also took part in drafting the article, revising it critically for important intellectual content, agreed to submit to the current journal, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests for this work.

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