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Adapting Helping Babies Breathe into a Virtual Curriculum: Methods, Results, and Lessons Learned

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Abstract

Introduction. The Helping Babies Breathe (HBB) curriculum is an established, effective method to combat neonatal mortality. The COVID-19 pandemic has disrupted in-person HBB training sessions worldwide, portending deficits in the dissemination of this important intervention. *Methods*. A pilot study to compare in-person versus virtual HBB training among US-based pediatric and family medicine residents. Two HBB master trainers condensed the curriculum into an abbreviated course that was offered to 14 learners in-person (n = 6) and virtually via Zoom (n = 8). A standardized 10-item survey was administered before and after the session to measure reported self-efficacy of critical elements of HBB. Difference of difference analysis was performed to detect differences in post vs pre-training results among the 2 groups using STATA MP 15. *Results*. All learners showed improvement in preparedness, assessment, and skills subcomponents of self-efficacy with no notable differences based on the type of learning medium. At baseline, in-person learners had a 7-point higher self-efficacy score (69.7) in comparison to virtual learners (62.8; $P = .26$). After training, the confidence score improved significantly; by 14.3 units for in-person learners ($P = .01$) and 12.9 for virtual learners ($P = .04$). There was no statistically significant difference in improvement between the 2 groups ($P = .67$). Furthermore, all learners passed the post-training knowledge assessment. *Discussion*. Virtual learning of HBB may be an alternative option in the setting of resource and travel limitations. Future work needs to assess possible differences in attainment of assessment skills and retention of the HBB curriculum among virtual learners.

Keywords

global health, neonatal care, newborn care, medical education, virtual learning

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Introduction

Childbirth is often an unpredictable event with multiple potential complications for both mother and infant. Patient risk for morbidity and mortality is uniquely high, and encounters may require urgent and pressured decisions. According to the World Health Organization (WHO), in 2017 neonatal deaths accounted for approximately 50% of deaths in young children worldwide, with the leading cause of death attributed to preterm birth complications.[1] Therefore, it is critical that every medical provider taking care of children, especially infants, acquire the vital training competencies for successful neonatal resuscitation. Helping Babies Breathe (HBB) is an internationally recognized training program that was developed to combat this pressing issue. The curriculum is part of Helping Babies Survive, a suite of courses published by the American Academy of Pediatrics (AAP) for healthcare providers to gain knowledge and skill with the initial steps of neonatal resuscitation in resource-limited settings.[2,3] According to the AAP, teaching HBB neonatal resuscitation techniques combats preventable poor outcomes and has reduced the neonatal mortality rate by up to 47% with implementation.[3]

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Table 1. Demographics of Study Participants.

	Virtual learners (n = 8)	In person learners (n = 6)
% Male participants	37.5	16.6
Level of training (Number of participants per group)		
Post graduate year 1 (PGY-1)	1	1
Post graduate year 2 (PGY-2)	3	3
Post graduate year 3 (PGY-3)	4	1
Post graduate year 4 (PGY-4)	0	1
Total number of deliveries attended in residency (%)		
0-5 deliveries	0	16
6-10 deliveries	0	0
11-15 deliveries	25	16.6
>15 deliveries	75	66.6
Prior HBB training	0	0
Prior NRP training (%)	100	100

The HBB curriculum and its application have saved numerous infant lives by employing basic steps for neonatal transition to postnatal life. Since its inception there have been more than 1000 HBB courses recorded on the AAP HBB course archive, spanning over 80 countries.[3] It is evident that this course offers a lifeline to communities in need. When the coronavirus and associated COVID-19 pandemic erupted, international travel was brought to a halt. Additionally, HBB global health work decreased dramatically. According to the AAP HBB course archive, in 2020 there were only 6 HBB courses taught worldwide, compared to more than 100 global service trips and master training courses completed in 2019.[4] This disparity is likely to exacerbate existing deficits in knowledge-base of neonatal resuscitation in low-resource settings.

Medical training programs have adapted to COVID-19 safety precautions by using various video-based communication platforms for education, and such platforms are becoming a standard of learning.[5] However, there is limited data available in the literature examining virtual HBB courses. One study did examine teaching the course via telehealth methods and demonstrated efficacy with HBB training, but did not provide a comparison to in-person learning.[6] This study offers the first direct comparison of virtual to in-person learning of HBB, to date, and demonstrates that a virtual HBB course is non-inferior to an in-person course.

Methods

Ethical Approval and Informed Consent

The project was reviewed by the Institutional Review Board (IRB) for the distribution and analysis of participant surveys and was granted an exemption as not human subject research from the IRB. All participants were resident learners recruited during protected resident education time, in two separate sessions. Prior to initiating the study, participants were notified that participation in this session was voluntary and would not be reflected in their academic evaluation.

Course Development

The Institute for International Medicine (INMED) offers a professional certificate course to become an HBB Master Trainer equipped with the skills to teach others the course material.[7] The two co-authors completed the HBB Master Trainer course offered through INMED and became HBB Certified Master Trainers prior to the start of this study. The curriculum was then modified into a condensed training course, using the HBB course supplemental materials, which are provided by the AAP. These were converted to a virtual presentation by including the HBB pathway images in a PowerPoint presentation to easily screen share over Zoom (Supplemental Appendix A). The full suite of HBB educational materials can be downloaded, at no cost to users, by visiting the AAP International Resources website.

Course Logistics

Fourteen learners in total were recruited to participate in the HBB training; participants were randomly assigned to each group, 6 to the in-person training, and 8 to the virtual learning. Table 1 shows the study population demographics.

The in-person and virtual learner groups were placed in separate conference rooms as demonstrated in the planned room configuration (Figure 1). The two rooms were connected virtually, via the video communication platform, Zoom. In conference room A, a mounted ceiling camera was focused on the instructor demonstrating skills on a NeoNatalie simulator. In conference room B,

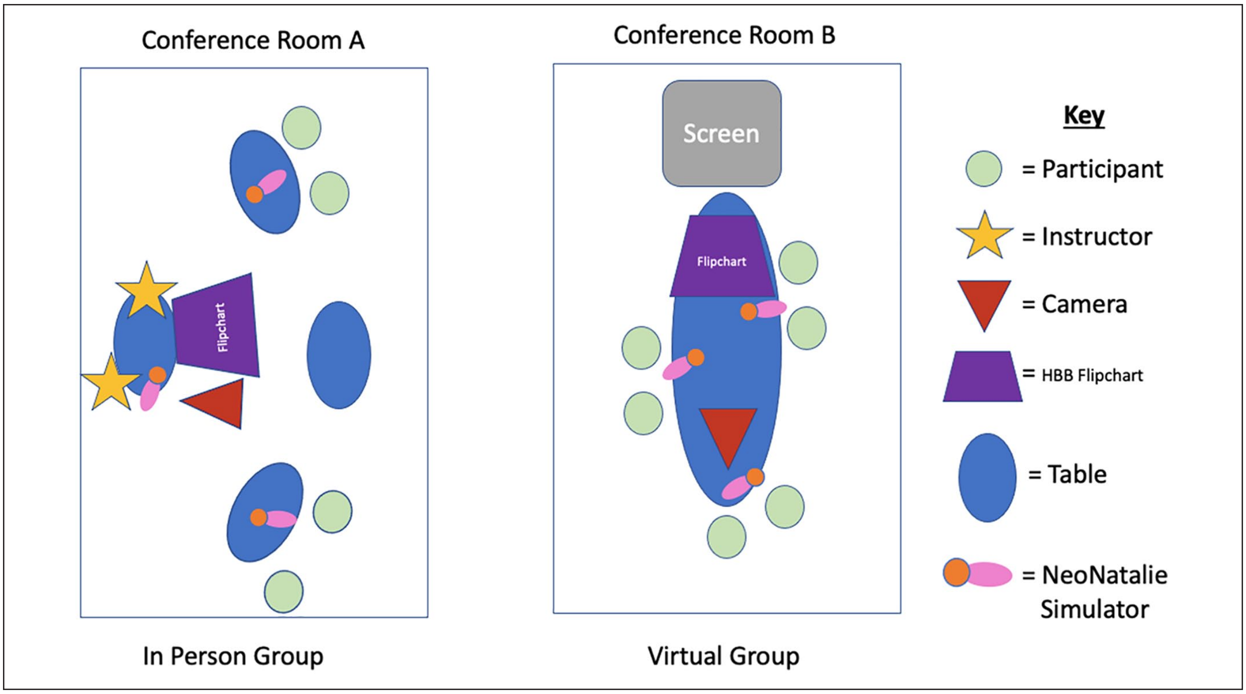

Figure 1. Planned room configuration diagram.

a mobile web camera was utilized, such that all participants could demonstrate their skills to the course instructors. During the course, the split-screen feature of Zoom was utilized so that both the PowerPoint and physical demonstrations could be shown simultaneously on the screen in conference room B. A HBB facilitator flip chart was also utilized by both groups.

Course Evaluation

At the end of the course, each participant completed a previously validated written knowledge check as well as two previously validated objective structured clinical exams (OSCE's) provided by the AAP. The OSCE's were performed individually with a master trainer. In addition, a standardized confidence survey was administered to assess participant's confidence with knowledge and skills, before and after the course (Supplemental Appendices B and C). The survey included 10 items with responses based on a 10-point Likert scale. Subscales were identified based on face validity and included measurement of confidence in preparedness (items 1 and 2), assessment (items 3, 4, 5, 7, and 9), and skills (items 6, 8, and 10). The distribution of survey data was assessed using descriptive statistics and internal reliability was assessed using Cronbach's alpha. Bivariate analysis was performed to test differences in the mean of confidence scores using ANOVA. Difference of difference analyses were performed to measure differential improvement in confidence score among in-person learners versus virtual learners using multivariable generalized linear models that adjusted for the number of deliveries attended by the learners. An estimated 95% confidence interval for the difference of difference values was used with the delta method. All statistical analyses were performed in STATA 15 MP.

Results

All participants completed the demographic survey, which revealed that 100% had previously completed NRP training and had experience with deliveries, with a majority of participants had attended more than 15 deliveries total while in residency among both in-person and virtual learning groups (75% and 67%, respectively). All participants completed a post-course knowledge check consisting of two OSCE evaluations and a written test. All learners achieved a passing score. In-person learners achieved an average score on the knowledge check of 97.2% (SD: 6.8) while virtual learners achieved an average score of 95.8% (SD: 3.9) ($P = .64$).

The average pre- and post-course confidence with survey items are displayed in Figure 2.

Based on Cronbach's alpha, the pre- and post-course confidence survey had excellent internal reliability ($\alpha = 0.89$ and 0.96, respectively). On average, in-person learners had a 7-point higher- baseline confidence score

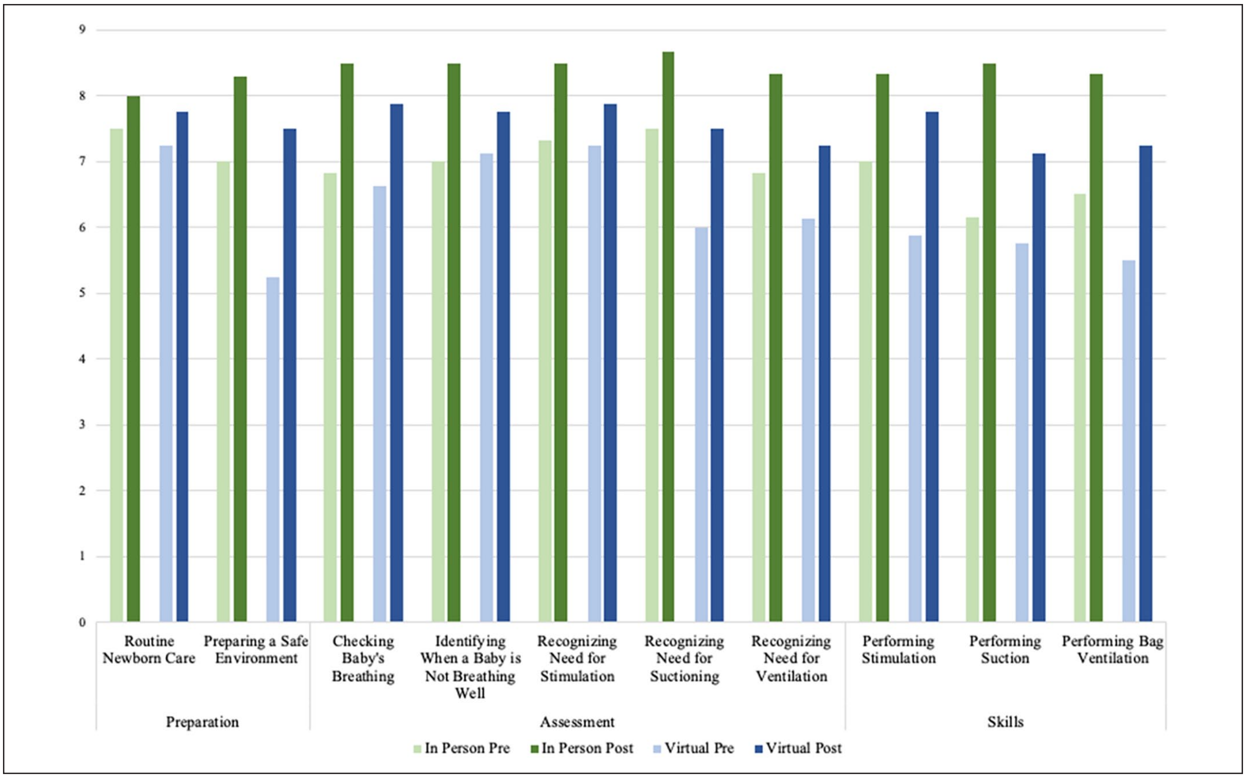

Figure 2. Average pre- and post-course confidence survey responses by item.

Table 2. Distribution of Average Confidence Score Before and After HBB Course and Across Different Types of Learners (In-Person vs Virtual).

	Virtual learners (n = 8)	In-person learners (n = 6)	Difference
Pre-course total	62.8	69.7	−6.9 (*P* = .26)[a]
Post-course total	75.7	84.0	−8.3 (*P* = .11)[a]
Difference	12.9 (*P* = .04)	14.3 (*P* = .01)	−1.4 (*P* = .67)[b]
Pre-course preparedness	12.5	14.5	−2.0 (*P* = .12)[a]
Post-course preparedness	15.3	16.3	− 1.0 (*P* = .37)[a]
Difference	2.8 (*P* = .05)	1.8 (.08)	1.0 (*P* = .36)[b]
Pre-course assessment	32.9	34.2	−1.3 (*P* = .68)[a]
Post-course assessment	37.9	42.3	−4.4 (*P* = .10)[a]
Difference	5.0 (*P* = .09)	8.2 (*P* = 0.01)	−3.2 (*P* = .12)[b]
Pre-course skills	17.4	21.0	−3.6 (*P* = .17)[a]
Post-course skills	22.5	25.3	−2.8 (*P* = .13)[a]
Difference	5.1 (*P* = .04)	4.3 (*P* = .02)	0.8 (*P* = .68)[b]

[a]Differences between the groups.
[b]Difference of difference analysis calculated using ANOVA.

(69.7) in comparison to virtual learners (62.8, *P* = .26) After training, the score improved by 14.3 for in-person learners (*P* = .01) and 12.9 for virtual learners (*P* = .04); however, the difference of difference (Δ of Δ) between the 2 groups (−1.5) was not statistically significant (*P* = .67). After adjusting for the number of deliveries attended by learners, this difference remained (*P* = .83). All learners showed improvement on the sub-scales of preparedness, assessment, and skills; however, this improvement was not statistically significant among the virtual learner group for assessment (Table 2). Difference of difference analysis did not identify statistically significant findings virtual learners had a slightly higher improvement in their self-report of preparedness (Δ of Δ=0.9, 95% CI: −1.5 to 3.4) and skills (Δ of Δ=1.7, 95% CI: −1.8 to 5.2). For assessment, in-person learners outscored the virtual learners (Δ of Δ=−2.1, 95% CI: −6.2 to 2.0). This data is summarized in Table 2.

Discussion

This study represents the first direct comparison of virtual to in-person learning of HBB, to date. On average, all learners reported improved confidence with delivery preparedness, assessment, and skills. Participants demonstrated competency with the validated assessments put forth by the AAP. At the completion of the course, all participants possessed qualities of effective delivery room providers as determined by the HBB curriculum. Specifically, there was a marked improvement in the report of confidence after the course, irrespective of the learning medium, that is, in-person or virtual. The results of the knowledge score also did not reveal a difference based on the learning medium. Taken together, these findings suggest that the benefit of a virtual course on trainee's knowledge and confidence is similar to that of in-person trainees.

The success of the virtual course can be attributed to multiple logistical factors. First, having 2 instructors present was critical to the course delivery; one instructor to lecture and facilitate discussion and one to demonstrate skills over Zoom. This model allowed evaluation and adjustments of demonstrations in real-time for both learning groups. In regard to the physical setup of the learning environments, there were multiple lessons learned. First, it was helpful to have the HBB facilitator flip chart on display in both rooms for participants to follow, as well as a large split-screen display of both PowerPoint and video demonstrations. Having the virtual participants oriented around a single large conference table promoted group learning, in contrast to the traditional model of separate stations. It is vital to have a portable camera in the virtual room so that the learners can request specific instruction, and instructors can offer support to individual participants as needed. Teaching this course in real-time allowed for questions and answers and live group discussion, as opposed to a prerecorded session. Finally, in the authors' experience, the AAP's HBB course materials lend themselves to convert easily to a virtual format.

A strength of this study design is that virtual participants were evaluated via the validated model of the in-person OSCE exam and knowledge check, which were administered on-site by a master trainer. In addition, a comprehensive assessment of learner confidence before and after the course was administered to these highly-trained learners. When creating or adapting a curriculum, it is important to concomitantly create a scholarly assessment of learning. To do so effectively, it is vital to measure participants' baseline confidence with the learning objectives. In this study perceived confidence was used as the surrogate learning marker. A successful learning process was demonstrated by increased confidence in participants' knowledge and skill acquisition, regardless of the individual starting point. This is especially important when assessing advanced learners, where small differences in confidence may equate with large clinical significance. This was easily achieved in this study using an extended Likert scale in the evaluation design. While the study population was composed of resident physicians previously certified in the AAP's Neonatal Resuscitation Program (NRP), the evaluation tool was able to appropriately measure improvement in learning, with high internal reliability.

A final advantage of this study design is that it was created and implemented by two resident physicians that were invested in this education initiative. Therefore, this project was developed with a limited supporting budget and is a cost-effective method for curriculum implementation. The authors received institutional grant funding to cover the AAP NeoNatalie newborn simulators, and the remaining HBB instructor educational materials are available free of charge on the AAP website. In addition, this course was offered through volunteer resident time and the use of medical school facilities at no additional cost.

There were some notable limitations to this study; however, the data presented in this manuscript represents the best available data on this topic. First, the small sample size limited the statistical analysis. There were stringent social distancing restrictions in place at the institution, impacting the number of participants per room. Nevertheless, this report is the first to examine virtual teaching of HBB and provide direct comparisons of virtual learning to in-person learning for HBB education. Although the sample size precludes the ability to draw strong inferences about non-inferiority, the finding of considerable improvement in preparedness, assessment, and skills confidence among virtual learners suggests its utility in this setting. The comparator in-person arm of this study also includes a condensed version of the HBB curriculum, precluding the ability to compare this to an existing standard practice for HBB. However, this decision was made to accommodate the time constraints surrounding in-person training. Further investigation to compare abbreviated and full-length HBB is needed but falls outside the scope of this study. In this instance, a two-hour course was appropriate. However, it is possible that the intangible benefits from lengthier group discussion could be lost. There are significant potential advantages to an abbreviated course as outlined previously. It is critical to continue to explore various course adaptations using alternative technologies and rigorously evaluate such methodologies.

Finally, HBB is traditionally taught to providers with significant variation in delivery room experience. This course was taught to residents at a United States-based residency training program who have all had previous resuscitation experience. This may limit the applicability to different populations. Despite this limitation, the course evaluation tools were able to detect learning among this highly trained group using the novel confidence assessment. All learners reported improved confidence with the course learning objectives. Furthermore, this improvement remained when correcting for the number of deliveries attended by both groups.

Conclusions

The value of the HBB education and training is widely known and highly acclaimed. The results of this study indicate a promising development in the HBB curriculum in the setting of the current pandemic. This study showed that HBB can be easily adapted into a virtual curriculum, demonstrates noninferiority to in-person learning. Utilizing virtual communication platforms, HBB may continue to impact the lives of neonates around the world without increasing the spread of COVID-19. Larger implications of this study include reaching more delivery providers globally by eliminating significant costs associated with HBB training trips. Additionally, virtual teaching may allow a greater network of care providers to be reached. A recent systematic review has shown that retention of HBB knowledge and skills decline over time.[8] Using a virtual, video-based platform could facilitate more frequent check-ins with providers and the addition of refresher courses. While the value of a video-based curriculum is highlighted, in some countries, where HBB could have a large impact, may have limited access to the internet. Even so, with the expansion of technology, more regions are accessible via internet-based communication than ever before.

Future directions include assessing this virtual course in a low-resource setting where traditionally in-person HBB courses are taught. Additionally, it would be useful to replicate this model with a larger sample size to increase the generalizability of these findings.

Author Contributions

CS: Sobelman conceptualized and designed the study, acquired the data, performed data analysis, guided interpretation, drafted the initial manuscript, and approved the final manuscript.
KR: Richard conceptualized and designed the study, acquired the data, guided the analysis and interpretation, contributed to drafting the manuscript, and approved the final manuscript.
PM: McQuilkin contributed to the conceptualization of the study, guided interpretation, critically revised the manuscript, and approved the final manuscript.
NF: Fahey contributed to the conceptualization of the study, performed data analysis, guided interpretation, contributed to drafting the manuscript, critically revised the manuscript, and approved the final manuscript.

Declaration of Conflicting Interests

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

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Supplemental Material

Supplemental material for this article is available online.

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