Effect of Educational Intervention on Neonatal Resuscitation Knowledge and Skill: A Quasi-Experimental Study among Nursing Students

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ABSTRACT

Background Neonatal mortality remains a major concern, with birth asphyxia being a leading cause. Neonatal resuscitation, performed by trained healthcare personnel, helps reduce perinatal mortality. This study assessed the effectiveness of an educational intervention on nursing students' knowledge and skills in neonatal resuscitation.

Data & Methods A quasi–experimental non-equivalent control group design was adopted among 80 undergraduate nursing students from two colleges in Kathmandu, with 40 each in the intervention and control groups. The intervention group received education and hands-on training using manikins. Pre- and post-tests were conducted using a structured questionnaire and observation checklist. Data analysis was done by using chi-square test, Mann-Whitney U test, and Wilcoxon signed-rank test.

Results The study revealed a significant improvement in post-test knowledge within the intervention group (median score: 49.0) compared to the control group (31.5) (p<0.001). While pre-test skill scores did not differ significantly, post-test scores were significantly higher in the intervention group (24.0) than in the control group (10.0) (p<0.001).

Conclusion Educational intervention with demonstrations effectively enhances neonatal resuscitation knowledge and skills among nursing students, emphasizing the importance of hands-on training for competence in neonatal emergency care.

Keywords: Educational intervention, knowledge, skill, neonatal resuscitation, nursing students

INTRODUCTION

Birth marks a challenging transition from fetal life to newborn stage [1]. This transition requires skilled intervention in approximately 10% of all deliveries [2]. Birth asphyxia, which occurs in the fetus or newborn due to lack of oxygen to various organs [3], remains a serious cause of mortality and morbidity [4]. Worldwide, birth asphyxia is responsible for approximately 23% of neonatal deaths and 29% of early neonatal deaths each year [5]. Many early neonatal deaths related to birth asphyxia in resource-limited settings have historically been misclassified as fresh stillbirths [6]. Persistent gaps in knowledge regarding birth asphyxia diagnosis and inadequate neonatal resuscitation skills have contributed to deficiencies in service quality [7]. The first minute after birth, known as the "Golden minute™", is the crucial period for initiating neonatal resuscitation [8]. This intervention is performed on newborns experiencing difficulty with airway, breathing and circulation [9], and serves as a primary response to birth asphyxia [10]. More than half of all deliveries occur in healthcare facilities, but the quality of resuscitation at birth remains insufficient. Identifying effective strategies to enhance and sustain neonatal resuscitation competency is essential for improving the quality of care [8].

Neonatal resuscitation is one of the most essential skills required to be learned by the nurses to save the lives of newborns. The success of newborn resuscitation depends upon the knowledge and clinical skills of health personnel as well as access to basic equipments [11]. A systematic review concluded that educational intervention on neonatal resuscitation can facilitate students in gaining knowledge and essential skills to get acquainted with complex medical contexts [12]. Hence, all health professionals should have the capacity to resuscitate newborn babies within one minute of birth to save the lives of newborns [11]. This skill is mandatory for the student nurses as this will help them in practical settings to handle emergency cases of birth asphyxia. There is a paucity of similar studies in Nepal, especially among nursing students. Therefore, this study aimed to provide educational intervention on neonatal resuscitation to nursing students, planned based on the Theory of Planned Behavior (TPB) [13], and to assess its effectiveness on their knowledge and skills. This study can add information on whether education combined with practical demonstrations can prove to be effective in enhancing the students' knowledge and skills as gaining clinical skills during this period can make them competent while they begin clinical practice [14].

DATA & METHODS

Study design and period

We used quasi-experimental non-equivalent control group design to evaluate the effectiveness of educational intervention on the knowledge and skills on neonatal resuscitation among undergraduate nursing students. The study was conducted from September 2022 to August 2023.

Study population and participant recruitment

The study population was undergraduate nursing students studying in nursing colleges of Kathmandu. We purposively selected two nursing colleges affiliated to Tribhuvan University, that is, Nepalese Army Institute of Health Sciences, College of Nursing (NAIHS-CON) and Patan Academy of Health Sciences (PAHS), following the same entry requirements. We restricted the study population to third year undergraduate (B.Sc.) nursing students since they are expected to assist normal deliveries. Therefore, they should have knowledge and skills of neonatal resuscitation in case of emergency. One of the two colleges was randomly assigned into experimental group. There were in total 80

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students in two colleges, with 40 in each. Total enumerative sampling technique was used to select the participants for the study.

Pre-intervention

Pre-test knowledge on neonatal resuscitation was assessed before the intervention by the researchers themselves using structured, self-administered questionnaire. The neonatal resuscitation skills were observed in the manikins by using observation checklist. The knowledge questionnaire was developed based on literature review and consultation with experts. It was pretested among the similar population followed by minor revisions based on the pretest results. It consists of 46 multiple choice questions in which four questions were multiple response type. The scores ranged from 0-55 (0-100%). Those providing 80% and above correct answers were considered to have good knowledge competency and those providing less than 80% correct answers have poor knowledge competency [15]. It took about 20-25 minutes to fill out the questionnaire on knowledge and next 20-25 minutes to assess the skill of neonatal resuscitation of each participant. Before collecting back the filled questionnaire, the participants were requested to check for completeness and accuracy of data. This was followed by observation of the skills in the manikins by using observation checklist. The checklist of neonatal resuscitation was adapted from the checklist for Helping Baby Breathe (HBB) developed by United States Agency for International Development (USAID) and Maternal and Child Health Integrated Program (MCHIP)[16] with some modifications. Each item was given either 0 for "No" or 1 for "Yes" with the total scores ranging from 0-27.

Intervention

The educational intervention package was developed by considering TPB as the behavioral change theory [13]. This theory believes behavioral intention as the best predictor of a behavior, which in turn is determined by behavioral attitude, subjective norms and perceived behavioral control that means perceived control over performance of one's behavior. In our study, we used two constructs: behavioral attitude towards practicing neonatal resuscitation skills and perceived control over performance of one's behavior to exhibit such practice. These ultimately influence one's behavioral intention followed by performing the behavior (Figure 1). The intervention package included information on assessment of newborn at birth, golden one minute, birth asphyxia, neonatal resuscitation, preparation of resuscitation, initial steps of resuscitation, indicators and technique of bag and mask ventilation, chest compression technique and decontamination of instruments after use. Then, an educational session using the planned educational package regarding neonatal resuscitation was provided by the researchers to the experimental group in their classroom using an interactive lecture of one hour followed by one hour of demonstration, and one hour of re-demonstration in the manikins. To increase compliance to the provided instructions, we tried as far as possible to make the package comprehensive and clear. We combined both theoretical and practical sessions along with demonstration and return demonstrations by the participants in the comfortable environment. Practical sessions were conducted by using manikins. The details of the intervention package are included in the supplementary file. In between the sessions, refreshment and stationaries such as, diary, pen and pencil were provided to all the participants.

Post-intervention

Post-test was performed in both groups 10 days after the intervention by using the same questionnaire and observation checklist as in the pre-test. Two observers were enrolled for assessing pre-test and post-test skills in the
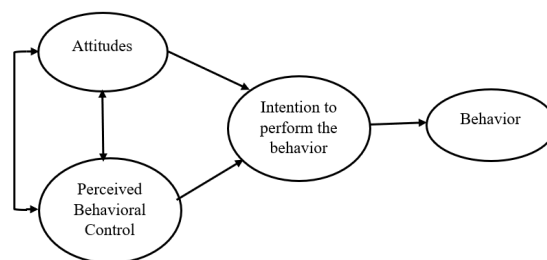

Figure 1: Modified Theory of Planned Behavior adapted from Ajzen 2005 [13]

experimental and control groups to reduce observer bias. The observers were briefly explained about the checklist but they were blinded to the allocation of the participants into experimental and control groups. Explanation of the procedure of skills assessment was provided to the participants. The skills were assessed among 25% of the total sample size, which was 10 in each of the intervention and control groups based on the availability of the participants because of the clinical posting of the students.

Data analysis

To compare the characteristics of the intervention and control groups, we used the chi-square test (for categorical variables) and the Mann-Whitney U test (for continuous variables). Mann-Whitney U test was used to evaluate
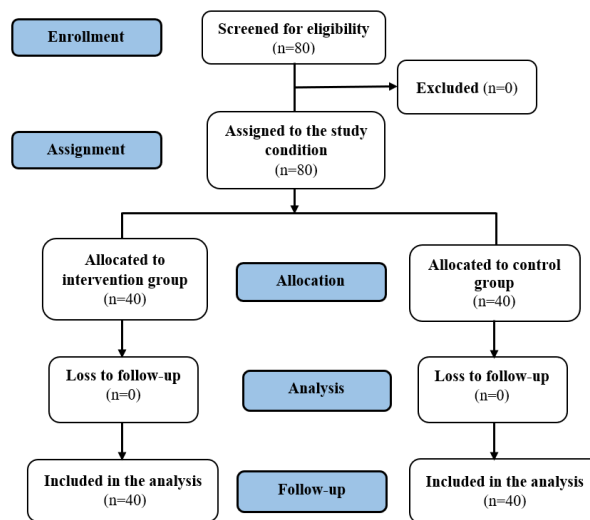

Figure 2: Participant flow diagram

the differences in pre-test and post-test scores between intervention and control groups. Similarly, Wilcoxon signed-rank test was performed to analyze the difference between pretest and post-test scores in each group. All the data analysis was performed in IBM SPSS statistics 29.0.1.0 (171) version.

RESULTS

Altogether 80 participants were enrolled in our study with 40 in each of the intervention and control groups. All the recruited students were present during the pre-test and follow-up in both the experimental and control groups. So, there were no non-response and loss to follow-up. Everything was performed as per the plan. Figure 2 presents the flow of the participants through each stage of the study.

Table 1 shows no significant difference between the intervention and control groups in terms of age, ethnicity

Table 1. Socio-demographic characteristics of the participants					
Socio-demographic characteristics	Intervention group (NAIHS) n=40		Control group (PAHS) n=40		p-value
	Number	Percent	Number	Percent	
Age (in years)					
19-20	5	12.5	9	22.5	
21-22	34	85.0	30	75.0	
>22	1	2.5	1	2.5	
	Median age (IQR): 21.5 (22.0-21.0)		Median age (IQR): 21.0 (22.0-21.0)		0.282*
Ethnicity					
Brahmin/Chhetri	27	67.5	21	52.5	0.171**
Janajati and others	13	32.5	19	47.5	
Religion					
Hindu	35	87.5	34	85.0	0.745**
Others	5	12.5	6	15.0	
*Mann-Whitney U test; **chi-square test					

Table 2. Effect of educational intervention on knowledge regarding neonatal resuscitation between the intervention and control groups					
Knowledge	Intervention group (NAIHS); n=40		Control group (PAHS); n=40		p-value*
	Median (IQR)	Average difference	Median (IQR)	Average difference	
Pretest	30.0 (29.0-30.8)	19.0	29.0 (29.0-30.0)	2.5	0.089
Posttest	49.0 (48.0-50.0)		31.5 (30.3-32.0)		<0.001
p value**	<0.001		<0.001		
*Mann-Whitney U test; **Wilcoxon signed rank test; IQR: Interquartile range					

Table 3. Effect of educational intervention on skills regarding neonatal resuscitation between the intervention and control groups					
Skills	Intervention group (NAIHS); n=10		Control group (PAHS); n=10		p-value*
	Median (IQR)	Average difference	Median (IQR)	Average difference	
Pretest	11.0 (1.0)	13.0	10.0 (2.5)	0	0.385
Posttest	24.0 (1.25)		10.0 (2.5)		<0.001
p value**	0.005		0.904		
*Mann-Whitney U test; **Wilcoxon signed rank test; IQR: Interquartile range					

and religion (p>0.05). The median age of the participants was 21.5 years in the intervention group and 21.0 years in the control group, and the age ranged from 19-25 years. The majority of them were Brahmin/Chhetri by ethnicity and Hindu by religion.

During the pre-test, we did not find a statistically significant difference in the median knowledge score between the two groups. However, during the post-test, there was a significant difference in the scores between the groups (p<0.001). The median knowledge scores in the intervention group and the control group were 49.0 and 31.5 respectively. (Table 2)

The median knowledge scores in both the intervention and control groups increased significantly during the post-test (p<0.001). However, the difference between the pre-test and post-test knowledge scores was higher (19.0) in the intervention group compared to the control group (2.5).

We did not find a significant difference in the pre-test skills scores between the intervention and the control groups (p=0.385), whereas during the post-test, the scores were significantly different between the groups (p<0.001). There was a statistically significant difference between the skills scores of pre-test and post-test in the intervention group (p=0.005) and no significant difference in the control group (p=0.904). (Table 3)

DISCUSSION

This study depicted significant increase in the median knowledge and skills scores among the nursing students after intervention. The difference in the scores between the intervention and control groups was not significant before intervention, whereas after intervention, the difference was significant.

Neonatal resuscitation training can provide the students essential knowledge and skills and prepare them in effective handling in the real scenario. Our study shows that the median knowledge scores regarding neonatal resuscitation which were not significantly different between the two groups during the pre-test came to be significantly different during the post-test (p<0.001). The median knowledge score in the intervention group increased from 30.0 to 49.0, while that in the control group increased from 29.0 to 31.5. We found a significant increase in the median knowledge score in both the intervention and control groups during the post-test (p<0.001). The difference between the pre-test and post-test knowledge scores in the intervention group was higher (19.0) than in the control group (2.5). This is in line with other studies which showed increased knowledge after the intervention [17–19]. Contrarily, Patidar & Kumar found a significant rise in the post-test knowledge score in the intervention or study group whereas no significant increase in the control group was observed [20]. The reason for the significant difference in both groups in our study might be that the assessment of knowledge during the pre-test itself might have sensitized the control group students to study neonatal resuscitation, which might have increased their knowledge during the post-test.

The development of clinical skills is regarded as an essential component of nursing education [21]. We found a statistically significant difference between the skills scores of pre-test and post-test only in the intervention group. This aligns with a previous study in which all participants in the intervention group achieved a full knowledge score and successfully demonstrated the appropriate skills following the intervention [22]. Pawase also found a significant difference between mean pre-test and post-test skills scores in the intervention group [17]. A systematic review depicted improvement of neonatal resuscitation skills through simulation training [12]. On the other hand, in a study by Liaqat et. al, the skill was significantly increased in both groups during the post-test while the mean difference in the skills was significantly higher in the intervention group [23]. This shows that the educational interventions provided to nursing students are effective in enhancing their neonatal resuscitation knowledge and skills, which can be helpful in making them competent and skillful enough to be able to provide the emergency care. The median pre-test skills scores between the intervention and the control groups were not significantly different, while the difference in the median post-test skills scores was found to be highly significant between the groups (p<0.001). This is supported by another study which showed a statistically significant difference in favour of the intervention group compared to the control group in increasing the skills score (p<0.001) [19].

Strengths and Limitations
The strength of this study was its design, that is, we used an intervention study by including both intervention and control groups between which we compared the results during the pre-test and post-test. In addition to the knowledge, we also assessed the skills of the nursing students through direct observation. However, there are a few limitations too. The knowledge and skills of the nursing students were assessed in a smaller sample within a short time interval (7-10 days) after the intervention. This limited the assessment of long-term retaining effects on the knowledge and skills of the participants. In addition, skills were assessed in only 25% of the participants since most of them had clinical postings during the period. This may introduce selection bias and limit the robustness of the skill-related findings. While the observers were blinded to group allocation, the participants were not blinded, which could introduce bias in the results. In addition, this study could not account for the effect of self-learning on the topic which could have confounded the effect of the intervention.

CONCLUSIONS
A significant positive effect was observed among the nursing students regarding their knowledge and skills after educational intervention. This study demonstrated that providing education with practical demonstrations to the future nursing workforce empowers them with the required knowledge and skills during critical moments of the life of neonates. This indicates the need to appropriately train nurses on neonatal resuscitation before starting their professional careers so that they can tackle the emergency confidently. Such studies can inform the academicians for the inclusion of neonatal resuscitation training in nursing education in order to enhance the competency and confidence in the nursing graduates. We recommend further large-scale intervention studies, particularly RCTs among a large sample in multi-centered settings. Similarly, studies assessing the long-term effect of interventions on knowledge and skills help to estimate the retention effect of the intervention. Moreover, future studies should evaluate comprehensive skill across all participants which could not be accomplished in our study.

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Authors' Contributions
SB: conceptualized and designed the research, did literature review, data collection, drafting and editing the manuscript; BK: conceptualized and designed the research, did literature review, data collection, analysis, and drafting and editing the manuscript; SS: involved in design of the research, literature review, data analysis and interpretation, drafting and editing the manuscript; RKB: did literature review and data collection for the research; NS: involved in data collection and analysis; LN: did literature review and data analysis. All authors reviewed the manuscript and agreed to be accountable for all aspects of the research work; SS is the corresponding author.

Ethical Approval Ethical clearance was obtained from the Institutional Review Committee of Nepalese Army Institute of Health Sciences, Sanobharyang, Kathmandu (Reg. No. 551). The participants were clearly explained about the objectives and nature of the study. Written informed consent was obtained to ensure the right to autonomy of the subjects.

Conflict of Interests The authors declare that there is no any conflict of interest.

Availability of Data Data will be made available upon request to the corresponding author.