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A STUDY TO ASSESS THE EFFICACY AND ACCEPTABILITY OF "APPS ON SICK NEWBORN CARE" IN NURSING STUDENTS

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Abstract

Objectives: *To evaluate the efficacy of "Apps on sick newborn care" in nursing students as defined by improvement in their knowledge scores (assessed by multiple choice questions, MCQ). The secondary objective was to evaluate acceptability of the apps in nursing students.*

Methods: *This cross sectional study was conducted on 56 undergraduate nursing students. Participants completed 20 MCQs before workshop. The one day workshop included 4 work stations; each mentored by two facilitators for a group of 14 students. Clinical case management of four topics namely i) triaging, ii) hypothermia and hyperthermia, iii) seizures and hypoglycemia and iv) feeding low birth weight and sick neonates were demonstrated on the interactive mobile device and poster wall charts at each work station. All students underwent pre and post workshop knowledge assessment. Their acceptability was evaluated on a five point Likert's scale followed by focus group discussion (FGD).*

Results: *The scores in MCQ improved significantly after the workshop (pre and post, 6.52 ± 2.25, 13.13± 1.61; p<0.001). The students achieved overall satisfaction from learning achieved in the workshop on sick newborn care.*

Conclusion: *Sick newborn care apps have a potential role for integration into the undergraduate nursing curriculum.*

Key words: Apps on sick newborn care, Standard treatment protocols, Focus group discussion,

Contributor's statement page

- Mrs. Poonam Joshi had primary responsibility for protocol development, analytical framework, enrolment of participants, and writing the manuscript. She would act as the overall guarantor of the manuscript.
- Ms Meena Joshi, and Dr. Anu Thukral, helped in execution of the study performed teaching sessions using educational apps during the training and contributed to the writing of the manuscript.
- Dr. Anu Thukral moderated the focus group discussion, performed the analysis of the focus group discussion and contributed to the writing the manuscript.
- Dr Ashok K Deorari participated in the development of protocol, provided analytical framework for the study, supervised the enrolment, contributed to the final outcome assessment and provided technical inputs into writing the manuscript.

Introduction

Neonatal health is the key to child survival and wellbeing. [1] Nearly 99% of all neonatal deaths occur in low and middle income countries due to infections, prematurity and asphyxia. [2] The main reason for high mortality is believed to be the lack of competent and adequately skilled health care professionals in general and nursing professionals in specific. [3] The nursing professionals act as a backbone of neonatal intensive care unit (NICU) and play key role in managing sick neonates.

Preparation of nursing professionals to work in NICU starts at the pre-service level. The nursing students are taught neonatal nursing in total 20 hours as per their curriculum recommended by the Indian Nursing Council (INC). Nursing faculty along with experienced neonatologists is continuously looking for new innovative technology to include in class room teaching along with conventional methods. Various teaching and learning methods on neonatal nursing including participatory learning method and webinars in the classroom have been already successfully tried using the high quality teaching and learning material available on management of sick newborn. [4, 5]

The available educational apps on “sick newborn care” is evidence based, prepared by experts in neonatology and neonatal nursing of the World Health Organization (WHO)-Collaborating Centre for Training and Research in Newborn Care, All India Institute of Medical Sciences (AIIMS) with the help of Neonatologists from South-east Asian Regional Organization (SEARO) region and now available on Android Google play for the learners. [6]

Use of the smart phones and tablets has become very popular in today’s society. Nowadays smart phones and tablets are being used as handheld computers for various purposes. Majority time technology available in these devices is used to update the social networking and to keep oneself well informed. They are also being used increasingly for instant communication, text messaging, downloading and reading e-books, image viewing, podcasts listening and sharing educational resources etc.[7] Educational app is the latest addition to the list of purposes.

Apps are the software programs that have been developed to run on mobile device (either available free or on payment) for the educational purpose. The sophisticated mobile devices (smart phones, tablets) have the special features of fast processors, improved memory, smaller batteries, handy and highly efficient operating system that helps in performing the complex functions. Currently there are approximately more than 20 apps available including this app on sick newborn care for nurses. These apps offer a novel method of providing alternative learning option in nursing education. [8]

Easy availability and access to mobile devices such as smart phones and tablets do give us an opportunity to reflect on the role of technology in education in general and nursing education in specific. The efficacy and acceptability of the device (mobile phone/tablet) based

application in improvement of knowledge among health care professional has been formally assessed by few researchers [5,9,10] but no one has assessed so far its efficacy and acceptability among under graduate nursing students. We therefore designed this study with the primary objective to evaluate the role of educational app on management of sick newborn available on smart phone and tablet in improving the knowledge of nursing students. An additional objective was to evaluate the acceptability of the app by the nursing students of a selected nursing college.

Material and Methods

Subjects and setting

This cross-sectional study, using mixed method approach was conducted in October 2014 in All India Institute of Medical Sciences, New Delhi, in which 56 under graduate nursing students were enrolled as participants. Teaching was imparted to the students in a single day workshop. Administrative approval was taken from the principal of the college. Written informed consent was taken from nursing students for the participation, and for focus group discussion (FGD) before enrollment into the study. It was assured that the findings would be used for the research purpose only.

Methodology

The workshop consisted of demonstration of the tool and interactive lectures by four teams (each team having 2 facilitators) on clinical case management on four topics namely i) triaging (rapid assessment and immediate management of emergencies), ii) management of hypothermia and hyperthermia, iii) management of seizures and hypoglycemia, and iv) feeding low birth weight and sick newborns. The poster wall charts were also used along with apps during the interactive sessions to promote effective problem based learning among the students at each work station. They were further given similar case studies to demonstrate in return.

During the topic “triage” nursing students learnt the approach used in rapid assessment and immediate management of sick newborn based on emergency signs. In “hypothermia and hyperthermia” work station the approach and management of a neonate with hypothermia/ hyperthermia was learnt. During the topic “seizure and hypoglycemia” the group learnt the cardinal differences between seizures and jitteriness and differential diagnosis of neonatal seizures. Further they learnt the approach used in the management of a neonate with seizure and hypoglycemia, the protocol for administration of the common antiepileptic medications and ongoing care. In the work station on “feeding of the low birth weight and sick neonate” the students learnt the approach to be used to decide the initial feeding method and the steps of spoon/paladai feeding and oro-/naso-gastric tube feeding. An independent team consisting of senior neonatologists supervised the workshop.

Outcome assessment

The methods and tools for imparting teaching and outcome assessment were standardized by conducting in-house discussion and mock runs. The baseline demographic data included age, basic educational qualification, residence, number of hours surfing internet daily and availability of smart phone etc. Primary outcome was improvement in knowledge (assessed by MCQ). Assessment of knowledge was performed by administering 20 MCQ's based on the topics covered in the modules. These questions were mainly factual questions, peer reviewed and validated by experts at the time of development of STP.

Secondary outcome of the study included assessment of the satisfaction from the perspective of the nursing students through Likert's scale and focus group discussion (FGD). The Likert's scale (five points) included 20 questions addressing to the feedback on content, its presentation, design, and application, teaching methodology, usability and overall satisfaction. The focus group discussion was carried out by a moderator and investigator experienced in holding FGD.

Sample size

A pilot study was done on 10 nursing students. The mean knowledge scores of the students were 4.1± 1.5 (2-7). Anticipating one unit increase in the knowledge score with the SD of 1.5 following the training, the estimated sample size was 26 with the assumed power of 90% at 0.05 level of significance. Due to easy availability all 56 available students were enrolled.

Data Collection

Unique number to each participant was assigned by the first author (PJ). After collecting baseline data including demographic profile, pre-test knowledge questionnaire was administered to the participants by the main investigator (PJ). Thereafter students were helped to download the apps by the facilitators. The teaching was imparted to the students about the use of apps in an overview session before beginning the workshop by the corresponding author (AKD). Students were divided in four groups (14 students in each group). Four teaching sessions were held at four work stations simultaneously on triaging, management of hypothermia and hyperthermia, management of seizures and hypoglycemia and feeding LBW and sick neonates using educational apps on smart phone. The students, who did not have smart phones, were provided with android tablets (in a small group of 6-7 students). Each session lasted for 45 minutes. The students were rotated among the stations. The post test knowledge questionnaire was administered and post workshop feedback on use of educational apps on sick newborn care was taken from the participants at the end of the workshop.

Focus group discussion (FGD) was held next day morning, at the same study site with 9 randomly selected nursing students, which lasted for 40 minutes. The aim of the discussion and

implication of participation in the study was explained to the participants. The moderator of the focus group (AT) and the principal investigator (PJ) ensured that each item on the agenda was discussed and each participant had sufficient opportunity to express their views. The FGD was conducted in English; the moderator facilitated the group and two independent people audio taped the proceedings separately and these were transcribed verbatim. One additional person noted key themes and monitored the non verbal interactions.

Data analysis

Collected data was coded and entered into Microsoft excel sheet and analyzed using SPSS 17.0. Mean and standard deviation for knowledge scores were computed. Paired t test was used, for establishing the significance of score gains, as the scores were assumed to have normal distribution. The level of significance was set at 0.05 level ($p < 0.05$). The satisfaction of the nursing students collected on five point Likert's scale was expressed as median (range) and mean (SD).

The FGD were recorded, transcribed, and the data transcripts analyzed qualitatively by two investigators independently (PJ, AT) and consensus on verbatim and generated themes was attained.

Results

Fifty six nursing students [age (years), mean ± SD, range, 21.34±0.69, (20-23)] from a selected nursing college participated in the workshop. The basic qualification of the participants was senior secondary (50/56, 89.3%) and graduation (6/56, 10.7%). Majority students were from urban area 54/56 (96.4%). All the participants were computer literate and comfortable with internet usage before participating in the workshop. All the students were doing at least one hour internet surfing daily for academic purpose. More than half of the participants (30/56, 53.6%) had smart phones with them. Nearly 50% of the students were using their mobiles for studying human anatomy, drug calculation, period of gestation calculation, and reviewing drugs etc. [Table 1]

The pre-training MCQ score of the participants was 6.52 ± 2.25. The training resulted in significant improvement in post MCQ scores (13.13± 1.61 vs. 6.52 ± 2.25, $p<0.001$). (Figure 1, Table 2)

The participants expressed their overall satisfaction from the workshop and felt that the workshop on sick newborn care using educational app available on smart phone was very useful for learning neonatology. The participants expressed their satisfaction with the content, its presentation, design of the app and method of teaching. All their doubts related to the covered topics were cleared. All the participants found the algorithm approach used for case

management very useful. They suggested "apps on sick newborn" care should be used for nursing students of other nursing colleges. (Table3)

Focus group discussion

FGD revealed that majority participants' expectations from the workshop on apps on sick newborn care were met, however two participants were expecting the workshop to be more practical, than just theory, but later reiterated that still the workshop was helpful in practical learning. Majority were satisfied with the content and its presentation. All agreed that the educational app was appropriate, handy, bed side tool, easily downloadable, easy to refer and can be opened at any time. All the participants expressed that "apps on sick newborn care" should be used for nursing students of other colleges. Some of the verbatim are presented in Box 1.

Many participants had desired for having more time than given at seizures and hypoglycemia and feeding work station. Majority students wanted questions of problem based type for their evaluation and more evaluations at repeated intervals. There were few who had faced difficulty in downloading the app due to non-availability of internet connection. There were some who did not have the smart phone at the time of study, but said they would download and use the app once they have the smart phones with them.

Discussion

This study demonstrated a significant increase in knowledge scores of the participants in sick newborn care. Following the workshop, participants expressed their satisfaction with the educational app and the methodology adopted in teaching sick newborn care in the workshop. They expressed their willingness to use the apps for learning neonatology and at the same time suggested that the apps on newborn care should be used for nursing students of other colleges.

The knowledge scores of the participants improved significantly after the training. These Apps on sick newborn care have not been tested before in nursing students at undergraduate level and this study is the first step towards formal teaching and assessment of the undergraduate nursing students' knowledge in neonatology using "apps on sick newborn care". The potential use of Apps in the classroom with existing smart phone technology has been already tried out by some researchers with favorable results.[11] Many researchers have also evaluated the efficacy of medical apps among the health care professionals and patients with successful results. [5, 11-14]

A study on use of apps for drug calculation [15] by health professionals has demonstrated higher accuracy in calculations in an interventional trial with a before and after design and comparison of the smart phone calculator. We also chose a before and after design to assess the effectiveness in terms of knowledge scores. However, in the present study immediate post-test gain in knowledge scores could be attributed to the possible spillover effect of the workshop. To find out the true gain in knowledge scores of the participants reassessment of knowledge score is recommended after some time gap, the same had been reported by a participant in the FGD.

This study used teaching of standard treatment protocols developed from evidence based practices advocated by world Health Organization (WHO). Inclusion of clinical demonstrations and return demonstrations using clinical case management in all four work stations helped the students in problem based learning in neonatology.

The triangulation of qualitative and quantitative results in our study suggested consistency and also showed that study findings were valid. This was rigorously designed study and first of its kind in the developing world assessing the efficacy and acceptability of "apps on sick newborn care" in undergraduate students. This opens a new way for teaching sick newborn care to the nursing students in the class room in developing countries.

In the present study facilitators for the workshop were experienced neonatologists and neonatal nurses trained in device based teaching. The participants expressed overall satisfaction with the content; and were comfortable with the use and the idea of implementation of "Apps on sick newborn care" in the class room. They were also satisfied with the teaching skills of the facilitators. However at the same time it was stated by some participants that the "apps on sick newborn care" are to supplement the class room teaching, not to replace the teacher.

In other nursing colleges nursing faculty's non-familiarity with the "apps on sick newborn care" at large might limit the use and transfer of knowledge related to sick newborn care to the undergraduate nursing students. So there is need to train the nursing faculty in using the educational apps on sick newborn care in all nursing colleges. Single centre study and absence of control group further limit the genarlizability of the findings. The study can be replicated in other settings using larger sample size.

Conclusions

Post workshop gain in the knowledge scores of the participants suggests that the training on the use of educational app on sick newborn care has the potential to improve the knowledge of the nursing students and appeared acceptable and user friendly for learning purpose. Though conventional teaching methods are still a part of the curriculum, the educational apps on newborn care can be seen as an effective and promising method for future nursing education and can be incorporated along with conventional teaching in the curriculum.

What is already known?

Smart phones and tablets are being used for communication and retrieval of information related to health care.

What this study adds to?

Educational Apps on "sick newborn care" available on smart phone and tablet can be considered for teaching learning activity in the class room.

Table 1: Demographic variables of undergraduate nursing students

n= 56

Variable	**f(%)**
Age (mean± SD), range	21.34±0.69, (20-23)
Basic qualification	
Senior secondary (10+ 2)	50 (89.3)
Graduation	06(10.7)
Residence	
Urban	54(96.4)
Rural	02(3.6)
Computer literate and comfortable with internet usage	
Yes	56(100)
No	-
Number of hours internet surfing daily for academic purpose	
One hour or more	56(100)
No	-
Using apps for studying	
Yes	27(48.2)
No	29(51.8)

Table2: Pre and post workshop knowledge scores of undergraduate nursing students

n= 56

Pre-workshop knowledge scores	**Post workshop knowledge scores**	**p value**
6.52 ± 2.25	13.13± 1.61	0.001

Table 3: Satisfaction scores of participants on Likert scale

SNo.	Category/Area	median (range)	mean ± SD
1	**Content**		
	• Learning objectives were clearly presented	4(3-5)	4.34±0.55
	• Content was related to learning objectives	4(4-5)	4.46±0.50
	• Content was explicitly clear, not ambiguous	4(2-5)	4.38±0.62
	• Content was easy to understand	5(4-5)	4.54±0.50
2	**Presentation of content**		
	• Flow diagram (algorithms) in STP were easy to follow	5(3-5)	4.61±0.53
	• Steps in Procedure/Skill video were clear	4(3-5)	4.38±0.59
3	**Design of the application**		
	• Design and color of the screen are appropriate	4(2-5)	4.04±0.63
	• Font size of letter is appropriate	4(2-5)	4.25±0.69
4	**Application**		
	• It is easy to access content of each link	4(2-5)	4.04±0.69
	• App makes it easy for me to learn sick newborn care	4(2-5)	4.04±0.69
	• Algorithmic approach is helpful in learning sick newborn care	5(3-5)	4.55±0.54
	• It promotes interactive session between the student and teacher	5(3-5)	4.48±0.57
	• All my doubts on the particular topic were cleared	4(3-5)	4.34±0.51
	• It will help me to hold bedside discussion with my teacher		

		4(3-5)	4.21±0.59
5	**Confidence**		
	• I am confident to use gained knowledge and skills in sick newborn care in future	4(3-5)	4.25±0.58
6	**Usability**		
	• I want to use the app for learning my neonatology	4(3-5)	4.36±0.52
	• It is user friendly	4(3-5)	4.41±0.56
	• It will keep my interest high in learning sick newborn care	5(3-5)	4.50±0.57
7	**Overall satisfaction**	4.5(3-5)	4.48±0.54
	• I am overall satisfied with educational application on sick newborn care		
8	**Suggestions**	5(3-5)	4.61±0.53
	• I would suggest these apps for nursing students of other colleges		

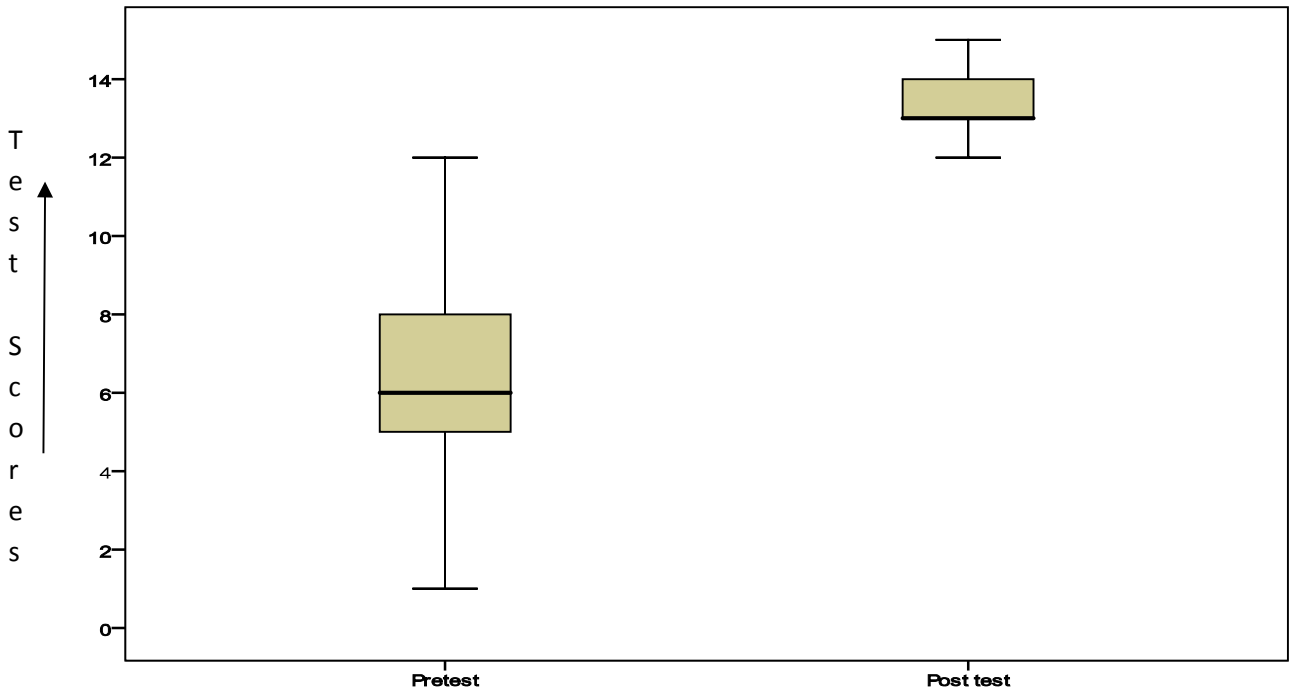

Figure 1: Gain in knowledge scores of nursing students after the workshop

Box1: Participants' views related to satisfaction, advantages, limitations and utility of educational apps- Some selected verbatim from FGD

Meeting the expectations

P1: Yesterday when I came, I thought this workshop would be practically oriented, I mean like NRP…. Doing bag and mask and all, but I found flow charts and theory. It did help me in learning about medication…, however it should be made more hands on type.

P2 : Both theory and practical aspects were covered in the workshop

P4: I felt like studying …. I really found it to be effective, means this course was different…earlier we used to study by presentations and with the use of ppts. It was little different and found it easy and appropriate …. Whatever was taught, it actually got into my mind.

P8: I was expecting it to be more practical, but it was more of a theory, but it will help me in my practical learning.

P9: It was quiet effective theory based practical learning.

Presentation of content

P5: All the flow charts, practical things and case examples were good.

P9: Algorithm and flow charts used in the workshop were easy to understand. Everything was classified, …..like different stations were there, where we were taking small topics, and learning

P1: Classes taken at stations matched with my level…

P4: All extreme situations were covered that helping in learning management of conditions.

P2: Clinical cases included were interesting.

P3: My expectations with the workshop were met.

Delivery of content

P6: I like the way it was taught. If simply giving flow sheets, we do not understand, we do not even think to read that, but if someone is teaching the flow chart in a particular way, we understand it easily.

Difficulties encountered in learning during the workshop

- Related to time schedule for stations

P7 andP1: More time is needed for learning intravenous fluids and medication…

P1: Medication part was little difficult to understand… Actually it is about feeds and intravenous fluids…case scenarios were not discussed… only little bit. More clinical problems could have been added.

P4: Rest was alright. We did not get time to learn calculations. We want to become perfect in administration of medication. We are following whatever is being followed (in the clinical area).

- Utility of apps

P9: I got the confidence after the workshop. When we are working in PHC/CHC, when there are no residents, we will able to tackle all the things like hypothermia, monitoring blood sugar levels without any command or instructions.

P2: we should be allowed to practice what is learned…., in clinical area.

- Suggestions related to course content and assessment

P6: There can be one station of jaundice in the workshop.

P9: Basic questions were there…. They can be improved, I mean more MCQs, little more difficult questions, problem based, case examples in assessment……..

P9: We want more frequent evaluations….may be at 4months, 6 months…

- Limitations

P4: I could not download yesterday due to non-availability of net connection…..

P9: Do not have android phone right now, but would download the apps once we have…..

-Usefulness for other nursing students

P9: In remote area if students have apps downloaded, they (students) can use and increase their knowledge, but……

P9: Apps alone will not be helpful without teacher…

P6:.If they have doubts; they need teacher to clear…

P8: They are to be taught how to manage a sick baby and gain skills otherwise merely looking at the book or app they will not learn.

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