



Midwifery Education in Practice

Blending virtual with conventional learning to improve student midwifery skills in India



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ABSTRACT

India's state of Bihar has suboptimal quality of pre-service training for auxiliary nurse midwives. To address this, state government of Bihar implemented a blended training model to supplement conventional classroom teaching with virtual training. A 72-hour virtual training package with updated content on key maternal and newborn health practices was developed for final year students and broadcasted from one instructor location simultaneously to two auxiliary nurse midwives training centres. This pre-post intervention study compared skills of two auxiliary nurse midwife student cohorts. Eighty-five students from pre-intervention cohort of academic year 2012–13, received only conventional teaching during the final year. The 51 students in the post-intervention cohort from successive academic year 2013–14, received a combination of the both conventional and virtual training. The two cohorts were objectively assessed on identified midwifery skills. A passing score was set at achieving 75% or higher. The students exposed to blended learning scored 32.57 points ($p = < 0.001$) more than their counterparts, who received only conventional teaching. In the post-intervention cohort, 55% students ($N = 28$) passed as compared to none in the pre-intervention cohort. We found blended learning approach effectively improved access to quality training, and identified key midwifery skills of auxiliary nurse midwife students from remote locations.

1. Introduction

Government of India (GoI) and Indian Nursing Council (INC) implement a two-year auxiliary nurse midwives course with an aim to provide basic health care services in rural areas of the country. This program of auxiliary nurse midwives came into existence in the year 1966 and students who successfully complete the course are registered as Registered Auxiliary Nurse Midwife (Mavalankar and Vora, 2008; INC, 2017).

Auxiliary nurse midwives are responsible for implementing the national health programmes apart from maternal and newborn child health care and family planning at the primary health care and community level. The curriculum followed by the auxiliary nurse midwife training centres covers basic competencies expected from a pre-service midwifery education to qualify as an auxiliary nurse midwife. However, the implementation of this curriculum in actual practice is not optimal (Sharma et al., 2015).

The Indian state of Bihar also offers this auxiliary nurse midwives

training course. There are twenty-one public sector auxiliary nurse midwives training centres in the state. The quality of the training is poor due to inadequate physical infrastructure, insufficiently equipped laboratories and libraries, a shortage of faculty, and a predominantly didactic teaching styles. This results in inadequate clinical experience and confidence in auxiliary nurse midwives after completing the course successfully before being deployed at health facilities (Evans et al., 2013; Anand and Ahmed, 2013).

The government of Bihar planned to test the feasibility of a blended learning approach through virtual training to address the poor quality of teaching at the public sector auxiliary nurse midwives training centres. This intervention provided the auxiliary nurse midwives training centres with modern information technology and expert trainers using standardized evidence based instructional package. This paper discusses on the effectiveness of this blended learning approach through virtual training in improving midwifery skills in auxiliary nurse midwife students of two public sector auxiliary nurse midwives training centres.

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Use of information technology such as virtual learning platforms have a potential to overcome the challenges being faced by training institutions in imparting quality education. The approach is increasingly being recognized globally as an effective way to enhance students' knowledge and skills (Austin and Balasubramaniam, 2012; Moazami et al., 2014). Moazami and colleagues concluded that virtual teaching methods improved endodontic skills among Iranian dental students when compared with conventional teaching (Moazami et al., 2014). Another study demonstrated the usefulness of a video-assisted teaching module in instructing nursing students in India about the care of dementia patients (Austin and Balasubramaniam, 2012).

To address the shortage of competent faculty and poor quality of education, the state government of Bihar initiated a virtual training program to complement conventional classroom teaching at selected public sector auxiliary nurse midwives training centre. This program was launched with an aim of introducing a blended learning approach (i.e., combining virtual with conventional training) for strengthening students' knowledge and skills and, ultimately, increase the availability of competent and confident auxiliary nurse midwives for deployment at health facilities. The objective of this study was to evaluate the effectiveness of blended learning approach model in improving identified key midwifery skills of auxiliary nurse midwife students in low resource settings. We believe that this study will generate evidence on the usefulness of blended learning approach through virtual training for enhancing the midwifery skills of auxiliary nurse midwife students from remote locations.

1.1. The blended learning approach

This blended learning model using a virtual training approach was implemented with conventional classroom teaching where the former acted as a complement to existing teaching and learning process. An updated 72-hours virtual training package was designed based on the midwifery curriculum for auxiliary nurse midwives by the INC incorporating GoI guidelines for maternal and newborn health care, family planning and reproductive health. This 72-hours training package was delivered in a structured manner in two hourly sessions three times in a week. In total, students attended 36 sessions (72 hours) of virtual training over a three-month period. Each session included theoretical knowledge on the concerned topic delivered through interactive PowerPoint presentations, technical content with questions and case scenarios followed by live demonstrations from the expert faculty using mannequins and models through the virtual platform. All the students had the opportunity for two-way interaction between the instructor and remote auxiliary nurse midwife training centres for discussions, feedback and clarification of doubts. Hence, this session was a mix of theory, practical, discussion, decision making through case studies and exercises and interactive learning. At the end of each session, assignments were given to students as number of cases for practice at the skills lab and attached clinical sites. Regular supportive supervision visits were conducted by the program staff to the auxiliary nurse midwives training centres throughout the duration of trainings and thereafter to follow-up on the post-training learning process. Feedback was taken from the faculty on the assignments given to the auxiliary nurse midwife students during virtual training sessions. It was ensured by the training centre coordinators, facilitators and instructors that students practise skills in the skills lab and at the attached clinical practice sites. Table 1 shows the content of the 72 hours virtual training package.

To deliver the virtual training package, the state government of Bihar installed the hardware and software necessary for establishing virtual classrooms at four public sector auxiliary nurse midwives training centres. The college of nursing at the Indira Gandhi Institute of Medical Sciences in Patna was chosen as the virtual training instruction delivering site to the identified auxiliary nurse training centres because it had qualified and trained nursing faculty, adequate training infrastructure, and a well-equipped maternal and child health skills

Table 1
Components of virtual classroom training package.

| Component | No of hours |
|---|-------------|
| 1. Antenatal care | 17 |
| 2. Intra-natal care and immediate postpartum care | 27 |
| 3. Postpartum care | 6 |
| 4. Newborn care | 8 |
| 5. Family planning | 4 |
| 6. Other (e.g., breast and cervical cancer examinations, IV drug initiation, catheterization) | 10 |
| Total | 72 |

laboratory with all required simulation models, mannequins, equipment, and training materials.

Final year auxiliary nurse midwife students attended virtual training sessions to complement conventional classroom instruction. The virtual classrooms enabled these students of remote training centres to access high quality learning content, view live simulated skills demonstrations, interact with experienced and qualified faculty, and practice midwifery skills on simulation models and mannequins under virtual supervision.

2. Methods

2.1. Study design

This study employed a pre- and post-intervention design without a control group. Data collection was conducted among cohorts of auxiliary nurse midwife students of the two public sector auxiliary nurse midwives training centres in Bihar (located 54 and 77 miles away from the instruction site college of nursing in Patna). Virtual projection set-ups were installed in four auxiliary nurse training centres; however, data collection was restricted to only two training centres due to unavailability of eligible students at the remaining institutions during both phases of data collection. The pre-intervention cohort consisted of auxiliary nurse midwife students who completed their maternal and newborn health training through conventional classroom learning in the academic year 2012–13, prior to the introduction of the virtual training package. They were having their final year practical examination by the time the virtual training set-up and package were complete. Their presence served as a baseline to compare the results of the virtual training for the successive batch as this batch would also experience the same conventional classroom learning as the previous batch but would also have the experience of virtual training through the blended learning approach model. The post-intervention cohort of academic year 2013–14 consisted of students at the same institutions who completed their maternal and newborn health training in the following academic year 2013–14 through a blended learning approach that included the 72-h virtual training package in addition to conventional classroom learning. For the virtual training, the components of the midwifery section of auxiliary nurse midwife curriculum was identified in alignment with GoI guidelines for skilled birth attendance (GoI, 2010). Based on the content of the virtual training, a set of maternal and newborn health related skills were identified. A standard objective structured clinical examination (OSCE) checklist detailing all the sequential steps for each skill was developed. Each component of the checklist was tested in the field and also proof read by the technical experts of the technical advisory group of INC before finalization.

2.2. Study participants and sample size

This study was approved by the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health. The eligible students for inclusion in this study were the final year ones from the selected two auxiliary nurse midwives training centres who had

Table 2
Comparison of Mean OSCE scores in pre-intervention and post-intervention cohorts using independent sample *t*-test.

| Skill | Maximum possible score | Mean score (SD) | | | |
|--|------------------------|----------------------------------|-----------------------------------|---------------------|---------------|
| | | Pre-intervention cohort (n = 85) | Post-intervention cohort (n = 51) | Difference in score | P value (df) |
| 1 Management of second stage of labour | 12 | 2.41 (1.92) | 8.76 (2.51) | 6.20 | < 0.001 (134) |
| 2 Active management of third stage of labour | 10 | 4.35 (2.44) | 8.41 (1.85) | 3.95 | < 0.001 (134) |
| 3 Essential newborn care | 10 | 2.55 (1.34) | 7.78 (1.71) | 5.20 | < 0.001 (134) |
| 4 Newborn resuscitation | 12 | 1.32 (2.18) | 8.37 (2.61) | 7.02 | < 0.001 (134) |
| 5 Partograph plotting | 12 | 0.43 (1.18) | 4.98 (4.08) | 4.55 | < 0.001 (134) |
| 6 Infection prevention | 20 | 13.44 (3.94) | 18.78 (1.60) | 5.34 | < 0.001 (134) |
| Total score | 76 | 24.52 (8.45) | 57.09 (8.35) | 32.57 | < 0.001 (134) |

completed the course related to maternal and newborn health either by conventional teaching (pre-intervention cohort) or through conventional and virtual training i.e. blended learning (post-intervention cohort). Sample size calculation was not conducted as all eligible students were invited to participate in this assessment. A total of 85 students in the pre-intervention cohort and 51 students in the post-intervention cohort were consented and participated in the study.

2.3. Data collection

Identified key midwifery skills around the time of childbirth for the auxiliary nurse midwife students were assessed using OSCE. This examination covered the following six key midwifery skills: 1) management of the second stage of labour, 2) active management of the third stage of labor, 3) essential newborn care, 4) newborn resuscitation, 5) plotting and interpretation of partograph and 6) infection prevention. The maximum possible score for each OSCE skill station is shown in Table 1; the highest possible total score was 76 points. Competency was defined as scoring 75% or higher (57 or more points) averaged across all six skill stations.

On the day of the assessment, six separate stations were set up to evaluate the competency of the auxiliary nurse midwife students. Simulation models, mannequins, and scenario-based questionnaires were used to assess their skills and decision making abilities. Six students were assessed at a time, one student per station. Each student spent 10 minutes at a station before moving on to the next one, and it took approximately 60 minutes for six students to complete the entire OSCE process. Each station was manned by a standardized observer faculty who watched and scored the performance of students on their OSCE skills checklist. It was ensured that auxiliary nurse midwife students waiting to be assessed were not exposed to any of the skill stations prior to their turn.

A total of six observers were trained for data collection and their skills standardized in preparation for OSCE skills assessment. They were trained through a two day 'skills standardization workshop' by technical experts of the study team. During the training, the observers were oriented on assessing skills of the students by observation without prompting, scoring the standardized skills checklist ensuring their privacy and confidentiality. During the data collection, the observer's role was to observe the student's skills as per the checklist and note down the performed and unperformed steps for every step of each skill. The observer had no interaction with the student and had no access to any personal identifier of the student. The scores of the students were not shared with the school. Verbal consent was obtained from all study students prior to the assessment. No personal identifiers of any kind were collected from students. Data were collected from the pre-intervention cohort in February 2013 and from the post-intervention cohort in June 2014.

2.4. Data analysis

Data were analysed using the IBM SPSS Version 22 software package. Mean student scores and the percentage of students who achieved competency in each cohort were calculated and compared for statistical significance using an independent *t*-test and Pearson's Chi-square test, respectively. Since the two student cohorts were independent of one another, independent *t*-test was performed to check for significant differences in the mean score between the two cohorts. The maximum allowable alpha error considered was 5%. Linear regression modelling with robust standard error estimation was performed to adjust for the clustering effect by school.

3. Results

All study auxiliary nurse midwife students (all female) completed their final year, either through the conventional learning (pre-intervention cohort) or blended learning approach (post-intervention cohort). There was a significant difference of 32.57 points ($p < 0.001$) in the mean scores of the pre-intervention cohort (24.52 points, SD 8.45) and the post-intervention cohort (57.09, SD 8.35). Mean scores for all six practices also increased significantly from pre-to post-intervention assessments (Table 2).

Competency levels differed significantly ($p < 0.001$) between the two cohorts: none of the 85 students in the pre-intervention cohort achieved the cut-off score of 75%, compared with 55% (28 of 51 students) of the post-intervention cohort (Table 3).

Linear regression analysis was performed to adjust for the effect of clustering with robust standard error estimation. On average, students in the post-intervention cohort scored 32.9 points (95% CI 4.1–61.8) more than students in the pre-intervention cohort, and the difference was significant ($p = 0.04$). The difference in average scores between the two auxiliary nurse training centres was just 1.4 points (95% CI 6.1–9.1%), which was not statistically significant ($p = 0.24$) (Table 4).

4. Discussion

Teaching in resource-constrained settings is a challenge due to poor infrastructure, lack of qualified faculty, and limited resources (Evans

Table 3
Competency of students in pre-intervention and post-intervention cohorts using Chi-square test.

| | Pre-intervention cohort | Post-intervention cohort | P value (Chi Square) |
|--------------------------------------|-------------------------|--------------------------|----------------------|
| Competent (OSCE score \geq 75%) | 0 (0%) | 28 (54.9%) | < 0.001 df (1) |
| Needs improvement (OSCE score < 75%) | 85 (100%) | 23 (45.1%) | |
| Total | 85 (100%) | 51 (100%) | |

Table 4
Linear regression of mean scores adjusted for clustering by schools.

| Difference in mean score between: | Adjusted mean difference (95% CI) | P value (t-test) | Coefficient of determination Overall P value (F test) |
|------------------------------------|-----------------------------------|------------------|---|
| Pre- and post-intervention cohorts | 32.98 (4.15–61.82) | 0.04 | 0.7 < 0.001 |
| Schools | 1.4 (–6.17–9.14) | 0.24 | |

et al., 2013; Nandan et al., 2007). Our study found that blending virtual training with conventional classroom learning significantly improved midwifery skills of auxiliary nurse midwife students, as measured using OSCE. More than half (55%) of the students were found competent (scored 75% or more in OSCE) in the key midwifery skills during post-intervention assessments. Another study conducted among medical students of university of Queensland, Australia, also found that blended learning (e-learning incorporated with classroom teaching) approach resulted in a higher level of student's performance in newborn examination on standardized assessment as reflected by increased mean scores in the intervention group than that of control. The study concluded that blended learning approach can be used for improving the skills and performance of midwives (Stewart et al., 2013).

Studies conducted in the past, support the argument that virtual trainings are effective in knowledge gain and skills improvement of the attendees (Kumar, 2010; Elarousy, 2014). In 2010, a study conducted in India (Kumar, 2010) found video-assisted teaching useful in improving knowledge regarding needle stick injuries among staff nurses in experimental group (88%) as compared to control group (37.8%) which was statistically significant ($p < 0.001$) similar to our study. A study in Saudi Arabia, evaluated effectiveness of e-learning and found improved performance related to newborn resuscitation procedure of nursing students exposed to e-learning along with conventional classroom teaching, compared to control group who were exposed to only conventional classroom teaching though not statistically significant (Elarousy, 2014). Other studies also reported no significantly effective improvement in knowledge and skills of students exposed to blended learning approach. (Bertsch et al., 2007; Hortos et al., 2013). However, in our study, the difference in the mean student scores as well as level of competency was statistically significant.

Our intervention used the combination approach of blending conventional classroom teaching with virtual training for improving the midwifery skills of auxiliary nurse midwife students. The usefulness of similar blended learning approach as this study has already been demonstrated among students from general nursing schools in Bihar (Agrawal et al., 2016). Our study suggests that virtual training is an effective complement to conventional classroom learning for auxiliary nurse midwife students even in remote locations with limited resources.

The main advantage of this blended learning approach model was that theory and skills demonstrations were simultaneously done during each session, so that students gained knowledge and applied skills at the same time. In Bihar, this platform also allowed standardization of skills across institutions by exposing students to the same curriculum and qualified instructor.

This blended learning approach in Bihar also aimed at improving the readiness to practice post-course completion by the auxiliary nurse midwives. A survey conducted in a school of midwifery, New Zealand to evaluate the effectiveness of blended learning approach and its integration in their midwifery curriculum showed more readiness among participants in delivering the care (Patterson et al., 2015). Similarly, post-intervention tracking is required for these auxiliary nurse midwife students who were exposed to the virtual training through blended learning approach model to see their willingness and confidence to practice in real facility settings.

Malauzdi and Chyun commented that the use of innovative methods

like virtual platform for midwifery education enables students to actively engage with their curricula and thereby help in improving their knowledge and skill building (Mulauzdi and Chyun, 2015). Most of these studies have been conducted in developed countries with better infrastructure to utilise blended approach in learning but their contribution is greater when qualified faculty and instructors are scarce, as is the case of many auxiliary nurse midwives training centres in Bihar.

Our program was designed not to replace conventional learning with virtual training, but rather use a blended approach to improve the midwifery skills of students. Apart from blended learning, post intervention follow-up meetings were also conducted in the form of supportive supervision visits by the study team to ensure continuous skill building for post-intervention cohort irrespective of their competency status thus giving an equal opportunity for each student to enhance the skills during their internship. The faculty demonstrated and evaluated all students on the taught skills and ensured that auxiliary nurse midwife students independently practice in the skills lab in order to achieve the desired level of competence.

5. Study limitations

There are some limitations associated with this study. We assessed final-year auxiliary nurse-midwife student relying on an objective structured clinical examination using models and case scenarios to assess clinical competency, rather than observing students with real patients. We found this to be the best alternative possible, given that students are not allowed to treat patients independently before completing a mandatory supervised internship at a clinical practice site. We assumed that the students of the two cohorts assessed before and after the intervention were different, because it was impractical to assess the same students before and after the implementation of the intervention. Only students who had completed their course work by conventional teaching (pre-intervention cohort), or through a combination of conventional and virtual training. We assumed that students in consecutive academic classes at the same institution would have similar in personal characteristics and would be exposed to the same standard of conventional classroom learning. Unfortunately, having a control group was not feasible due to logistical issues.

6. Conclusions

Introducing virtual training as part of a blended learning approach is an effective model in improving key midwifery skills among auxiliary nurse midwife students. The approach is especially useful for educating students who attend training institutions that have limited faculty and infrastructure. Based on the study findings, we hypothesize that in the future, the blended learning model will be able to prepare more competent and confident auxiliary nurse midwives than conventional training. Through this training, auxiliary nurse midwives will be able to ensure better practices during institutional deliveries, thereby contributing to an impact in reducing the mortality and morbidity among mothers and newborns. While the implementation of virtual classrooms proved feasible in this setting, further research is needed on the cost-effectiveness and feasibility of the intervention before it is scaled up.

Conflict of interest

None to declare.

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Ethical approvals

This study was approved by the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health.

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