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ORIGINAL SCIENTIFIC REPORT

A Distance Blended Learning Program to Upgrade the Clinical Competence of District Non-doctor Anesthesia Providers in Nepal

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Abstract

Background Across Nepal, anesthesia at a district level is provided mostly by non-doctor anesthesia providers (anesthesia assistants—AAs). Nepal's Government recognized the need to sustain competence with continuous professional development and to upgrade 6-month trained working AAs to professional equivalence with the new national standard of 12-month training. As they are essential district health workers and AA clinical training sites are full, an innovative distance blended learning, competency-based, upgrade 1-year course was developed and conducted in 2014–2017 for two batches.

Methods The course content was developed over 18 months by a team of Nepali and overseas AA training experts. The 1-year course started with a refresher course, continued with tablet-based 12-month self-learning modules and clinical case logs, regular educational mentor communication, midcourse 2-week contact time in an AA training site, regular text messaging and ended with clinical examination and multiple-choice questions. Tablet content included 168 new case studies, pre- and posttests, video lectures, matching exercises and a resource library. All module work and logged clinical cases were uploaded centrally, where clinical mentors were able to review work. Clinical skills were upgraded, as needed, through direct clinical contact midway through the course. Quantitative and qualitative course assessments were included.

Results Fourteen working AAs in first batch and eight working AAs in second batch from district, zonal and mission hospitals across Nepal were enrolled. All remained working at their hospitals throughout the course, and there were no significant tablet problems inhibiting course completion. Twenty-one AAs completed all modules successfully with time required for module completion averaging 19.2 h (range 11.2–32). One AA left the course after 3 months with a personal problem. Subjectively, AAs felt that the obstetric and pediatric modules were more difficult; lowest marks were objectively seen in the airway module. Clinical mentors averaged 8.2 h mentoring review work per module with direct student communication of 2.9 h per module per month. Participants logged a total of 5473 clinical cases, ranging between 50 and 788 cases each. Complications were recorded; outcomes were good. Challenges were the national IT infrastructure making data synchronization difficult and the lack of clinical exposure at some AA's hospitals. Nineteen AAs attended the final examination, and all passed. Two AAs withdrew before the final examination period due to personal and logistic reasons.

Conclusion This is the first use of distance blended learning to upgrade district health workers in Nepal and perhaps for non-doctor anesthesia providers globally. Key success factors were motivated students, cultural and contextualized clinical content, good educational mentoring relationships with regular communication, central IT and motivational support, and face-to-face midcourse clinical contact time.

Introduction

Nepal is a landlocked low-income country with difficult terrain limiting transportation. Despite these difficulties, Nepal seeks to ensure essential surgical services for the rural population. Anesthesiologists in the country are few in number and concentrated in urban settings, and this disparity is addressed through task shifting by training midlevel providers in anesthesia: anesthesia assistants (AA) [1].

To meet the need for comprehensive essential obstetric care (CEOC) and essential surgery across rural Nepal, the Nepal Government sanctions, and supports, delivery of anesthesia at district level by anesthesia assistants (AAs) [2]. From 2002 until 2011, 94 AAs were trained in a 6-month pre-service program. These AAs were trained in designated hospitals by qualified physician anesthesiologists with experience in training AAs. To enroll in the course, the participant had to be either a staff nurse or health assistant (highest academic degree for paramedics). Since 2012, a 12-month AA training program which replaced the 6-month program has been running annually within the country, delivered by the National Academy of Medical Sciences, a government university. There are 14–20 participants trained every year. There remain forty-six 6-month trained AAs working actively across Nepal [3].

In 2011–2012, The Nick Simons Institute (NSI) conducted the "Follow-Up and Enhancement Program"(FEP), involving brief assessment and training in the rural AA's hospitals, and found that most AAs conduct a large number of cases, many complicated, with infrequent or no anesthesiologist present and that AAs had no continuing training to support their professional career [3].

Maintaining competence and a consistent presence through educational support are important components of the provision of essential surgical services at district hospitals. However, all national AA training sites were saturated with fresh students, and it is better if each AA remains in his/her post throughout any educational upgrade; so distance blended learning became the solution that allowed this to happen.

Computer-based learning (CBL) is commonly used by medical professionals for distance education. Distance learning is seen as having a positive effect on student performance with more types of teaching methods, more student flexibility and cost effectiveness [4]. Blended learning (BL) is defined as the combination of computer-based learning and traditional face-to-face teaching. Frehywot et al. [4] in a review found that low- and middle-income countries (LMIC) primarily use blended learning in pre-service medical education, particularly for those in rural areas. However, the authors were unable to document any studies of distance blended learning courses used for in-service, clinical-skill-based trainings in LMIC [4].

The Nepal Government accepted a proposal by the Nick Simons Institute to upgrade the 6-month trained non-doctor anesthetists (AAs) to the equivalent of 12-month AAs through a distance blended learning (DBL) course. This paper will review the results and our experience with conducting the DBL anesthesia assistant upgrade (AAU) course for two batches of students between June 2014 and February 2017 and as an effective model for upgrading of isolated essential health workers.

Materials and methods

The anesthesia assistant upgrade (AAU) course consists of a 12-month program of structured distance learning of core material consisting of case studies and lectures, 2-week intensive direct clinical training, recording of clinical cases and supplemented by a week of refresher course. Regular structured mentor–AA educational support by phone call and text message reinforced the content and continued throughout the program (Table 1).

Tablets were used as the primary educational platform, due to ease of use and lack of reliable Internet access in most parts of the country for these workers. The tablet used was an Acer model B1-710 at a cost of $200 each. The total course cost was $50,000 and included tablets ($4400),

Table 1 Major educational elements in the course

Educational elements	Duration
1. Refresher course (knowledge and skill)	5 days
2. Twelve modules on tablet including case studies, video lectures and pre- and post-module examination	12 months
3. Direct educational mentoring via phone and e-mails	12 months
4. Clinical, in-hospital, midcourse contact time in training center	2 weeks
5. E-logbook recording	12 months
6. Regular text message on module content	12 months

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software development ($7000), and mentors payment and other logistics such as transport costs for face-to-face teaching times and examinations as well as maintenance of the software used ($38,000). All of these costs were financed by the Nick Simons Institute.

Upon completion of all the required elements, the students took the final examination consisting of multiple-choice questions, clinical skills testing and an oral examination.

The Nepal Government's National Health Training Center ratified and approved the course; it was developed and run by the Nick Simons Institute, Kathmandu, Nepal. The course was run from April 2014 to April 2015 for the first batch and from January 2016 to February 2017 for second batch.

Results

In the first batch, fourteen anesthesia assistants were selected, and in the second batch, eight were selected. Their working facilities included community, district, zonal and regional hospitals. They were all fully qualified and experienced staff nurses or health assistants (the highest paramedical cadre) and had already been trained in anesthesia on the 6-month program, and all were actively providing anesthesia in remote places in Nepal.

Computer-based learning (CBL) modules: measuring knowledge and confidence

Participants must score a minimum of 80% in each post-module MCQ examination, before being able to pass on to the next module. The result of post-module multiple-choice questions (MCQs) averaged 87.65% with average case studies result being 90.6%. There was improvement noticed in knowledge as well as manikin and patient care skills, tested before and after the course as shown in Fig. 1.

The post-module evaluation showed the average time per module was 19.9 h (range 11.2–32 h). As per the students' feedback, case studies and video lectures were deemed the most effective way to learn the material. Subjectively, AAs felt that the obstetric and pediatric modules were more difficult; but lowest marks were actually seen in the airway module. Time required for clinical mentoring averaged 8.2 h per module with direct student communication averaging 2.9 h per module per month.

Twenty-one participants completed all modules on schedule, while one left the course after 3 months due to a personal problem.

Logbooks: measuring practice

AAs were consistent at recording, and a total of 5473 cases were logged by the twenty-one participants with the case range from 50 to 788 per year per student. This is possibly the largest number of directly logged, electronically recorded cases by non-doctor anesthesia providers

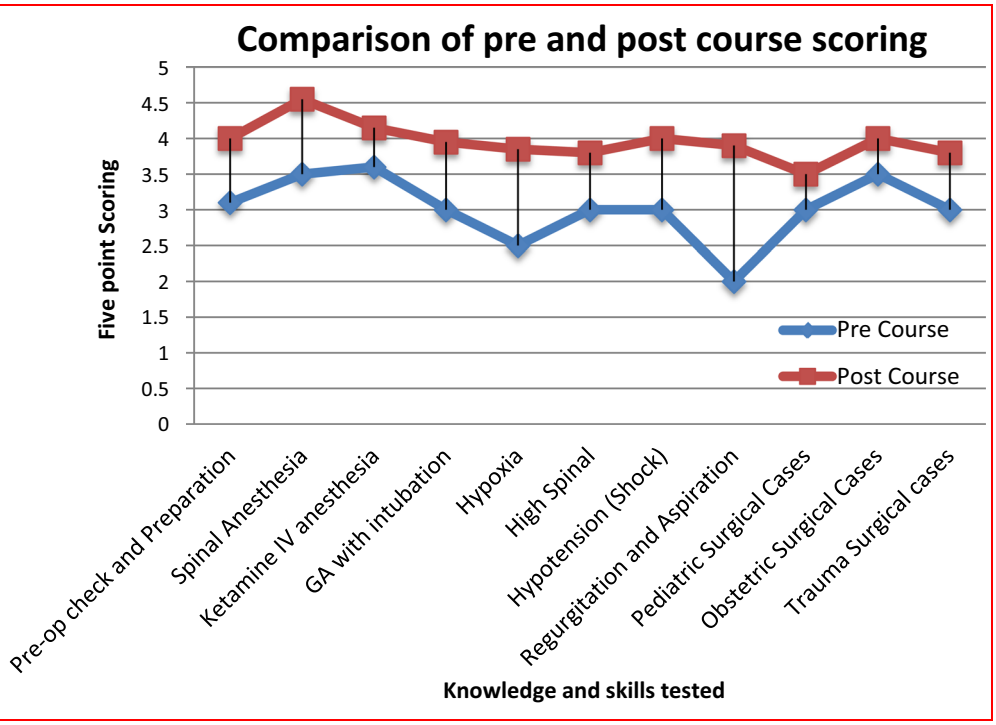
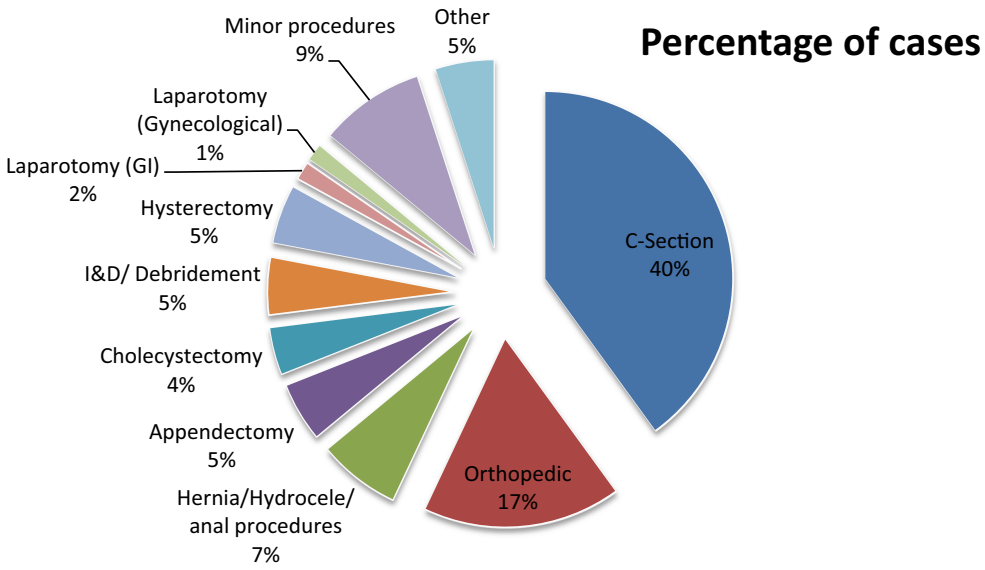


Fig. 1 Comparison of pre- and post-course scoring on knowledge based on questions and skill on manikin

Fig. 2 Overall case records



anywhere in the world. Very low caseloads were seen at hospitals in the region with the most remote districts (the Far-Western region), and highest caseloads were recorded at a mission hospital in western Nepal.

40% of the recorded cases were caesarian section of which 99% received spinal anesthesia. Ninety-one laparotomies (2% of total cases) were recorded. Nine hundred seventeen (17% of total cases) cases were of orthopedic surgery which includes closed reduction as well as open reduction. Percentage of distribution of cases is shown in Fig. 2.

Complications were recorded in 7% of the cases, the commonest being hypotension (67%) during spinal anesthesia, managed with a vasoconstrictor and IV fluids. There was one case recorded with high spinal block leading to cardiac arrest, which was successfully managed, with no neurological sequelae.

Final examination

The final examination system used was the same as that currently used in the national 12-month anesthesia assistant final assessment process, combining, written, oral and clinical examinations. Nineteen out of twenty-one students appeared in the final examination; two students withdrew just before the examination due to personal and logistic reasons. The written examination consists of multiple-choice questions which had a mean score of 88.98% (range 82–97.3%). The oral examination's mean score was 87.8% (range 80–95%); all participants passed. The five clinical skills tested were basic life support (BLS), ketamine anesthesia, intubation, spinal anesthesia and the pre-anesthesia checkup (PAC). The average result was 89% (range 80–95%). All the AAs who presented in the final examinations passed using the 1-year AA course benchmark of 80% for a pass mark.

Discussion

Keeping essential health-care workers at their posting, while ensuring continued professional development, is a challenge for developing countries. Taking the best of distance learning and concentrated clinical contact time along with regular mentoring is an effective way to mitigate this challenge. Our experience showed that we were able to satisfactorily upgrade essential AAs to the national standard without compromising patient care at their places of work.

All participants, with modest English and computer proficiency completed the course content, regularly completed e-logbooks and demonstrated increased knowledge and clinical skills while remaining at their posts. When selecting the students, attitude and motivation was a key component to the selection process. They had to be willing to do the learning outside of their regular hours of work with no extra compensation.

A common problem in LMICs is trying to utilize content that has been developed in high-resource countries [4]. In contrast, the anesthesia assistant upgrade blended learning course (AAU) was developed over 18 months by a team of Nepali and overseas physician anesthesiologists (from the UK and Australia) who are experienced in anesthesia assistant training in Nepal. The developers worked in collaboration with the Nick Simons Institute in the development of the anesthesia assistants to improve the surgical services in rural Nepal.

Other challenges include bridging the digital knowledge gap in students and instructors [5]. In this course, orienting the students to the application and tablet took only 2 h and was done on the first day of launch week which was practiced over next four days. By the end of the week, all were comfortable with the application navigation and how to do the various learning exercises.

With each module, a few of the students experienced technical difficulties with the application. Most of the difficulties were in synchronization, due to poor WiFi Internet connections at their location. The lack of national IT infrastructure presented one of the challenges to the smooth implementation of delivering the AAU content through the tablets. Sometimes in the most remote locations, it could take a week to synchronize work for the mentor to review.

Westover and Westover [6] found that blended learning was superior to straight distance learning e-courses in student performance and retention because of the direct contact with the instructor. By starting the course with hands-on training, the mentors were able to assess the baseline for each of their students and develop a good relationship with them. This personal connection formed the foundation for the mentoring relationship throughout the course. The mentors expressed satisfaction in their role with their students and remained motivated throughout the course. They said the expectation of regular communication was the reason the students remained motivated and finished all their work on time.

Some students lacked exposure to an adequate number of general anesthetics at their posting to ensure competency. These students were assigned to 2-week midcourse contact time (MCCT) at a larger facility under the supervision of a clinical mentor. Seven students were identified by their mentors as not being competent in certain critical skills and were required to do another intensive 2 weeks of MCCT at the completion of the twelfth module. The mentors felt that this concentrated time was the most effective part of their mentoring experience and was key to ensuring clinical competency prior to the final examination.

Lessons learned from the course include:

- Using content that was contextualized with the local culture and working environment was seen as essential to student and clinical mentor acceptance.
- The student–clinical mentor relationship and communication was seen as the foundation and key to successful completion.
- Success also depended on having a motivated cadre—willing to engage in distance education while continuing full time in their daily clinical duties.
- Combining distance learning for knowledge and concentrated clinical training modules ensured clinical competency in clinical skills.

Conclusion

Many LMICs have low numbers of health-care workers or clinical trainers, or both. Distance blended learning (DBL) education is an effective alternative to traditional educational models, especially in cases for the purpose of upgrading or refreshing clinical skills where it is problematic to remove students from their work sites, where they may be the sole provider of a service. In Nepal, this is significantly related to the geography of the country, but in other situations, it may simply be staffing constraints. This is the first use of distance blended learning to upgrade district health workers in Nepal and perhaps for non-doctor anesthesia providers globally.

The benefit of DBL education is the reduction in the problems associated with critical health workers being away from their post for training. Our experience should only be applied to the situation of in-service, skills-upgrading, and refresher training. When considering each country's needs for upgrading critical health-care worker's skills while remaining at their posts, the DBL methodology is another effective arrow in the educational quiver.

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Authors' contribution SS and SK conception and design, acquisition, analysis and interpretation of data, drafting the paper and final approval of the version to be published; OR conception and design, interpretation of data, revision and final approval of the version to be published; and SP interpretation of data, revision and final approval of the version to be published.

Compliance with ethical standards

Conflict of interest None.

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