A pilot of the use of Short Message Service (SMS) as a training tool for anaesthesia nurses

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Background: Anaesthesia nurses form a critical part of the team providing perioperative care to patients, but no accredited training exists for them in South Africa. In this setting, short in-service training interventions are a pragmatic attempt at improving nurse performance and patient outcomes. Traditional didactic teaching formats have limitations, and mLearning (the use of mobile telephones to facilitate education) has proved equivalent or superior to traditional teaching methods in several settings. Despite very high levels of mobile phone ownership amongst healthcare workers in Africa, this form of educational delivery has not been tested in the hospital-based nursing population.

Methods: A telephonic true/false pre-test was performed with 12 nurses of varying levels of training, to assess their pre-existing knowledge of anaesthesia. A pre-learning package was then delivered to them in the form of daily SMSs for a month, covering relevant anaesthesia content. A telephonic post-intervention test was performed to assess whether anaesthesia theory knowledge had improved.

Results: Median test scores out of 30 were compared using a Wilcoxon signed rank test and were statistically higher in the post-intervention test: 25 (IQR 20–26) vs. 21 (IQR 20–21.25) ($p = 0.018$).

Conclusions: The results demonstrate an association between a cheap and widely available educational vehicle, and an increase in nurse knowledge scores. The use of mobile telephones in medical education in limited-resource settings should be explored further.

Keywords: anaesthesia nurse, eLearning, mLearning, nurse education, Short Message Service (SMS)

Background

The role of the anaesthesia nurse, as an assistant to the anaesthetist in perioperative care of the patient, is critical to patient well-being and safe functioning of the theatre environment. In a review of Anaesthetic Incident Monitoring interviews in Australia, anaesthetists reported that the lack of a trained anaesthesia assistant was a major contributor towards adverse events and that the presence of a skilled assistant was a critical factor in the prevention of further complications.[1] In a simulated theatre-based model, the presence of a trained nurse reduced errors in an emergency situation.[2]

In South Africa, training anaesthesia nurses is a complex task because no formal accredited anaesthesia training programme exists and nurses enter their roles in anaesthesia with varying levels of prior education. The South African Nursing Council does not sanction Enrolled Nurse Auxiliaries, with a one-year certificated training programme, to perform as independent anaesthesia nurses. However, in several local hospitals, Enrolled Nurse Auxiliaries are the only nurses available to perform the role of anaesthesia nurse and equal task proficiency is expected from them and Registered Nurses who have up to four years' university education.

A pragmatic approach to training these nurses is to provide in-service or on-the-job type interventions. This type of intervention has been successful in improving nurses' performance in other clinical specialties,[3] but barriers to traditional didactic training exist, particularly in resource-constrained environments. These include delivery costs associated with lecturers, difficult access to protected time away from clinical responsibilities, and lack of access to experts in a particular field because of geographical or temporal factors. eLearning, or the use of electronic media and devices to facilitate teaching and learning, is an approach with increasing utility that solves many of these problems and provides increased scalability.[4] eLearning may prove as effective but cheaper than traditional training methods, particularly in the resource-poor setting.[5] But it is not without costs or barriers to implementation. Access to computers and the capacity to use them may reduce the efficacy of computer-based eLearning in the developing world.[6] Mobile telephones are gaining popularity as vehicles for delivering training and potentially solve some of the issues of cost and capacity associated with traditional, computer-based eLearning.

Since the advent of widespread accessibility to mobile telephones, their use in healthcare (mHealth) and in education (mLearning or mEducation) has grown.[7] About 98% of sampled healthcare workers in Kenya owned mobile telephones,[8] and training delivered via SMS has led to improved nurse adherence to guidelines in that country and several other African projects.[9,10] SMS-based training interventions have also shown retention of knowledge scores equivalent to didactic teaching at 30 days,[11] while an improved adherence to guidelines was sustained at 6 months post the original intervention in a project in Kenya.[12] In rural South Africa a group of nurses reported several 'organically grown' mobile-telephone-based practices facilitating learning, including reflective practice, emotional support and teaching in unpredictable situations.[13]

The success of mLearning in the developing world has been well documented in African rural healthcare workers treating
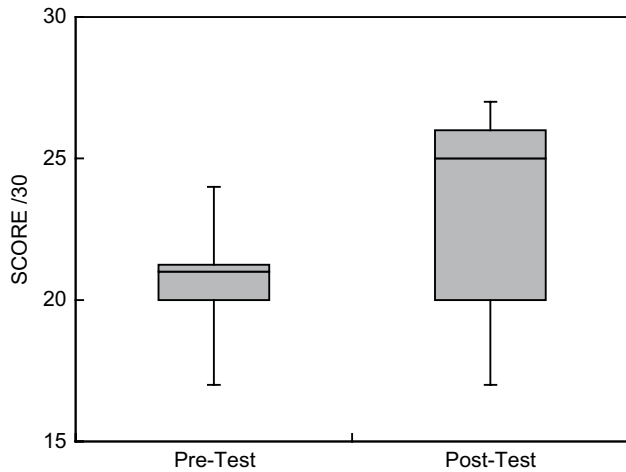
Figure 1: 'Pretest' vs. 'posttest' results (/30) depicting median, inter-quartile range and maximum and minimum values.

infectious diseases,[9,10,12] but only one study, on nurses screening for breast cancer in Iran, was found in a hospital-based setting.[11] Documentation of its efficacy in an African hospital-based scenario was not found and it has not been proved in anaesthesia nurses. This study attempts to validate the use of SMS as a training tool for hospital-based anaesthesia nurses.

Methods

The author's department hosts an annual anaesthesia nurse short course and the 12 candidates who had signed up for the in-person short course were recruited to the study telephonically as a convenience sample. A quasi-experimental, one-group, pretest–posttest study design was employed because the small number of candidates precluded meaningful randomisation to intervention and control groups, and it would have been ethically questionable to withhold a training intervention from a paying learner candidate when that intervention had proved successful in a different context.

Four Registered Nurses, six Enrolled Nurses and two Enrolled Nurse Auxiliaries were included in the sample with an age range from 31 to 62. Nine candidates were female and three male. Four were already employed at the hospital where the course is hosted and the remaining eight were recruited from other hospitals in the Cape Town Metro. Previous experience as anaesthesia nurses ranged from 'no experience' for 2 nurses, to 'more than 10 years' experience' for 2 candidates, while 6 nurses reported 6 months or less experience. All candidates had applied to their local hospitals to be selected to attend the course.

A pre-intervention telephonic true/false test was performed after verbal consent had been obtained for participation in the study. The training intervention delivered took the form of a 'pre-learning package' consisting of two SMS messages sent daily for a month. After the last SMS had been sent, a post-intervention telephonic true/false test was performed. No other formal training was delivered during the study period.

To create the pre-learning package, a body of relevant anaesthesia-related theory amenable to instruction via SMS was identified from the curriculum of an on-site anaesthesia nurse course held annually at Groote Schuur Hospital. This was then further divided into point-form sentences of 160 characters or less to comply with the maximum length of a single SMS. The

SMSs were designed to include pure anaesthesia theory statements, questions for candidates to answer, and tasks set for them to complete. Important facts were repeated. SMSs were sent from the researcher's own telephone and candidates were encouraged to respond via SMS to questions asked or to engage in dialogue with the researcher if they needed clarity on certain issues.

Sixty true/false questions related to the SMSs were designed and peer reviewed by departmental colleagues, then randomly assigned to either a 30-question 'pre-intervention test' or a 30-question 'post-intervention test'. All candidates performed the 'pretests' and 'posttests' telephonically at a predetermined convenient time.

Median scores for the 'pretests' were compared with median scores for the 'posttests' test using a Wilcoxon signed rank test suitable for comparing the matched non-normal continuous data.

Following completion of the study, candidates were requested to provide informal written descriptive feedback of their experience of the pre-learning package, to aid the researcher's understanding of the experience of the SMS-based learning and to guide the design of future interventions.

Results

Individual candidate results for the pretest and posttest showed an increase in scores for 9 out of 12 candidates. Eleven out of 12 candidates contributed actively to the learning process, responding to questions with answers or further questions, seeking clarity on particular issues and expressing enjoyment in the process. On a morning during the study when the daily SMSs had not been sent before 11h00, a candidate messaged the author with 'Hey Doc, no lectures today?'.

The single candidate who did not engage with the process reported being on leave in a remote part of the country with limited mobile telephone signal access for the duration of the study. This candidate (reported as Candidate 1 in Table 1) produced the worst score of the group with a drop in results of 3/30. With mobile phone ownership and access upwards of 90% in South Africa, mHealth interventions are usually a successful method for engaging with previously difficult to reach groups.[7]

Table 1: Individual 'pretest' vs. 'posttest' results (/30)

Candidate	Pretest	Posttest	Difference
1.	20	17	−3
2.	17	20	3
3.	23	25	2
4.	19	26	7
5.	20	27	7
6.	22	24	2
7.	21	20	−1
8.	20	25	5
9.	21	20	−1
10.	24	27	3
11.	21	26	5
12.	21	26	5
Median	21	25	4

Note: Median test scores out of 30 were statistically higher in the post-intervention test: 25 (IQR 20–26) vs. 21 (IQR 20–21.25) ($p = 0.018$).

Discussion

The results demonstrate an association between an increase in knowledge test scores and an educational intervention based solely on regular SMSs. Similar positive results, reinforcing the efficacy of this cheap and widely accessible training tool, were obtained in studies using SMS to train nurses and community health care workers in other developing country settings.[7,9–12]

Theoretical knowledge acquisition should form part of an anaesthesia nurse's training,[14] and the absence of a trained anaesthesia assistant can be a major contributor towards adverse outcomes.[1] The need for quality training interventions and trained staff is further highlighted by studies in the theatre environment[2] and in the broader healthcare context, where level of nurse training is consistently linked to patient outcomes.[15–17] This is of particular importance in resource-poor settings where sub-optimal health-worker performance is a widespread problem.[5]

The small sample size of this study limits the extent to which the findings can be extrapolated but, with the high prevalence of mobile telephone ownership in healthcare workers,[8] further utility for this training vehicle could be explored.

This study did not address important educational questions relating to why or how mHealth educational interventions may have been useful in this group, and this should be the subject of further study to guide the design of educational interventions.

When asked to describe their experience of the pre-learning package, candidates responded positively and all were amenable to further SMS-based training. Nurses are knowledge-based workers who require access to increasingly complex, timely and accurate information, and the mobile telephone is a powerful resource that can facilitate that access. Expanding nurses' competency in information literacy and encouraging the idea that mobile phones are resources with which to tap into wide networks of information should be a priority in modern nurse education.[18]

Conclusion

This study demonstrates an association between a cheap, widely accessible and easy to execute educational intervention and improvement in nursing knowledge test scores. The mobile telephone offers a powerful tool to medical educators, particularly those in resource-limited settings, where its use has not been widely studied. There is thus a need for further research into the utilisation of mobile telephones as a vehicle for delivering training and encouraging self-directed learning amongst healthcare workers in the developing world.

Ethical considerations

The UCT Human Research Ethics Committee and the Professional Master's Committee (PMC) have approved the ethical conduct of the methods and data collection in the study.

Conflict of interest – The authors declare that they have no financial or personal relationship(s) which may have inappropriately influenced them in writing this paper.

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