

**Validation of the use of Short Message Service (SMS)  
as a training tool for anaesthetic nurses.**

by

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## **Declaration**

I, Rowan Alexander Duys, hereby declare that this thesis is based on my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

I empower the university to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

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Date: ...29 March 2015.....

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## **Abstract**

### **Background**

Anaesthetic nurses form a critical part of the team providing peri-operative care to patients, but no accredited training exists for them in South Africa. In this setting, without a formal training programme, 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 proven 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 SMS's for a month covering relevant anaesthesia content. A telephonic post-intervention test was performed to assess if anaesthesia theory knowledge had improved.

### **Results**

Median test scores were compared using a Wilcoxon Signed Rank test and were statistically higher in the post-intervention test: 83,3% (IQR 66,7-86,7) vs. 70% (IQR 66,7-71,7) ( $p=0,018$ ).

### **Conclusions**

The results show that knowledge scores of hospital-based anaesthetic nurses can be improved using training by SMS, thus validating the use of the mobile phone as a cheap, widely accessible and effective educational vehicle.

## **Abbreviations:**

- **SMS** – Short Message Service
- **UCT** – University of Cape Town, South Africa
- **PMC** – Professional Masters Committee of UCT
- **ENA** – Enrolled Nurse Auxiliary
- **EN** – Enrolled Nurse
- **RN** – Registered Nurse
- **ANSC** – UCT Department of Anaesthesia Anaesthetic Nurse Short Course
- **AAA** – Abdominal Aortic Aneurysm

## Glossary

- **eLearning:**
  - “an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction, and that facilitates the adoption of new ways of understanding and developing learning”<sup>(1)</sup>
- **mLearning:**
  - A form of eLearning
  - The use of mobile devices, such as telephones, to facilitate learning or education
  - Synonym: mEducation
- **mHealth:**
  - mHealth is the umbrella term given to the use of mobile communication technologies to promote health by supporting healthcare practitioners.
- **Short Message Service (SMS)**
  - A text messaging service component of phone, Web, or mobile communication systems. It uses standardised communications protocols to allow fixed line or mobile phone devices to exchange short text messages.
- **Pre-Learning Package:**
  - An educational programme delivered in advance of a particular course or lecture series, aimed to prime or prepare learners for the course material. Often delivered in a form suitable for self-directed learning.
  - In this research project the pre-learning package was the SMS-based intervention studied, and the course was the Anaesthetic Nurse Short Course.
- **Anaesthetic Nurse Short Course (ANSC)**
  - An onsite course, held annually at Groote Schuur Hospital for nurses from around the Cape Metro district with an interested in anaesthesia.

- **Pre-Intervention Test or Pre-Test**
  - A knowledge test, delivered before the SMS-based training intervention, aimed at assessing candidates knowledge at the before any training had been undertaken.
  
- **Post-Intervention Test or Post-Test:**
  - A knowledge test, delivered after the SMS-based training intervention, aimed at assessing if candidates knowledge had improved following the training.

# **Protocol**

## **Title**

Validation of the use of Short Message Service (SMS as a training tool for anaesthetic nurses.

## **Aim**

To determine if SMS or 'text' messages are an effective tool with which to improve the knowledge and understanding of anaesthetic nurses, thus validating this inexpensive and widely available method for knowledge dissemination.

## **Objectives**

1. To assess nurses' knowledge of anaesthesia prior to the pre-learning package
2. To develop and deliver the pre-learning package using SMS as the delivery method
3. To test for improvement in nurses anaesthesia knowledge after the educational intervention

## **Introduction and Background**

The role of the anaesthetic nurse, as an assistant to the anaesthetist in peri-operative care of the patient, is critical to patient wellbeing 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 anaesthetic 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.<sup>(2)</sup> In a



simulated theatre-based model, the presence of a trained nurse reduced errors in an emergency situation.<sup>(3)</sup>

In South Africa, training anaesthetic nurses is made a complex task because they lack a formal accredited training programme and enter their roles with varying levels of prior education: equal expectations of task proficiency are placed on Registered Nurses, with up to 4 years university education, and Enrolled Nurse Auxiliaries, with one to two years training. A pragmatic approach to training is to conduct in-service or on-the-job type interventions and these have been successful in improving nurse performance in other clinical specialties.<sup>(4)</sup> However, training interventions are not always successful<sup>(5)</sup> and standards of nursing care are consistently linked to a complex interaction between their education level, staffing numbers (or nurse to patient ratios) and the nursing practice environment.<sup>(6-8)</sup>

Since the advent of widespread accessibility to mobile telephones, their use in healthcare (mHealth) and in education (mLearning or mEducation) has grown. Ninety-eight percent of sampled healthcare workers in Kenya owned mobile telephones<sup>(9)</sup> and training delivered via SMS has led to improved nurse adherence to guidelines in several African projects.<sup>(10, 11)</sup> SMS-based training interventions have also shown improved retention of knowledge and behaviour change at 30 days when compared to traditional didactic training<sup>(12)</sup> while an improved adherence to guidelines was sustained at 6 months after the original intervention in a project in Kenya.<sup>(13)</sup>

The success of mLearning in the developing world has been proven in rural healthcare workers treating infectious diseases,<sup>(10, 11, 13)</sup> but its effect on hospital-based nurses has not been documented. This study attempts to validate the use of SMS as a training tool for hospital-based anaesthetic nurses.

Should we show that educational interventions using SMS as the only instruction tool are effective at improving nursing knowledge of a particular subject in the South African context, there is scope to expand both the audience and subject matter covered. Furthermore, as prevalence of 'smart phones' ownership grows in the South African and African markets, more complex material will be accessible via cellphone, diversifying the subject matter that can be covered. This could have profound implications for the training of hospital staff in South Africa's resource-constrained environment.

### **Target Population:**

The target population for this project is all 12 nurses enrolled in the University of Cape Town (UCT) Anaesthetic Nurse Short Course (ANSC) in 2013.

The ANSC is an annual course for anaesthetic nurses of varying experience and training levels, run by the doctors and anaesthetic nurses of the UCT Department of Anaesthesia, aimed at nurses from hospitals all over the Cape Metro. Twelve nurses attend the course which involves working on-site at Groote Schuur Hospital for 3 months and the ANSC will be considered a separate entity from the pre-learning package.

Nurses that have been accepted to do the UCT ANSC will be asked to enrol and participate in the study which will take place in the month preceding their arrival at Groote Schuur Hospital for the beginning of the ANSC proper.

### **Study Design**

A single-group, pretest-posttest design will be employed because small candidate numbers will preclude separation into large enough control and intervention groups. Also, it would be ethically questionable to withhold a training intervention, supported by studies in other contexts, from a group of learners that have paid for a course.

### **Method**

1. Development of the Pre-Learning Package:

- 1.1. Identify content from the ANSC curriculum which is relevant for an introductory pre-learning package. *(Appendix A)*
- 1.2. Convert the 'Pre-learning Package' into a series of SMS messages. *(Appendix B)*
2. Design 'pre-intervention' and 'post-intervention' true/false tests to test candidates' knowledge in this area.
  - 2.1. Write 60 questions
  - 2.2. Randomly assign 30 questions to a "pre-test" and 30 test questions to a "post-test" *(Appendix C)*
  - 2.3. Create a model answer to both tests and obtain peer review of the tests and answers *(Appendix D)*
3. Perform "pre-tests" telephonically with all candidates.
4. Deliver twice daily SMS's to candidates covering the most important facts relating to the chosen area:
  - 4.1. Information should be well categorized
  - 4.2. Important points are to be repeated.
  - 4.3. SMS's are to be sent on week days only, for a period of 1 month; approximately 50 messages.
  - 4.4. Attempts will be made to keep SMS's relatively brief
5. Content of the SMS's should include:
  - 5.1. Theory or information.
  - 5.2. Tasks to perform.
  - 5.3. Questions to be answered.
6. Candidates will be encouraged to respond to questions via SMS
7. Perform "post-tests" telephonically after the final SMS's have been sent, before candidates arrive at Groote Schuur Hospital for the beginning of the ANSC proper

8. Compare test results to demonstrate a statistical difference between the knowledge scores of candidates before the SMS-based pre-learning package and their scores after the pre-learning package. A Wilcoxon Signed Rank test will be used to compare these matched non-normal continuous data sets.
9. Request informal feedback from candidates explaining their experience of the SMS-based course to assist in design of further interventions. (*Appendix E*)
10. Results to be submitted for publication in the Southern African Journal of Anaesthesia and Analgesia

### **Inclusion criteria**

All candidates attending the ANSC will be included.

Candidates who refuse to partake in any stage of the process will be excluded.

### **Recruitment**

The ANSC is an open course available to all nurses in the Cape Town metropole. Advertisements are sent out by the Groote Schuur Hospital theatre mentor to the unit managers of all government hospitals and candidates make applications to their own management structures to be released for the duration of the training.

Once candidates have confirmed attendance of the ANSC, they will be telephoned to explain the planned pre-learning package and the related study. It will be made clear that refusing to partake in the pre-learning package will, in no way jeopardise or adversely affect the candidate's progression through the ANSC.

### **Data Security**

Test results will be encrypted and stored on 2 computers alone. Participants' names will be removed from results. Candidates cellphone numbers will only be used with their consent, and will not be handed to any third parties.

### **Potential Benefits:**

It is hoped that candidates will improve their knowledge of anaesthesia during the pre-learning package.

### **Consent**

Informed consent to participation will be obtained telephonically by the principal investigator prior to enrollment in the pre-learning package.

### **Compensation:**

Participants will not receive compensation for their participation.

### **Insurance:**

None required.

### **Potential Harms and Ethics**

No potential harm to participants was foreseen. The UCT Human Research Ethics Committee and the Professional Masters Committee (PMC) have stated that the conduct of the study and the data collection appear to have followed sound ethical principles, and the PMC have approved the submission of the study for the purposes of an MMed mini-dissertation.

# **Structured Literature Review**

## **Introduction**

Patient experience of healthcare is intimately related to standards of nursing care. Literature shows that high standards of nursing care and good patient outcomes are in turn linked to 3 factors: nurse staffing, i.e. the ratio of nurses to patients, nurse education levels, and nurse practice environment and perception of empowerment.<sup>(7)</sup>

Nurse to patient ratios are important across a wide array of clinical scenarios including, but not limited to, critical care, pain management, and surgical patients.<sup>(8)</sup> Minimum standards for safe anaesthesia practice in the UK are regarded as a dedicated anaesthesia nurse or assistant for every patient under anaesthesia.<sup>(14)</sup> While this ratio is not strictly enforced<sup>(14)</sup> in South Africa, it remains the goal in the institutes in which this researcher has worked.

Most research regarding the influence of nurse education levels on patient outcomes relates to whether nurses have university-obtained bachelor degrees in nursing or non-university diploma type training. Conflicting data exists, with some studies showing no correlation between the proportion of university-educated nurses and patient outcome, but consensus appears to be that an increased proportion of university-trained nurses is associated with improved patient outcomes.<sup>(15)</sup> This is of limited relevance to the South African anaesthesia context since large proportions of our anaesthetic nurses are neither university nor college trained to the level of Registered Nurse (RN). Many have only completed the one or two years training at a nursing school, which is the requirement to become an Enrolled Nurse (EN) or Enrolled Nurse Auxiliary (ENA).

Perhaps of more relevance to this research project is whether or not short course training interventions on specific skills are able to influence patient outcomes because this is the field of education with which anaesthetists and their nursing

colleagues are more likely to engage. What is clear is that not all training interventions work. Lewin et al implemented a training intervention for nurses in nurse-led clinics in Cape Town, South Africa attempting to improve Tuberculosis cure rates and to decrease loss to follow up. The intervention comprised an 18-hour experiential, participatory in-service training programme for clinic staff delivered by nurse facilitators and focusing on patient-centredness, critical reflection on practice, and quality improvement. Despite favourable results during pilot work, they were not able to produce a statistically significant improvement in the intervention group of clinics. This was thought, in part, to be due to organisational factors where nurses were not empowered or facilitated to improve their own working environment.<sup>(5)</sup> However, in a later study in TB clinics in the Free State, a different nurse education intervention was able to cause improved cure rates.<sup>(4)</sup> While the details of the structure of the intervention were not available, the lesson that some training interventions change practice or outcomes whilst others prove ineffective is illustrated.

The third indicator of high standards of nursing care consistently reported in the literature is the nurse practice environment. This concept describes several factors which influence the manner in which nurses relate to their working environment, patients and colleagues and includes a complex interaction between perceptions of empowerment, the presence of collegial relations with doctors, feeling supported and valued and an ability to facilitate change. Where these factors are present, patient outcomes appear to be positively affected.<sup>(6)</sup>

Recent literature is beginning to attribute favourable patient outcomes data to nursing factors where links have not previously been made. Anaesthetists will be well versed in literature reporting a link between case-volume and good outcomes. Where hospitals treat a large number of patients with a particular condition, they appear to achieve better results than hospitals where that condition is treated only rarely.<sup>(16)</sup> A review of discharge data for patients undergoing treatment for

Abdominal Aortic Aneurysm (AAA) as it related to the three indicators of good nursing care, nurse staffing, education and practice environment, indicated a strong correlation between good nursing indicators and good patient outcomes. In fact, in those hospitals with high case volumes but below average nursing care, patients outcomes tended to be worse, and, in those hospitals where low case volumes were prevalent but nursing indicators were good, patient outcome data appeared to improve. The authors argue that this implies a causative link between good outcomes and standards of nursing care in patients with AAA.<sup>(7)</sup>

The anaesthetist to anaesthetic nurse relationship differs from most doctor-nurse teams in that there is frequently a one-to-one-to-one ratio for anaesthetist to nurse to patient. This may, some would argue, dilute the effect of nursing care on the patient, since the doctor in the team more closely supervises the nurse. The counter-argument is that, since the state of anaesthesia so closely resembles one of critical illness, where organ support is needed and deteriorations in clinical state can occur quickly, the working relationship between doctor and nurse is particularly important. They are a team where competence and teamwork are critical to managing patients, particularly during emergencies. Kluger et al report data from Anaesthetic Incident Monitoring interviews with anaesthetists suggesting that the lack of a trained assistant was a major contributor towards adverse events, and that the presence of a skilled assistant is a critical factor in the prevention of further complications or management of the critical situation.<sup>(2)</sup> In a simulation model, the presence of a trained assistant versus untrained theatre nurse reduced errors in an emergency situation.<sup>(3)</sup>

Having established the relationship between nursing standards and patient outcomes, it becomes important to understand how anaesthetists may become involved in improving nursing care.

### **Strategies to improve nursing performance**

It is beyond the scope of the average anaesthetist to influence the nurse staffing levels in a hospital environment. However, it may be argued that all anaesthetists should insist on an identified, allocated and well-trained anaesthetic nurse for each



case. While this may be impractical in the South African setting, it remains a worthwhile goal.

Equally, changing the nurse practice environment is a complex problem involving nurse management, political environs and nurse perceptions of empowerment, but is also influenced by the presence or lack of collegial relations with doctors, and this is an area over which anaesthetists have some influence.

With regards to training of anaesthetic nurses, to date no formalised curriculum or minimum standards have been drafted by nursing or anaesthetic organisations in South Africa. The South African Nursing Council, who regulate and certify all nurse training in South Africa have not yet recognised Anaesthesia as a suitable discipline for Specialist Nurse Practitioner status although it is unclear if they have ever been engaged on the subject. Furthermore, the issue of certifying and formally training anaesthetic nurses is complicated by the fact that nurses of widely varying undergraduate qualifications work as anaesthetic nurses in South African hospitals. There is no minimum qualification for anaesthetic nurses and so Registered Nurses, Enrolled Nurses or Enrolled Nurse Auxiliaries can and do perform the role.

In the USA and some European countries, nurse anaesthetists may run anaesthetics alone with intermittent support from physician anaesthetists at critical times. However, in South Africa a doctor must be present for all anaesthetics and is assisted by their anaesthetic nurse. The South African structure is similar to that in practice in the United Kingdom and the Australia-New Zealand region but the regulatory and training environment in these other regions enforces a much higher minimum standard than that in South Africa. The Australia New Zealand College of Anaesthetists publishes guidelines describing these minimum standards stressing the importance of the Anaesthesia Team.<sup>(17)</sup> This team concept has been explored in a series of interviews with anaesthetists and their assistants, to understand the individual roles better and how the team environment may be improved.<sup>(18)</sup>

Considering that anaesthetic nurses in South Africa come from such a wide variety of training backgrounds and levels, the problem of designing a formalised, accredited and certificated training course is complex. However, since all anaesthetic nurses are expected to fulfill similar tasks, regardless of their training background, in-service or on-the-job training offers a simple, achievable intervention.

### **eLearning - an alternative training tool**

Traditional education has been delivered in the form of didactic lectures, from an expert to pupils, supported by an accompanying text containing relevant facts. These didactic lectures attempt to deliver a single package of knowledge to a group of learners with variable learning styles and efficiency, simultaneously. Also, a lecturer or teacher is required to be present for each learning event. Recent changes in access to information and communication technology (ICT) are offering teachers and learners new tools with which to progress.

Elearning is “an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning.”<sup>(1)</sup>

Some of the potential advantages of eLearning over traditional training methods discussed by Rasmussen et al in their reviews of the effect of eLearning in health include: reduction of the costs associated with delivery of educational outcomes, creating systems which can be easily scaled to reach wider audiences, breaking down geographical barriers to education and broadening access to experts and new curricula.<sup>(1)</sup>

Other stated advantages mentioned in the literature include user convenience, program design flexibility, adherence to adult learning principles and accommodation of multiple learning styles.<sup>(19)</sup> These authors also report positive

attitudes towards the self-paced learning, self-direction and flexibility of time and situation afforded by eLearning from their review of nurses' perceptions of learning in the online environment.

But is eLearning effective? Two reviews, published in June 2014 studied the appropriate literature to understand the impact of eLearning for undergraduate health professionals on knowledge, skills, attitudes and satisfaction. One group has studied 'offline' eLearning interventions because lack of Internet access is seen as a barrier to eLearning in developing countries<sup>(1)</sup> and another studied the impact of 'offline' eLearning content.<sup>(20)</sup> Both groups found eLearning was equivalent, possibly superior, to traditional learning and both propose further investment in its development to address the global healthcare staff shortage. These reviews need to be understood in the context of anaesthesia nurse training in South Africa where almost no formal regulated training, didactic or otherwise, is the norm. This paucity of training may increase the impact of the in-service training intervention, which is the focus of this study.

It must be stated that in the healthcare environment, blended learning, which combines eLearning with hands-on skills-based training, may be the most suitable or effective training style largely because of the requirement for practical skills that form such a large proportion of healthcare work at all levels.<sup>(1)</sup>

### **mLearning**

Barriers to effective eLearning do exist. Those most often reported are lack of access to computers and network connectivity or bandwidth<sup>(20)</sup>. While almost all medical schools in the US and Canada have employed online training material in their curricula in recent years, lack of access to the relevant technology has reduced its penetration and effectiveness in the developing world. Factors quoted in a qualitative review of barriers to effective eLearning in Sri Lanka in a distance learning type environment include limited support with the use of the required technology, lack of access to internet and computers, difficulties in dealing with the

self-directed learning approach implicit in most eLearning programmes, lack of academic prowess or confidence, and perceptions that eLearning was inferior to 'on-campus' training.<sup>(21)</sup>

Some of these challenges or barriers can be addressed by 'mLearning'. mLearning means education through, or facilitated by, mobile telecommunications devices. In the main, this involves the use of mobile telephones but personal digital assistants (PDA's), tablet computers and other purpose built devices have been used. It is also sometimes referred to as mEducation. In a review of factors that influence mobile phone ownership and use in healthcare workers and users in Kenya, 98% of healthcare workers were found to own and use mobile phones<sup>(9)</sup>. Global penetration of mobile phones is now said to be close to 95% of the population and the largest growth in subscriptions in the last few years has been in developing markets<sup>(22)</sup>. If patterns of ownership are the same in South Africa, this represents a huge untapped resource and communication method. Virtually all of the nurses in South Africa could be contactable to be engaged in a bidirectional, real time conversation, on an individualised basis and this conversation could be used for a variety of activities including training, data gathering and dissemination of information.

mHealth is the umbrella term given to the use of mobile communication technologies to promote health by supporting healthcare practitioners. It includes health data collection, delivery of healthcare information, patient observation and provision of care, and its application has grown rapidly with the growth of mobile phone use. mLearning in healthcare is another application of mHealth. A systematic review of mHealth projects in Africa identified 2 of 44 documented projects to be dedicated to staff training, support and motivation.<sup>(22)</sup>

A pilot project in Botswana showed that health workers in remote areas could be linked to specialists to seek advice on clinical decision making<sup>(23)</sup> and a programme to educate Community Health Workers (CHW) in Malawi to utilise mobile phones to

collect data, send and receive results and promote drug adherence was able to save a health service money and double their Tuberculosis programme capacity.<sup>(10)</sup>

Mobile phones of varying levels of sophistication exist in the market. Some, known as feature-phones, allow only voice calls and simple text message or short message service (SMS) functionality but newer devices, known as smart-phones, support full internet access. While access to broadband communication is growing in the developing world, much can be accomplished with SMS technology alone. SMS is simple to use, widely available and cheap.

Multiple studies have examined the use of SMS as a training tool demonstrating at least equivocal results when compared with traditional in-person training. A trial studying the effect of training via SMS for nurses engaged in breast cancer treatment in Iran, was able to demonstrate better retention of knowledge at 30 days in the SMS group compared to the traditional teaching style control group.<sup>(12)</sup> In a randomised cluster trial, adherence to Malarial paediatric treatment guidelines was measured in rural Kenyan clinics where the intervention group received SMS based training and the control group no intervention. Again, guideline adherence was improved by 23.7% in the SMS group, and there was a sustained improvement in adherence of 24.5% at 6 months.<sup>(13)</sup> It is thought that one feature of SMS training that contributes to the longevity of its effects on behaviour and knowledge could be that the SMS's remain a resource on the user's phone.

SMS has also been successfully used as a motivational intervention with supportive inspirational quotes sent along with guideline adherence data to another group of healthcare workers in Kenya. The workers reported a largely favourable perception of the SMS intervention and adherence to treatment guidelines was improved. The study group highlights the power that an individualised personal message may have to positively influence the working environment of healthcare workers, particularly those isolated geographically or professionally. Similar attention to attempting to improve the learning and working environment is a recurring theme in literature on training and behaviour change.<sup>(11)</sup>

In the South African context, SMS is being used widely as a patient focused intervention to improve adherence to HIV and TB treatment with some programmes working within a global team framework (see: <http://www.askmama.co.za/index.html>). Despite this, little scientific evidence is reported on the use of mobile telephones by healthcare for training in South Africa. Findings from interviews of 16 rural South African nurses attending an unrelated in-service training course report several 'organically grown' practices where nurses used their phones for: authentic problem solving, reflective practice, emotional support and belongingness, teaching in unpredictable teaching situations and life-long learning.<sup>(24)</sup> This study was also the only developing world paper identified that describes a further use for mobile phones in training: they may provide value as a tool for building a community of learners.

### **Using mLearning to improve care**

The literature reviewing the relationship between nursing care and patient outcomes is diverse, but supports that better nurses means better patient care. Equally diverse is the literature addressing the problem of effecting improvements in nurse care. One thorough review examines interventions aimed at improving performance of health workers in low-resource settings.<sup>(25)</sup> They report firstly, that far less is understood about the drivers of health worker performance in resource poor settings than in industrialised nations, despite the fact that inadequate worker performance is such a widespread problem in these low-resource settings. They outline the determinants of performance (usually as measured by adherence to guidelines) and the effectiveness of interventions to improve performance. By discussing the deficiencies in understanding which exist in this field, they illustrate relevant pointers for any team attempting to intervene and change health worker performance:

- Making information available is not enough to improve behaviour. Simply facilitating the dissemination of accurate guidelines, even if they are perfectly well understood, does not guarantee their implementation.
- Motivation to change behaviour and the methods of improvement of motivation, are critical determinants of the success of an intervention, and this motivation is governed by a complex interaction between health-worker factors, patient factors, work complexity factors, and the working and learning environments.
- External factors such as the community perception of health-workers, the socio-cultural and political landscapes and the overall economic picture in which the health facility exist all seem to play a role in predicting success or failure of performance improvement interventions.

Overall, this literature review strongly suggests that didactic training alone will not solve performance problems.

The review also distilled several trends that have relevance to interventions aimed at hospital-based nurses in low-resource settings:

1. Dissemination of written guidelines without additional interventions was generally ineffective
2. Supervision and audit with feedback was generally quite effective
3. Non-traditional training methods such as computer-based training might be cheaper and as effective as traditional training programmes
4. Multifaceted interventions, e.g. those that attempt to provide training and supervision, seemed more likely to succeed than single interventions.<sup>(25)</sup>

eLearning, and the more widely available mLearning, by opening a channel for bidirectional communication between learner and trainer, appear to have potential as interventions that can disseminate information but also provide a measure of supervision or ongoing communication.

Mobile telephones have also been shown to connect learners with each other, growing the community of learners and thus changing the learning environment.<sup>(24)</sup>

The use of mobile telephone-based applications which allow for group

communication, such as WhatsApp or WeChat, have not been investigated thoroughly, and the role of social media platforms such as Facebook in the learning pedagogy is also new and poorly understood despite its obvious potential to promote discussion and sharing of information.

Perhaps the most important lessons to be learned from studies of mLearning and mobile telephone-based performance interventions is that nurses are knowledge-based workers who require access to increasingly complex timely accurate information; and the mobile phone is a 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.<sup>(26)</sup>

Much research is required into which interventions work, and the reasons for their success. Rowe et al suggest 3 focus areas:

1. Research on determinants of performance in order to further understand and measure health-worker practices.
2. Rigorous trials to examine the cost-effectiveness of strategies to achieve and maintain high-quality performance.
3. Developing strategies for effectively disseminating clinical guidelines.<sup>(25)</sup>

The role of mobile phones as a means with which to intervene and train, to improve working environments through dialogue, and to audit interventions is assuming increasing importance. For those working in low-resource settings, it is perhaps the most important new development in the arsenal of the medical educator for decades.

## **Conclusion**

Mobile telephones are useful tools with which to improve nurse training and may facilitate sustained changes in performance but its effectiveness as an intervention in hospital-based nurses in South Africa has not been well documented.



### **Proposed Study**

The proposed study will attempt to add to the understanding of mobile telephone-based training interventions in the low-resource setting. The context of a hospital-based group of nurses is different from most research to date that has focused on rural-clinic based nurses and healthcare workers treating largely infectious or chronic diseases.

Anaesthetic nurses do not act as independently as rural prescribing nurses, but should be encouraged to understand as much as possible of the relevance of anaesthesia practice to ensure efficient reactions during emergency situations.

The purpose of this study, therefore, will be an attempt to validate the cheap and ubiquitously available resource of Short Message Service (SMS) messages, as a training tool for hospital based anaesthetic nurses at Groote Schuur Hospital in Cape Town.

## **Article for Submission**

### **Intended Journal**

The Southern African Journal of Anaesthesia and Analgesia  
*(Author Guidelines - Appendix F)*

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**Keywords:**

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Short Message Service (SMS)

## **Submission Abstract:**

### **Background**

Anaesthetic nurses form a critical part of the team providing peri-operative care to patients, but no accredited training exists for them in South Africa. In this setting, without a formal training programme, 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 proven 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 SMS's for a month covering relevant anaesthesia content. A telephonic post-intervention test was performed to assess if anaesthesia theory knowledge had improved.

### **Results**

Median test scores were compared using a Wilcoxon Signed Rank test and were statistically higher in the post-intervention test: 83,3% (IQR 66,7-86,7) vs. 70% (IQR 66,7-71,7) ( $p=0,018$ ).

### **Conclusions**

The results show that knowledge scores of hospital-based anaesthetic nurses can be improved using training by SMS, thus validating the use of the mobile phone as a cheap, widely accessible and effective educational vehicle.

## Submission Article

### Background

The role of the anaesthetic nurse, as an assistant to the anaesthetist in peri-operative care of the patient, is critical to patient wellbeing 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 anaesthetic 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.<sup>(2)</sup> In a simulated theatre-based model, the presence of a trained nurse reduced errors in an emergency situation.<sup>(3)</sup>

In South Africa, training anaesthetic nurses is made a complex task because they lack a formal accredited anaesthetic training programme and enter their roles with varying levels of prior education: equal expectations of task proficiency are placed on Registered Nurses, with up to 4 years university education, and Enrolled Nurse Auxiliaries, with one to two years diploma-based training. 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<sup>(4)</sup> but barriers to traditional didactic training exist, particularly in resource-constrained environments and 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.<sup>(20)</sup> eLearning may also prove as effective but cheaper than traditional training methods, particularly in the resource-poor setting.<sup>(25)</sup> But access to computers and capacity to use them may reduce the efficacy of computer-based eLearning in the developing world<sup>(1)</sup> and mobile telephones are gaining popularity as vehicles for delivering training.

Since the advent of widespread accessibility to mobile telephones, their use in healthcare (mHealth) and in education (mLearning or mEducation) has grown. About 98% of sampled healthcare workers in Kenya owned mobile telephones<sup>(9)</sup> and training delivered via SMS has led to improved nurse adherence to guidelines in that country and several other African projects.<sup>(10, 11)</sup> SMS-based training interventions have also shown improved retention of knowledge and behaviour change at 30 days when compared to traditional didactic training<sup>(12)</sup> while an improved adherence to guidelines was sustained at 6 months post the original intervention in a project in Kenya.<sup>(13)</sup> 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.<sup>(24)</sup>

The success of mLearning in the developing world has been well documented in African rural healthcare workers treating infectious diseases<sup>(10, 11, 13)</sup> but only one study, on nurses screening for breast cancer in Iran, was found in a hospital-based setting.<sup>(12)</sup> Documentation of its efficacy in an African hospital-based scenario was not found and it has not been proven in anaesthetic nurses. This study attempts to validate the use of SMS as a training tool for hospital-based anaesthetic nurses.

## **Methods**

A convenience sample of 12 nurses was recruited telephonically into a quasi-experimental, one-group, pretest-posttest study design 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.

Candidates had varying levels of experience and exposure to anaesthesia but had expressed an interest in further anaesthesia training. 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 anaesthetic 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 SMS’s were designed to include pure anaesthesia theory statements, questions for candidates to answer, and tasks set for them to complete. Important facts were repeated. SMS’s were sent from the researchers 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 SMS’s 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 ‘pre-tests’ and ‘post-tests’ telephonically at a predetermined convenient time.

Median scores for the ‘pre-tests’ were compared with median scores for the ‘post-tests’ 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 pre-test and post-test showed an increase in scores for 9 out of 12 candidates:

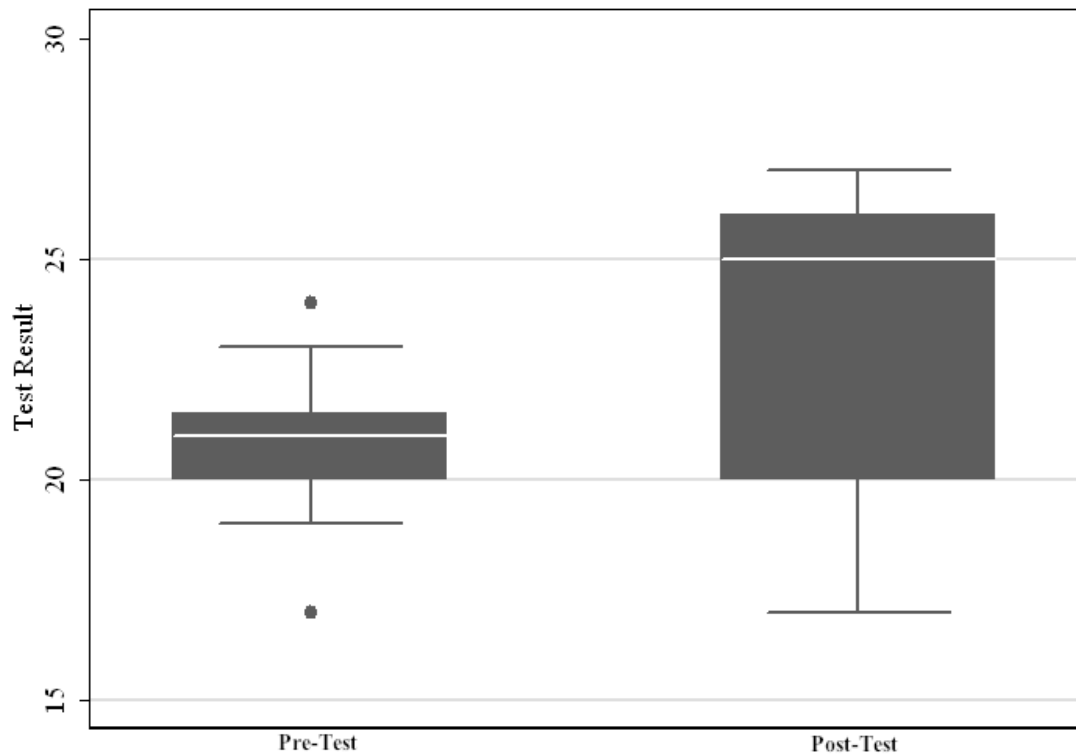
**Figure 1: Individual 'Pre-Test' vs. 'Post-Test' results (/30)**

<b>Candidate</b>	<b>Pre-Test</b>	<b>Post-Test</b>	<b>Difference</b>
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 test scores were statistically higher in the post-intervention test: 83,3% (IQR 66,7-86,7) vs. 70% (IQR 66,7-71,7) ( $p=0,018$ ).



**Figure 2: 'Pre-Test' vs. 'Post-Test' results (/30)**



## **Discussion**

The results demonstrate that SMS is an effective tool in the dissemination of knowledge content for training purposes. Similar positive results, reinforcing the efficacy of this cheap and widely accessible training tool, were obtained in studies using SMS to train nurses in other developing world settings.<sup>(10-13)</sup>

Theoretical knowledge acquisition should form part of an anaesthetic nurse's training,<sup>(14)</sup> and the pre-test results demonstrate varied levels of pre-existing knowledge in our candidates, which is important in the context that the absence of a trained anaesthetic assistant can be a major contributor towards adverse outcomes.<sup>(2)</sup>

The significant improvement in knowledge scores between pre-test and post-test results demonstrate the efficacy of SMS as a training tool and the need for quality

training interventions and trained staff is highlighted by studies in the theatre environment<sup>(3)</sup> and in the broader healthcare context where level of nurse training is consistently linked to patient outcomes.<sup>(6-8)</sup> This is of particular importance in resource-poor settings where health-worker performance is such a widespread problem.<sup>(25)</sup>

The small sample size of this study limits the extent to which the findings can be extrapolated, but with the prevalence of mobile telephone ownership high in healthcare workers,<sup>(9)</sup> further utility for this training vehicle could be explored.

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 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.<sup>(26)</sup>

## **Conclusion**

This study validates the use of SMS messages to disseminate knowledge to nurses. Though limited in scope, the results demonstrate a need for further research in the utilisation of mobile telephones as a vehicle for delivering training and encouraging self-directed learning amongst healthcare workers in the developing world.

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**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:**

I declare that I have no financial or personal relationship(s) which may have inappropriately influenced me in writing this paper.

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## Appendices:

### **Appendix A: Curriculum for Pre-Learning Package**

#### **What is an anaesthetic and what is its purpose?**

- Anaesthesia facilitates surgery: renders the patient pain and movement free allowing the surgeon to operate.
- This can be achieved through general anaesthesia ie the patient is so deeply asleep that they do not respond to painful stimuli
- Alternatively, through regional anaesthesia ie: the nerves which supply part of a patient's body are turned off and the patient can, therefore, not feel anything while the surgeon operates. The patient can remain awake but won't feel the operation.
- The surgeon fixes the patient
  - o But the role of the anaesthetic team is ensure the patient makes it through the operation safely avoiding undue stress, pain, and risk to life.
- Who is the anaesthetic team
  - o Anaesthetic Assistant, or Anaesthetic Nurse
  - o Anaesthetist – senior and or junior
  - o All people in theatre environment that may be involved with patient's care eg: surgeon, scrub sister, porter, floor nurse
- **The most important person in the theatre is 'the patient'**

#### **What are the anaesthetic and surgical implications for the patient?**

- Surgery and anaesthesia cause stress on all organ systems. They induce short term or immediate risks and cause long term consequences which can result in improvement of health or risks to health.
- Main Organ Systems Affected:
  - Cardiac
    - Severe hyper or hypotension may result
    - Hypotension can be caused by the drugs used, blood or fluid loss, or the surgery itself
    - It can result in decreased perfusion of vital organs leading to ischemic damage
    - Hypertension can be caused by the drugs used, response to intubation or the painful surgical stimulus
    - It can result in complications such as stroke or severe bleeding as well as organ damage
  - Respiratory
    - General anaesthesia invariably renders the patient unable to maintain their own airway, so if the anaesthetic team does not take control of the airway rapidly, the patient could obstruct and be unable to breathe
    - Equally, patients who are deeply anaesthetised or who have been paralysed will not make any respiratory efforts and the anaesthetic team must then take over ventilation of the patient by blowing air into the patients lungs
    - Ventilating a patient with underlying lung disease becomes difficult for the team and influences the type of anaesthetic planned.
  - Neurological

- While many people will report that undergoing an anaesthetic gave them a lovely sleep, the incidence of sleep disturbance, confusion and other behaviour disturbances post anaesthesia is quite high.
    - Elderly patients are particularly at risk of post-operative confusion
- Stress Response
  - After any surgical procedure, people mount a hormonal, immunological and autonomic stress response, in keeping with the extent of the surgery, involving the release of multiple hormones including adrenaline, cortisol, growth factor etc.
  - This hormone response may contribute to post-operative conditions such as ARDS, thrombosis, sepsis which place people under an increased risk of death post-operatively
- Psychological effects:
  - Any operation or visit to the hospital causes stress, and the AA has an important role in helping allay fears and calming nerves

### **What is the role of the Anaesthetic Assistant?**

- Anaesthetic Assistant
  - Is an integral part of the anaesthetic team. With a role in:
    - Theatre efficiency – ensuring prompt arrival of correct patient
    - Patient advocate – often first to meet patient, important role in ensuring patient has a good experience ie ensuring comfort, reducing anxiety, answering questions about what will or will not happen



- Teamwork with anaesthetist, cannot do their jobs without each other
- Preparation: --- Always think ahead! Perhaps the most important role of the AA
  - For both routine and emergency situations
  - Who or what must be prepared?
    - The patient
    - Relevant equipment
    - Theatre Environment
    - Stocking of sundries
- Monitoring:
  - The anaesthetist cannot have their eyes on the monitor or patient at all times, the AA must be another set of eyes and ears ensuring vital signs remain as they should
- Patient safety
  - Another layer of defence to ensure no mistakes. If you see a mistake about to be made, stop everything and communicate.

### **What does an Anaesthetic Entail?/ When is the AA needed?**

- 3 phases
  - Pre-op assessment
    - Assessment of fitness for operation and anaesthetic

- Where are most important risks, do the benefits of the surgery outweigh the risks?
- Consent –does the patient understand the proposed method of anaesthesia?
- Includes planning of the proposed anaesthetic and communication of this plan to the team. Plan for
  - Induction
  - Maintenance
  - Choice of post-operative environment
  - Post-operative pain control
- AA's role: communicate with anaesthetist and prepare theatre appropriately
  - Including
    - Airway and intubation equipment
    - Drugs
    - Special equipment eg: bair huggers, temp probe, difficult intubation trolley etc
- Intra-operative Management
  - Induction --- High Risk period
    - The anaesthetic team gives the patient drugs to make them fall asleep
    - They then take control of the patients airway and breathing, position the patient correctly for the surgery and ensure that the patient is safe from harm and ready for the operation.

- Induction phase only comes to an end when the surgeons have made their first incision and the patient has responded appropriately.
- AA's role:
  - Assist in securing airway, positioning patient, and ensuring patient is safe and settled when the surgery starts.
  - High risk period when much goes wrong, many hands and much communication needed
- Maintenance
  - Keeping the patient asleep, usually with a continuous supply of drugs, either inhaled or injected
  - Close monitoring of the patient intra-operatively as risks to the patients health occur as the surgeons proceed with operation
  - AA's role:
    - less intense period for AA but will need to ensure that, as the operation proceeds, all equipment needs are met
    - Also good period to restock all sundries
    - AA should understand the monitors being used and the parameters being monitored.
    - Prepare for next case – communicate with anaesthetist
    - Ensure prompt arrival of next case
- Reversal/Emergence --- High risk Period
  - 'Waking the patient up'

- Usually involves turning off the drugs and waiting for them to be worked out of the patients system. When the levels of the drugs in the patient's body are low enough, they will wake up.
- Then, as they wake up, the team must give control of their airway back to the patient ensuring they can safely manage their own airway and look after their own needs
- AA's role
  - Verify high risk period, AA must be in theatre from before the start of emergence. Should not be waiting for a call for help!
  - Have all airway equipment ready for an emergency reintubation if extubation fails
  - Close eye on existing monitors – anaesthetist often busy, not always aware sats are dropping
  - Be prepared for transfer if patient is high risk and heading to ICU
- Post-operative Care
  - 2 goals of post-op care:
    - Safe Recovery
    - Adequate Pain Control
  - Recovery
    - A period of close monitoring to ensure a safe emergence from anaesthetic and surgery.
    - Many complications occur in the immediate post-operative period

- Therefore patient in recovery must be closely monitored and the environment well staffed.
- Pain Control
  - The anaesthetic team's role extends to the control of the patients pain in the post-operative period and so adequate analgesia must be established before the patient can be returned to the care of the ward staff
  - The goal of post-operative analgesia is to have patients wake up virtually pain free.
- AA's Role
  - Mainly prep for next case
  - Clean all equipment used for previous case appropriately
  - Prepare airway equipment, drugs, special equipment
  - Prepare patient mentally
  - Do WHO checklist
- Emergencies which threaten the patient's life can occur at any point throughout the 5 phases of anaesthesia and the AA should be prepared and available to perform their role in the anaesthetic team at any point.

## **Theatre Prep**

- Preparing the airway trolley
  - Before subjecting a patient to any anaesthetic, the anaesthetic assistant should ensure the presence and good working condition of a list of equipment which we remember with the acronym: IMALES

- Remember IMALES with 2 M's, 2 A's and 2 L's
- I – Introducer – used to give an armoured Endotracheal tube extra stiffness, or to assist with a difficult intubation by getting behind the epiglottis
- M – Macgills forceps – used to remove foreign bodies, manipulate the tip of the ET tube, or insert devices such as naso-gastric tubes and throat packs
- M – Mask's – applied to the patients face to allow Bag-Valve-Mask ventilation, before intubation. Various sizes should be available
- A – Ambubag – self-inflating ambubags allow ventilation of the patient, either via mask, ET tube or LMA, even if the oxygen or electricity supply fails. They are also useful during transport of patients
- A – Airway – Guedel or OPA airways are used to lift the tongue and other soft tissues of the mouth improving Bag-Valve-Mask ventilation. A variety of sizes should be kept easily available.
- L – Laryngoscope – Used to visualize the vocal cords when intubating. At least 2 different sizes, both checked to be working, should be kept on the trolley
- L – LMA – The laryngeal mask airway (LMA) is the first choice of airway for certain procedures but can also be used as a rescue airway when intubation is impossible. The size of LMA needed is dictated by the weight of the patient; check the shaft of each LMA to see the designated weight ranges. About 95% of people can be ventilated using an LMA.
- E – Endo-tracheal tube – (ET Tube) used to secure the patient's airway. Placed in the trachea, just beyond the vocal chords. Each tube should have a working cuff. Have 3 ET Tubes available; the size you want plus one size up and one size down.
- S – Suction – Suction through a yankauer connection is used to clear secretions, blood or stomach contents from the airway before intubation and before extubation. Check that the suction apparatus is actually

generating a negative pressure of greater than 50 (kpa???) before each case.

## **Appendix B: Pre-Learning Package SMS's**

### **Abbreviations to be used in SMS's:**

- AA                    anaesthetic assistant or nurse
- atic                    anaesthetic
- atst                    anaesthetist
- pt                      patient

### **Intro:**

1. Hi team! Welcome to the SMS pre-learning package. First an explanation of the abbreviations we will be using:
2. AA – Anaesthetic Assistant or Nurse. Atic – Anaesthetic. Atst – Anaesthetist. Pt – Patient
3. We will aim to send 2 – 3 packages of info a day. Some of these will be questions and you can answer via sms. There will be prizes for correct answers!
4. Week 1 will be: What is an Atic and what drugs do we use. Week 2: The implications for the pt of an Atic and surgery. Week 3: The role of the AA
5. If you need info to answer the questions try: a local Atst, a friendly AA, the library, Google or you can sms Dr Kambarami on 0721877790

### **What is Anaesthesia/Role of Anaesthetist**

6. Atic team includes AA, atst & all others in theatre eg surgeon, porter etc Atic team responsible for wellbeing of most important person in theatre: the pt!

159\*



7. The goal of atic is to put pt in a state allowing surgeon to complete operation without risk to life, stress, pain or memory of the event.

141

8. We achieve this state with general atic which means the pt is so deeply asleep they do not respond to or remember painful stimuli.

133

9. Or regional atic – the nerves which supply a part of the pt’s body are turned off with drugs therefore the pt cannot feel the operation but can remain awake

159

10. Name 3 regional blocks used for surgery on the upper limb, and 3 used for the lower limb

91

11. To achieve state of general atic we give drugs to cause 3 things: hypnosis (sleep), analgesia (reduced awareness of pain) and muscle relaxation (paralysis)

158

12. Name 3 injectable drugs that can be used to cause hypnosis (or sleep). Name an operation you did recently and the hypnotic agent you used.141

13. An anaesthetic has 3 phases- INDUCTION (where we give drugs to make the patient fall asleep), MAINTENANCE (where we give a continuous supply of drugs to KEEP people asleep) and EMERGANCE (where we stop the continuous drugs to WAKE people up).

14. Name a volatile hypnotic drug (a sleep gas) which we can use for induction AND maintenance and one which we can only use for maintenance

15. Name 2 volatile drugs or anaesthetic gases that can be used to cause hypnosis (or sleep). Which ones are available in your hospital? What is their colour coding

164

16. Name 2 drugs commonly used to cause analgesia during anaesthesia. Where are they used outside of theatre? Which analgesics did you use with your last case?

158

17. Name 3 drugs commonly used to cause muscle relaxation. How long does their effect last? Which did you use for your last case? Are they stored in the fridge?

160

18. Remember: The surgeon fixes the patient but our role is to get the patient through the operation avoiding stress, pain and risk to life. 139

19. But the number one rule is: The most important person in the theatre is the patient! 87

### **What are the anaesthetic and surgical implications for the patient?**

#### **Monday\*\***

20. Surgery and atics cause stress on all organ systems which results in risks during the surgery, immediately afterwards and for several days to weeks 152

21. Name 2 complications of surgery or anaesthesia which may occur immediately after an operation and 2 which may occur in the days to weeks following the op

22. What are the missing words? Deep Vein \_\_\_\_\_ is a common problem after operations and can lead to \_\_\_\_\_ Emboli which are life-threatening.

150

#### **Tuesday**

23. Cardiac effects of atic: Severe hyper or hypotension. Most atic drugs cause a drop in BP but hypotension can also be due to blood loss or the surgery itself

160

24. Prolonged hypotension can lead to under-perfusion of vital organs leading to ischaemic damage such as heart attacks and kidney failure. 129

25. What is the missing element? When tissues get less \_\_\_\_\_ than they need, it is called ischaemia, and the cells in those tissues begin to die. 146

26. Hypertension can be caused by the drugs used, response to intubation or painful surgical stimulus and can cause stroke, bleeding and other organ damage. 156
27. What is the most common drug used for induction of anaesthesia? What colour is it? What does it do to the blood pressure? 125
28. What is the most common effect of intubation on the heart rate? What is the most common effect of intubation on the BP? 123
29. Watch the monitor next time you assist with intubation. Do you see a change in heart rate and BP? Is this more marked with a rapid sequence intubation? 155

### **Wednesday**

30. Respiratory effects of atic: Pts under general atic are often unable to keep their airway open or breathe for themselves. 125
31. Therefore the atic team must intervene to secure an open airway rapidly and may need to ventilate the pt 109
32. Effects of atic on brain: General atic agents cause hypnosis however side-effects of these drugs include nausea, sleep disturbance and confusion 142
33. Elderly patients are at particularly high risk of post-anaesthetic confusion. Brain ischaemia, or lack of OXYGEN in the brain tissues, can also occur which may result in a stroke 90

### **Thursday**

34. Stress Response: Any surgical procedure leads to a hormonal, immunological and autonomic stress response in keeping with the extent of the surgery 150
35. Hormones released in the period after surgery include adrenaline, growth factor and cortisol 96

36. This physiological stress response contributes to post-operative complications like ARDS, thrombosis, heart attacks and sepsis 130
37. Choose one correct answer: Propofol is used for a) Hypnosis b) analgesia or c) muscle relaxation
38. Fill in the missing words: Propofol causes the BP to \_\_\_\_ and the P to \_\_\_\_ but intubation causes the BP to \_\_\_\_ and the P to \_\_\_\_.

### **Friday**

39. Surgery and anaesthesia also cause much anxiety for pts. The help of a friendly AA can be far more effective than drugs in calming pts. 141
40. Think of the last time you or a family member had a medical procedure like a vaccination or surgery. How did you feel?
41. Can you remember a nurse or doctor that made you feel more relaxed and calmed your fears?
42. Anxiety can be a major contributor towards tachycardia and hypertension during induction of anaesthesia

### **What is the role of the anaesthetic assistant?**

#### **Monday**

43. The purpose of the anaesthetic nurse
44. 2 main roles of AA: Patient Safety and Theatre Efficiency and all responsibilities relate to these goals 107
45. Who should be the first person to meet the pt when they arrive in theatre?  
Check a copy of the WHO checklist, who should fill in the first part?

46. To achieve pt safety, AA must be a pt advocate: first person to meet patient, check identity, consent and then ensure comfort and reduce anxiety

148

47. AA should be another layer of defense; working in a team with artist, ready to communicate to prevent mistakes

118

## **Tuesday**

48. Preparation for surgery and anaesthesia is vital. The patient, equipment, theatre environment and stocking of sundries should be prepared while in constant communication with the anaesthetist and surgeon.

49. During an emergency in theatre, which staff member is best placed to take a 'big picture' view and prepare for the next step?

50. Think about a resus or emergency you've been involved in recently; How much time was wasted fetching essential equipment or essential staff members? These are the steps we need to be thinking about at all stages during an operation.

51. The AA also is an important extra set of eyes and ears on the patient: you should understand the monitors, be able to read them ANS in keep in constant communication with the anaesthetist about the condition of the patient.

## **Wednesday**

52. What does NIBP stand for? What may cause the NIBP machine to give an incorrect reading? At what frequency is the NIBP cuff cycled during most GA's

53. What does a Sats probe actually measure? Give 2 pieces of information this device tells us about the patient

54. What are potential causes for error in the Saturation probe reading

55. ECG: What colour are the 3 ECG electrodes and which goes where: right shoulder, left shoulder and apex?

56. What device, commonly used by the surgeons interferes with the ECG?

57. Theatre Efficiency: prompt arrival of correct patient and preparation of theatre environment for next atic and surgery are responsibility of atic team

154

\*numbers at end of lines denote character count. SMS's should be kept to less than 150 characters

\*\* denotes scheduled day for sending of SMS

## **Appendix C: Pre-test and Post-test**

### **Pre-Test**

**Please answer True or False to the following questions:**

1. The most important person in an operating theatre, during an operation is the patient.
2. General Anaesthesia means a patient is aware of what's going on but is paralysed so is unable to react.
3. General anaesthesia means a patient is so deeply asleep that they do not respond to painful stimuli.
4. To achieve the state of general anaesthesia the anaesthetic team must use drugs to cause hypnosis, analgesia and amnesia
5. Regional anaesthesia means making only part of a patient's brain fall asleep so that they cannot feel the operation happening.
6. Isoflurane is an intravenous anaesthetic used to cause analgesia
7. Isoflurane can be used for the induction and maintenance of general anaesthesia.
8. Propofol is given intravenously to cause hypnosis
9. Fentanyl is given intravenously to cause hypnosis.
10. Suxemethonium or Scoline is used to cause muscle relaxation or paralysis.
11. Suxemethonium or Scoline is stored at room temperature
12. Deep Vein Thrombosis and Pulmonary Emboli usually occur intra-operatively.

13. Airway obstruction leading to breathing problems is a risk immediately after removal of the ET Tube or LMA
14. Most commonly used anaesthetic drugs cause the blood pressure to increase.
15. Hypertension caused by the intubation response can be ignored; it will not last long and is not dangerous.
16. Propofol is clear and colourless
17. Propofol causes an increase in blood pressure
18. Intubation usually causes a decrease in heart rate and blood pressure
19. Some people report sleep and behaviour disturbance after an anaesthetic
20. Elderly patients are at lower risk than other adults of post-operative confusion.
21. The physiological stress response to surgery does not contribute to post-operative complications
22. If the patient is anxious the first plan should be for the anaesthetist to give calming drugs.
23. If the theatre slate runs late, it is the responsibility of the scrub nurse and surgeon alone to speed things up.
24. The first part of the WHO Safe Surgery Checklist should be completed by the anaesthetic team.
25. The scrub nurse is usually the first person to meet the patient as they arrive in theatre.
26. The Anaesthetic Assistant should be the first person to meet the patient when they arrive in theatre.
27. The Anaesthetic Assistant has a responsibility to prevent mistakes; this may mean questioning the anaesthetist on their planned actions, before they take place.
28. During an emergency in theatre, the anaesthetic nurse should be present at all times and ready to prepare for the next step.



29. The green ECG electrode goes at the right shoulder

30. If a patient has cold peripheries the Sats probe may not work well on the finger and an ear probe may be needed.

## Post-Test

### **Please answer True or False to the following questions**

1. The most important person in an operating theatre, during an operation is the surgeon.
2. The purpose of anaesthesia is to MAKE the patient pain and movement free to allow the surgeon to operate.
3. To achieve the state of general anaesthesia the anaesthetic team must use drugs to cause hypnosis, analgesia and muscle relaxation
4. Regional anaesthesia means using drugs to temporarily turn off the nerves which supply a particular area of the body so that patients cannot feel the operation happening.
5. Brachial Plexus Blocks are used for surgery on the feet
6. Femoral Nerve blocks are used for surgery on the lower limb
7. Thiopentone is a volatile anaesthetic or anaesthetic gas used to cause muscle relaxation
8. Sevoflurane is a volatile anaesthetic or anaesthetic gas used to cause hypnosis
9. Morphine is given intravenously to cause analgesia during an anaesthetic
10. Rocuronium is used to cause hypnosis.
11. Vecuronium is stored in the fridge.
12. If a patient becomes unwell 2 to 3 days after surgery, the cause is NOT likely to be related to the operation or the anaesthetic.
13. An LMA is a suitable airway for a patient with frequent heartburn.
14. Anaesthesia can cause hypo or hypertension
15. The hypotension associated with anaesthesia is not dangerous.

16. Ischaemia occurs when tissues receive less Nitrogen than they need.
17. Thiopentone is the most commonly used induction agent
18. There is a greater risk of increased heart rate and blood pressure with rapid sequence intubations than with normal intubations.
19. People under general anaesthesia are often unable to keep their own airway open.
20. All people under general anaesthesia must be ventilated.
21. All people that undergo an operation will mount a physiological stress response in keeping with the extent of the surgery.
22. The physiological stress response can increase the risk of post-operative heart attacks, thromboses and lung complications
23. The anaesthetic assistant has an important role to play in reducing patient anxiety in the preoperative period
24. Ensuring theatre slates run efficiently is one of the roles of the anaesthetic team
25. The first section of the WHO Safe Surgery checklist should be completed by the scrub nurse
26. NIBP stands for non-invasive blood pressure
27. It is standard practice to measure patient's blood pressure every 15 minutes during a general anaesthetic
28. Saturation probes measure the percentage of haemoglobin molecules in arterial blood that are saturated with oxygen
29. The sats probe should be attached on the same arm as the BP cuff
30. The yellow ECG electrode goes at the apex of the heart.

## Appendix D: Test Model Answers

Before Test	
1	T
2	F
3	T
4	F
5	F
6	F
7	F
8	T
9	F
10	T
11	F
12	F
13	T
14	F
15	F
16	F
17	F
18	F
19	T
20	F
21	F
22	F
23	F
24	T
25	F
26	T
27	T
28	T
29	F
30	T

After Test	
1	F
2	F
3	F
4	F
5	F
6	T
7	T
8	F
9	T
10	F
11	T
12	F
13	T
14	F
15	T
16	F
17	T
18	T
19	F
20	T
21	F
22	T
23	T
24	F
25	F
26	T
27	F
28	F
29	F
30	F



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# Appendix F: Author Guidelines, The South African Journal of Anaesthesia and Analgesia (SAJAA)

## Online Submissions

Already have a Username/Password for Southern African Journal of Anaesthesia and Analgesia?

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Need a Username/Password?

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Registration and login are required to submit items online and to check the status of current submissions.

## Author Guidelines

### **How to submit your paper online:**

1. Registered authors must login to submit a paper
  - o [REGISTER HERE](#) if you do not have a username and password
  - o [LOGIN HERE](#) if you have already registered with SAJAA
2. Select Author
3. Click on [CLICK HERE TO FOLLOW THE FIVE STEPS TO SUBMIT YOUR MANUSCRIPT](#)
4. Follow the five steps to submit your paper
5. To view a video on how to submit a paper online [CLICK HERE](#)
6. To download instructions to authors [CLICK HERE](#)

### **Review policy and timelines**

1. Immediate notification if submitted successfully
2. Notification within 3 weeks if not accepted for further review
3. Notification within 3 months if accepted for publication, if revisions are required or if rejected by both reviewers.
4. Publication within 6 months after submission.

### **Aims, scope and review policy**

The *SA Journal of Anaesthesia and Analgesia* aims to publish original research and review articles of relevance and interest to the anaesthetist in academia, public sector and private practice. Papers are peer reviewed to ensure that the contents are understandable, valid, important, interesting and enjoyed. All manuscripts must be submitted online.

SAJAA is accredited by the Department of Education for the measurement of research output of public higher institutions of South Africa (SAPSE accredited). All articles in SAJAA will be peer reviewed.

### **Article sections and length**

The following contributions are accepted (word counts exclude abstracts, tables and references):

- \* **Original research** (2800 – 3200 words/ 4-5 pages)
- \* **Clinical Reviews** (2400 words/ 3-4 pages)
- \* **Drug Reviews** (2400 words/ 3-4 pages)
- \* **Case Studies** (1800 words/ 3 pages)
- \* **clinical of appraisals** (300 word trial summary and 300 word commentary, <600 words in total including references)
- \* **Scientific Letters** (2400 words/ 3-4 pages)
- \* **Letters to the Editor** (400-800words]

Please see the journal's section policies [section policies](#) for further details.

#### **FULL AUTHOR GUIDELINES**

##### **Title page**

All articles must have a title page with the following information and in this particular order: Title of the article; surname, initials, qualifications and affiliation of each author; The name, postal address, e-mail address and telephonic contact details of the corresponding author and at least 5 keywords.

##### **Abstract**

All articles should include an abstract. The structured abstract for an Original Research article should be between 200 and 230 words and should consist of four paragraphs labeled Background, Methods, Results, and Conclusions. It should briefly describe the problem or issue being addressed in the study, how the study was performed, the major results, and what the authors conclude from these results. The abstracts for other types of articles should be no longer than 230 words and need not follow the structured abstract format.

##### **Keywords**

All articles should include keywords. Up to five words or short phrases should be used. Use terms from the Medical Subject Headings (MeSH) of Index Medicus when available and appropriate. Key words are used to index the article and may be published with the abstract.

##### **Acknowledgements**

In a separate section, acknowledge any financial support received or possible conflict of interest. This section may also be used to acknowledge substantial contributions to the research or preparation of the manuscript made by persons other than the authors.

##### **References**

Cite references in numerical order in the text, in superscript format (Format> Font> Click superscript). Please do not use brackets or do not use the foot note function of MS Word.

In the References section, references must be typed double-spaced and numbered consecutively in the order in which they are cited, not alphabetically.

The style for references should follow the format set forth in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (<http://www.icmje.org>) prepared by the International Committee of Medical Journal Editors. Abbreviations for journal titles should follow Index *Medicus* format. Authors are responsible for the accuracy of all references. Personal communications and unpublished data should not be referenced. If essential, such material should be incorporated in the appropriate place in the text.

List all authors when there are six or fewer; when there are seven or more, list the first three, then ";et al."; When citing URLs to web documents, place in the reference list, and use the following format: Authors of document (if available). Title of document (if available). URL. (Accessed [date]).

The following are sample references:

1. Jun BC, Song SW, Park CS, Lee DH, Cho KJ, Cho JH. The analysis of maxillary sinus aeration according to aging process: volume assessment by 3-dimensional reconstruction by high-resolutonal CT scanning. *Otolaryngol Head Neck Surg.* 2005 Mar;132(3):429-34.
2. Polgreen PM, Diekema DJ, Vandenberg J, Wiblin RT, Chen YY, David S, et al. Risk factors for groin wound infection after femoral artery catheterization: a case-control study. *Infect Control Hosp Epidemiol*



[Internet]. 2006 Jan [cited 2007 Jan 5];27(1):34-7. Available from:  
<http://www.journals.uchicago.edu/ICHE/journal/issues/v27n1/2004069/2004069.web.pdf>.

More sample references can be found at: [http://www.nlm.nih.gov/bsd/uniform\\_requirements.html](http://www.nlm.nih.gov/bsd/uniform_requirements.html)"

### **Tables**

Tables should be self-explanatory, clearly organised, and supplemental to the text of the manuscript. Each table should include a clear descriptive title on top and numbered in Roman numerals (I, II, etc) in order of its appearance as called out in text. Tables must be inserted in the correct position in the text. Authors should place explanatory matter in footnotes, not in the heading. Explain in footnotes all non-standard abbreviations.

For footnotes use the following symbols, in sequence: \*, †, ‡, §, ||, \*\*, ††, ‡‡

### **Figures**

All figures must be inserted in the appropriate position of the electronic document. Symbols, lettering, and numbering (in Arabic numerals e.g. 1, 2, etc. in order of appearance in the text) should be placed below the figure, clear and large enough to remain legible after the figure has been reduced. Figures must have clear descriptive titles.

### **Photographs and images**

If photographs of patients are used, either the subject should not be identifiable or use of the picture should be authorised by an enclosed written permission from the subject. The position of photographs and images should be clearly indicated in the text. Electronic images should be saved as either jpeg or gif files. All photographs should be scanned at a high resolution (300dpi, print optimised). Please number the images appropriately.

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### **Review and action**

Manuscripts are initially examined by the editorial staff and are usually sent to independent reviewers who are not informed of the identity of the author(s). When publication in its original form is not recommended, the reviewers' comments (without the identity of the reviewer being disclosed) may be passed to the first author and may include suggested revisions. Manuscripts not approved for publication will not be returned.

### **Ethical considerations**

Papers based on original research must adhere to the Declaration of Helsinki on "Ethical Principles for Medical Research Involving Human Subjects"; and must specify from which recognised ethics committee approval for the research was obtained.

### **Conflict of interest**

Authors must declare all financial contributions to their work or other forms of conflict of interest, which may prevent them from executing and publishing unbiased research. [Conflict of interest exists when an author (or the author's institution), has financial or personal relationships with other persons or organizations that inappropriately influence (bias) his or her opinions or actions.] \* Modified from: Davidoff F, et al. Sponsorship, Authorship, and Accountability. (Editorial) JAMA 2001; 286(10) The following declaration may be used if appropriate: "I declare that I have no financial or personal relationship(s) which may have inappropriately influenced me in writing this paper."

### **Submissions and correspondence**

All submissions must be made online at [www.sajaa.co.za](http://www.sajaa.co.za) and correspondence regarding manuscripts should be addressed to:

The Editor, SAJAA, E-mail: [editor@sajaa.co.za](mailto:editor@sajaa.co.za)

**Note:** Ensure that the article ID [reference] number is included in the subject of your email correspondence.

### **Electronic submissions by post or via email**

Authors with no e-mail or internet connection can mail their submissions on a CD to: SAJAA, PO Box 14804, Lyttelton Manor, 0140, Gauteng, South Africa.

All manuscripts will be processed online. Submissions by post or by e-mail must be accompanied by a signed copy of the following indemnity and copyright form. [CLICK HERE](#) to download and save it to your computer.

Submissions by email should be send as an attachment to

#### Tips on Preparing your manuscript

1. Please consult the “Uniform requirements for manuscripts submitted to biomedical journals” at [www.icmje.org](http://www.icmje.org)
2. Please consult the guide on Vancouver referencing methods at: <http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=citmed.TOC&depth=2>
3. The submission must be in UK English, typed in Microsoft Word or RTF with no double spaces after the full stops, double paragraph spacing, font size 10 and font type: Times New Roman.
4. All author details (Full names, Qualifications and affiliation) must be provided.
5. The full contact details of corresponding author (Tel, fax, e-mail, postal address) must be on the manuscript.
6. There must be an abstract and keywords.
7. References must strictly be in Vancouver format. (Reference numbers must be strictly numerical and be typed in superscript, not be in brackets and must be placed AFTER the full stop or comma.)
8. It must be clear where every figure and table should be placed in the text. If possible, tables and figures must be placed in the text where appropriate. If too large or impractical, they may be featured at the end of the manuscript or uploaded as separate supplementary files.
9. All photographs must be at 300dpi and clearly marked according to the figure numbers in the text. (Figure 1, Table II, etc.)
10. All numbers below ten, without percentages or units, must be written in words.
11. Figure numbers: Arabic, table numbers: Roman

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## Submission Preparation Checklist

As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to these guidelines.

1. This manuscript has currently only been submitted to SAJAA and has not been published previously.
2. This work is original and all third party contributions (images, ideas and results) have been duly attributed to the originator(s).
3. Permission to publish licensed material (tables, figures, graphs) has been obtained and the letter of approval and proof of payment for royalties have been submitted as supplementary files.
4. The submitting/corresponding author is duly authorised to herewith assign copyright to the South African Society of Anaesthesiologists (SASA).
5. All co-authors have made significant contributions to the manuscript to qualify as co-authors.
6. Ethics committee approval has been obtained for original studies and is clearly stated in the methodology.
7. A conflict of interest statement has been included where appropriate.
8. The submission adheres to the instructions to authors in terms of all technical aspects of the manuscript.
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## Appendix G: Motivation for retrospective Ethics Committee review

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12 February 2015

Dear Professor Blockman,

As discussed telephonically, this letter serves as a request to the HREC to review the ethical issues encountered during the acquisition of data during 2013, which is now to be used in an MMED thesis. This extraordinary request is supported by the Department of Anaesthesia on the following basis:

Dr Rowan Duys first became involved with the Anaesthetic Nurse Short Course (ANSC) of the UCT Department of Anaesthesia during his first year as an anaesthesia registrar, and continued to be the lead registrar on this 10-year-old training programme into 2013. He felt strongly that it would be possible to enhance the learning experience of the 12 nurses enrolled on the 2013 course by delivering a pre-course learning package to be completed before their arrival at Groote Schuur for their 3 month period of on-site, on-the-job training.

He was also very interested in the growing use of mobile phones in the healthcare environment, especially in the opportunities they provided to engage with a large audience, in a two-way dialogue, at minimal expense. This made them ideal for delivery of

a pre-learning package to the group of enrolled students on the ANSC, since the majority of the students were off-site, at hospitals elsewhere in the Cape Metro. He wished to document any improvement in student knowledge scores as a means to audit and validate the training method.

Unfortunately, the dates for the course had already been set, and it was felt that the timelines were too short to be able to prepare a suitable submission to the ethics board before the course started. Following discussion with various departmental supervisors, he misunderstood the final plan, thinking it would be possible to obtain retrospective ethics approval for a study such as this with such limited scope for ethical transgressions.

He has since come to understand the policy better and now submits a brief summary of the methodology for review, in the hope that the Board will support the initial view that the ethical principles of the data collection were sound, and that it would be acceptable to publish the interesting and educationally valuable results.

The 12 nurses contacted in the study had enrolled in the UCT ANSC by responding to an advertisement sent to their respective nursing heads by a senior nurse in the Groote Schuur Theatre establishment. Their telephone numbers were obtained in the information requested during the application process.

A month before the on-site course began; Dr Duys telephoned all the candidates to:

1. Explain the proposed pre-learning package and how any data would be stored.
2. Obtain consent to:
  - i. Enroll the nurses in the package.
  - ii. Perform a telephonic True/False test with them, before the pre-learning package began and after it ended.
  - iii. Collect the data regarding their pre- and post-intervention test scores and possibly publish it anonymously either via oral presentation or written work.

All 12 nurses gave verbal consent, the pre-intervention tests were performed telephonically at a pre-arranged time and date, and the intervention began. The pre-learning package took the form of short message service (SMS) text messages being sent to the candidates everyday for a month covering theory, questions and tasks related to Anaesthetic Nursing.

After the month, and before the on-site course began. A further True/False test was performed telephonically and median scores for the pre and post-intervention groups were compared. All data was stored on a computer which is password protected. Candidates were assigned a number so that data regarding test scores and names were anonymised.

The full ANSC, on-site course, is not a pass/fail course. End of course exams are performed, but all candidates receive the same attendance type certificates. Therefore, the test-scores or participation levels of candidates in the pre-learning package did not influence their successful completion of the course.

Many thanks for the HREC's time and opinion on this matter. I believe the lack of application for ethics approval at the time of data collection to have been an honest misunderstanding, and I hope the methodology is viewed favourably.

Yours sincerely,

Professor RA Dyer, on behalf of Dr Rowan Duys



**UNIVERSITY OF CAPE TOWN**  
**Faculty of Health Sciences**  
**Human Research Ethics Committee**



**Room E52-24 Old Main Building**  
**Groote Schuur Hospital**  
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Website: [www.health.uct.ac.za/research/humanethics/forms](http://www.health.uct.ac.za/research/humanethics/forms)

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**13 February 2015**

**Dr R Duys**  
Anaesthesia Department

Dear Dr Duys

**Re: MMed proposal: VALIDATION OF THE USE OF SHORT MESSAGE SERVICE (SMS) MESSAGES AS A TRAINING TOOL FOR ANAESTHETIC NURSES**

The Human Research Ethics Committee does not provide retrospective approval for completed research. However, from your correspondence it appears that the data collection during the anaesthesia nurse short course was conducted ethically.

The HREC notes that failure to obtain research ethics approval from the HREC in UCT's Faculty of Health Sciences was a procedural rather than a substantive ethical lapse.

In instances such as yours, we believe it is up to the Degrees Board, to decide on whether they will allow low risk research which did not obtain prior research ethics approval to be submitted.

The HREC require that you complete the online tutorial TCPS 2: CORE (Course on Research Ethics). This tutorial is an introduction to the 2nd edition of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2). It consists of eight modules focusing on the guidance in TCPS 2 that is applicable to all research regardless of discipline or methodology.

Here is the link to the training course: <http://tcps2core.ca/welcome>

Please send your certificate to the HREC once completed.

Yours sincerely

**PROFESSOR MARC BLOCKMAN**  
**CHAIRPERSON, FHS human research ethics committee**