

Anaesthesia training for interns at a metropolitan training complex: does it make the grade?

Belinda Kusel,^{a*} Zane Farina^a and Colleen Aldous^b

^a Department of Anaesthesia, University of KwaZulu-Natal

^b College of Health Sciences, University of KwaZulu-Natal

*Corresponding author, e-mail: belinda.kusel@gmail.com

Background: Most anaesthesia-related mortality that occurs in level 1 hospitals in South Africa is avoidable. Improving training during internship, and consequently the skills of community service officers, could lead to safer anaesthesia practices.

Objectives: The objectives of the study were to determine whether or not the timing of the anaesthesia rotation during internship and other factors affected the outcome of the assessment at the end of the anaesthesia rotation, and to compare the perceptions of first- and second-year interns regarding their confidence levels at the end of their rotation.

Method: We conducted a retrospective study that compared 298 intern assessments over a three-year period. It included the assessment of interns by senior doctors in respect of three cases, an overall assessment of the interns' performance, and the number of cases carried out by them. In addition, a questionnaire was used to assess the interns' confidence levels at the end of the rotation.

Results: Little variation in the results was evident across comparisons of the year of internship, gender and age. Comparison according to university showed a slight variation. A wide variation in the number of obstetric cases (range 5–58) and endotracheal intubations (range 6–54) was observed. Over 80% of interns, regardless of the year, were confident enough to administer general anaesthesia and perform an endotracheal intubation. However, this perception of confidence by interns did not relate to the assessment of their competence.

Conclusion: The variance in the ability of interns to perform anaesthesia could not be accounted for by the training year, institution of undergraduate study, age or gender. It is likely that the assessment technique used did not provide a true reflection of the acquired skills or longevity of knowledge by interns. Further research in this area is recommended.

Keywords: anaesthesia, interns, training, standards

Introduction

Community service doctors administer anaesthesia in many rural hospitals across South Africa. Owing to the shortage of qualified anaesthetists,¹ qualified doctors are expected to be able to administer anaesthesia post internship. The only formal anaesthetic training for most doctors practising in level 1 hospitals is received during internship. Caesarean sections are the most commonly performed surgery in level 1 hospitals, and are often performed unsupervised by community service doctors in these hospitals.

Obstetric mortality in South Africa is higher than that in developed countries.^{2–4} It could be debated as to whether South Africa's maternal mortality figures should be compared with those of developed or developing countries. South Africa's maternal mortality rate (MMR) of approximately 300:100 000 is only slightly lower than the overall African MMR of 460:100 000. This ranges from 56:100 000 in Tunisia to 1 100:100 000 in Chad. The MMR in developed countries is around 16:100 000.⁵ The quality of obstetric anaesthesia at level one hospitals is a contributing factor to South Africa's high MMR as anaesthesia-related mortality for patients undergoing Caesarean sections in level 1 hospitals is higher than that in regional or tertiary hospitals.^{2–4,6} This is concerning as the majority of the patients undergoing Caesarean sections in level 1 hospitals should be healthy young women. Patients who are ill should be referred to higher levels of care. According to the last two published reports from the *Saving mothers. Confidential enquiry into maternal deaths in South Africa* (2005–2007³ and 2008–2010),⁴ South Africa has a MMR of 150–500/100 000. The

total number of maternal deaths from 2005–2007 was 4 077, of which 107 (2.7%) were anaesthesia related, and 4 867 from 2008–2010, of which 121 (2.5%) were anaesthesia related. The number of spinal anaesthesia-related deaths is rising (Figure 1). The majority of anaesthetic-related deaths were deemed to be avoidable.⁶ A large proportion of anaesthesia-associated maternal deaths occurred at district hospitals, 42% from 2005–2007, and 55% from 2008–2010. At this level of care, anaesthesia is frequently provided by community service doctors and improving training during internship and consequently the skills of community service medical officers could be a useful intervention to improve these figures.

The 2005–2007 *Saving mothers. Confidential enquiry into maternal deaths in South Africa* report recommended that "all interns should be required to show practical competency in both spinal and general anaesthesia, and to have spent a mandatory period providing obstetric anaesthesia under supervision".³ Therefore, it is important that any South African intern anaesthesia training programme is structured to prepare interns for obstetric anaesthesia, which they will be expected to provide at a district hospital during community service and in subsequent years in the district hospital.

The intern training programme in South Africa is currently a two-year programme, with compulsory rotations, including four-month rotations in internal medicine, surgery, obstetrics and gynaecology, paediatrics and family medicine, and two-month rotations in anaesthesia and orthopaedics.⁷

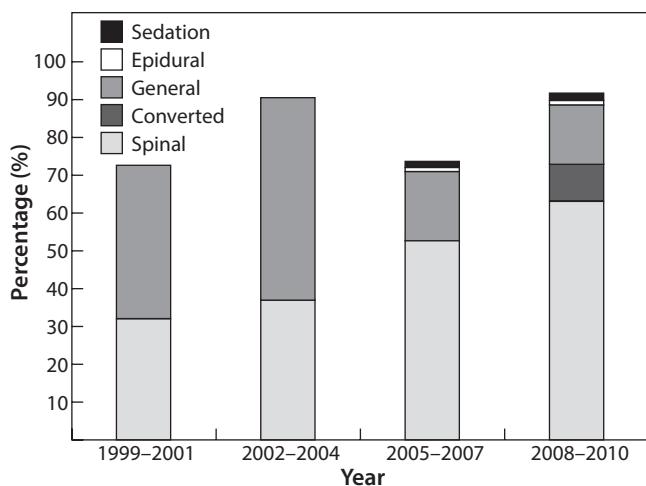


Figure 1: Maternal deaths relating to anaesthesia⁴

Previous investigators have found that increasing the duration of the anaesthesia rotation from two weeks to two months improved the interns' test scores by 10%, although certain areas of skill and knowledge were still lacking.⁸ This study did not evaluate the best timing for the anaesthesia rotation during the two years, or subsequent community service doctors' performance.

Currently, the two-month anaesthesia training rotation in the Pietermaritzburg complex which includes three hospitals (Greys, Edendale and Northdale), can occur at any stage of the 24-month internship training period. The impression by the doctors responsible for the training of interns in Pietermaritzburg was that second-year interns were more capable of providing anaesthesia than first-year interns at the end of the anaesthesia rotation. Therefore, the influence of timing on anaesthesia training was reviewed in this paper. Other chosen influencing factors were age, gender, medical school and the number of cases performed by each intern.

The transition from being a student to an intern is associated with a change in level of responsibility, work load and work content. During this phase, interns may have feelings of uncertainty and lack confidence regarding patient management and procedures.⁹ If this period of psychological insecurity impacts upon anaesthesia interns, poor performance would be evident in interns conducting anaesthesia blocks during the first six months of internship. Similarly, improved performance would be evident after assimilation of the new work environment.

According to the constructivist education theory, individuals gain new knowledge from experiences by incorporating these into their current frame of reference.¹⁰ According to this paradigm, it can be expected that candidates with a broader base of experience from previous rotations, i.e. second-year interns, would benefit more from their anaesthesia rotation, and would therefore be better equipped to provide anaesthetic services.

Method

This study compared intern assessments from January 2008 to December 2010, performed as part of the normal review process for the intern programme. The study included 298 intern assessments and 81 questionnaires. The data were

analysed retrospectively on assessments that were carried out during this time.

The two-month intern training programme in anaesthesia in Pietermaritzburg aims to teach academic and practical skills to equip interns for community service. It is designed to ensure the equal exposure of interns to obstetric anaesthesia and other basic anaesthesia. At the end of the block, the interns are assessed on their competency in administering one obstetric anaesthetic, one general anaesthetic and one non-obstetric regional anaesthetic. These assessments are completed by selected medical officers who have a Diploma in Anaesthesia, as well as by registrars or consultants. The interns are assessed on a scale from 1–5 ("1" being unsatisfactory and "5" being outstanding). The anaesthesia intern curator completes a final overall assessment of the interns. This assessment is also based on a 1–5 scale, and reviews interns' anaesthetic knowledge, patient care, airway management, spinal anaesthesia technique and professional qualities.

Two data sets were collected:

- *Quantitative data:* Quantitative data on the interns' assessment included an appraisal of three cases, i.e. obstetric anaesthesia, regional anaesthesia and general anaesthesia, as well as an overall block assessment. The number of cases that were performed was also collected. These data include the number of intubations and obstetric cases performed, as well as the total number of cases carried out. The study was on 298 intern assessments. Interns who did not complete their anaesthesia rotation were excluded.
- *Qualitative data:* Qualitative data on the interns' confidence at the end of the rotation were collected from July–December 2010. The interns completed an anonymous questionnaire at the end of their rotation to assess their level of confidence in administering anaesthesia and their opinions of the rotation. The questionnaire included information on the interns' confidence to perform intubations, obstetric anaesthesia and general anaesthesia. Eighty-one questionnaires were assessed.

All of the data were entered onto an Excel® spreadsheet, and averages for assessments and the number of cases compared to the study variables. The data were analysed using descriptive statistics. Biomedical research ethics committee approval was obtained prior to commencement of the study.

Results

The study included interns from all of the medical schools in South Africa. No significant difference was identified between the first- and second-year intern assessments by senior doctors. The overall assessment for both groups was 4.1 out of 5 (Figure 2). No differences were detected either following an additional subanalysis of quartiles within the year.

Similar assessments were made for the male and female interns. Women scored an overall assessment of 4.2 out of 5, and the men 4.1 out of 5 (Figure 3).

Interns were divided into three age groups, with a median age of 25, and a range of 22–39. The age group 22–24 years and that of 25–29 years performed slightly better than the group aged 30–39 years (overall assessments of 4.1, 4.2 and 3.8, respectively) (Figure 4). Data on other factors that might have

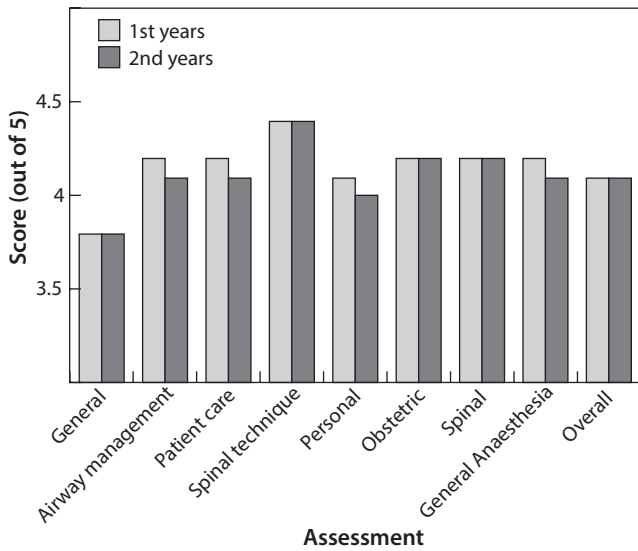


Figure 2: The overall intern assessment

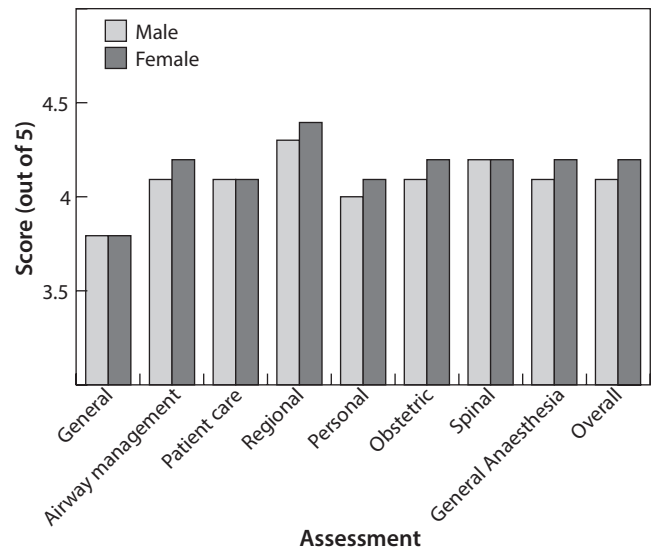


Figure 3: Intern assessment according to gender

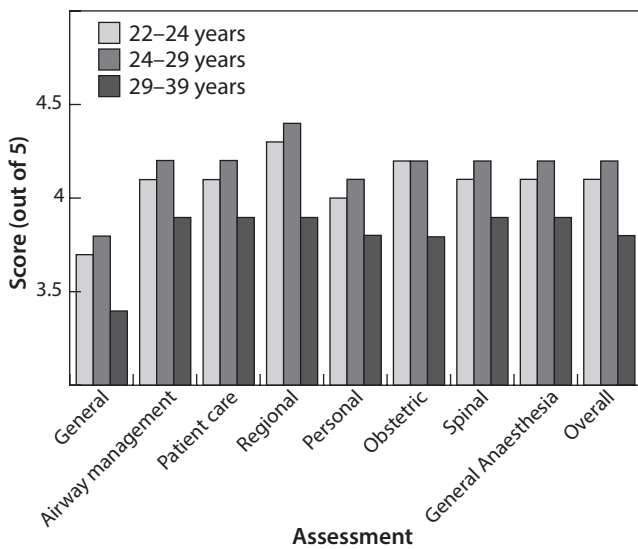


Figure 4: Intern assessment according to age

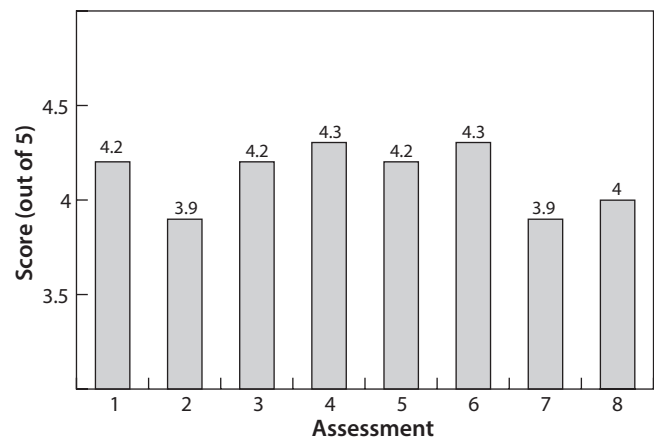


Figure 5: Overall assessment according to the university

influenced outcomes, i.e. previous graduate qualification, were not available.

When categorised according to the different universities, Kruskal-Wallis analysis (analysis of variance) of these data revealed that there was a significant difference between interns who scored high on performance and those who scored low (p -value 0.04). Comparison by university showed a slight variation, ranging from an overall assessment of 3.9–4.3.

The next assessed variable was the number of cases performed by the interns. A wide variation in the number of obstetric cases and endotracheal intubations was observed, as illustrated in Table I.

Table I: Performed procedures

Item	Median	Minimum	Maximum
Total cases	105	71	144
Obstetric cases	25	5	58
Intubations	27	6	54

Twenty per cent of the interns conducted fewer than 20 obstetric cases, and 14% fewer than 20 intubations. A comparison of the data showed that 19% of first-year interns and 22% of second-year interns undertook fewer than 20 obstetric cases. Four per cent of first-year interns, compared to 14% of second-year interns, assumed fewer than 15 obstetric cases!

The number of endotracheal intubations and obstetric cases performed, and the total number of cases carried out, was compared between groups. No major differences in the number of cases performed were found between first- and second-year interns, the different age groups, universities and gender.

There was no difference in the qualitative data between the first- and second-year interns in their perceptions of their confidence with regard to performing anaesthesia. Most interns were confident about performing obstetric anaesthesia. More than 80% of interns in both the first- and second-year groups were confident about administering general anaesthesia and performing endotracheal intubation (Figure 6).

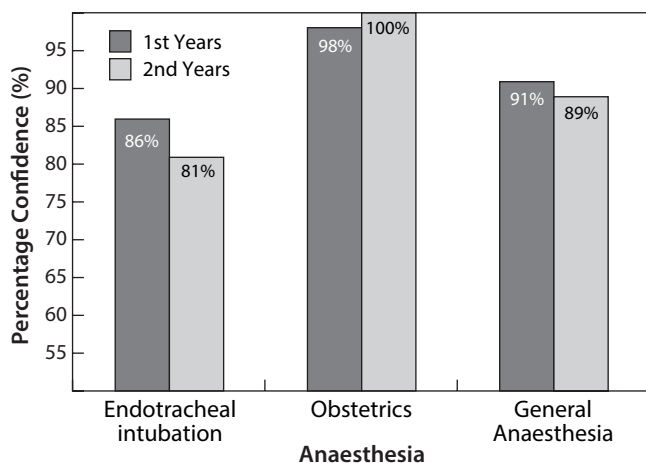


Figure 6: Confidence of the interns

It is important to note from these results that only one intern out of 298 was assessed by senior staff as being incompetent, e.g. he or she obtained an overall assessment mark below 3 out of 5. The majority of interns were assessed to be competent to provide basic anaesthesia, and reported that they felt capable of doing so.

Discussion

Numerous variables can affect outcomes at the end of the intern anaesthesia rotation. This study aimed to assess some of these variables. From an educational perspective, outcomes were expected to be affected by level of experience prior to the rotation and retention of knowledge.¹⁰

Based on the impression of the doctors who trained the Pietermaritzburg interns in anaesthesia, we expected to find that second-year interns would receive a better assessment score than the first-year interns. The suggestion by the constructivist education model is that second-year interns are better equipped (by their prior intern rotations) to benefit from anaesthesia exposure. However, this was not borne out by the data that we collected.

The reason for this may lie in the assessment process. It was noteworthy that at the end of the rotation assessment, only one intern was assessed to be below average or inadequate. This suggests a highly successful competency-based programme, or the use of an inappropriate assessment tool. A major problem is that senior doctors were reluctant to score their junior colleagues below average. The impression given by assessors during the discussion of the results with them was that there were other incompetent doctors, and that the assessment system had been changed to address this issue at the training site. As an outcome of this study, this training programme was altered to incorporate an earlier assessment to determine appropriateness and number of cases performed during the rotation. Previous assessments and feedback are now being generated to identify interns in need of further training.

Additionally, these assessments were performed in a formative fashion. Formative assessments include a range of formal and informal evaluations which provide qualitative feedback to interns. This increases learning opportunities for interns through the provision of regular feedback on their performance. This feedback aids in identifying areas needing improvement. Formative assessments of interns can be implemented through weekly evaluations and feedback,

as well as qualitative assessments, rather than with scoring systems.¹¹ It is recognised that assessors need to be schooled to make assessments, and given the confidence to award lower assessment scores, where required.

A limitation of the study was that outcomes were not assessed during community service. Thus, the long-term outcome of the anaesthesia training programme was not measured. It is conceivable that a doctor who felt competent by the end of an anaesthesia block performed in his or her first internship year would feel insecure about providing anaesthesia in a district hospital two years later, owing to the lack of opportunity to maintain his or her anaesthetic skills in the second year of internship. This is a function of the retention of knowledge and skills. Completing the anaesthesia rotation closer to the end of the internship could lead to better skill retention during the community service year, and hence better anaesthetic service outcomes. Various studies carried out on the retention of cardiopulmonary resuscitation skills have demonstrated that physical skills deteriorate over time.^{12,13} Theoretical knowledge is more stable over time.^{12,13} Simulation training has been shown to improve skills retention¹⁴ for up to one year. However, the long-term retention of these skills has not been studied. Research that focuses on the confidence and abilities of community service doctors after anaesthetic internship training could further determine this, and is therefore urgently needed.

The amount of training needed to acquire certain anaesthetic skills is also an important variable. A study on bag-and-mask ventilation and orotracheal intubation assessed the amount of training needed for an 80% success rate to be achieved for these procedures. A median of 25 procedures was required for bag-mask ventilation and 29 for orotracheal intubations. The inter-individual variability of orotracheal intubations was greater than that of bag-mask ventilation.¹⁵ The participants in this study were novices, and the interns in our study may have had some previous experience with these procedures, but it might still be important for a minimum requirement to be set for certain skills. In our study, 14% of the interns performed less than 20 endotracheal intubations. This falls below the minimum requirement set by the previous study. Even though most interns rated themselves as confident to perform endotracheal intubations, they might have been incompetent when performing these procedures.

A large variation was also observed with regard to the total number of cases performed by the interns. The median total number of cases conducted was 105. However, this number ranged from 71–144. Nevertheless, the number of cases performed was similar between the different groups of interns, indicating similar exposure.

Since a significant portion of clinical work during community service in district hospitals entails obstetric care, it is important to explore whether or not interns are adequately trained to perform obstetric anaesthesia. There was a huge variation in the number of obstetric cases carried out by the interns. At the time of the study, they did not need to perform a minimum number of obstetric cases in order to complete their rotation. A substantial minority (20%) of the interns in this study worked on less than 20 obstetric cases. This raises a question as to whether or not this training adequately prepares them to administer obstetric anaesthesia during community service. More second-year, than first-year, interns, performed less than 15 obstetric cases. This noted deficiency of intubations and obstetric cases in a subset of second-year interns was an unexpected finding which deserves further research. Did this occur because

of a misconception by second-year interns that obstetric anaesthesia is boring, or does this represent a group of interns seeking the excitement of more "dramatic" anaesthesia cases? Either scenario suggests a subset of interns who may be inadequately skilled for community service, especially as the majority of anaesthetic cases needing to be performed in rural hospitals are Caesarean sections.

There was no significant difference in the data between first- and second-year interns on self-assessment with regard to confidence levels. These data were only available from July–December 2010, and thus exclude the first two rotations of internship. Self-assessment is prone to bias as people may report more favourably on themselves than their assessors would. This was identified as an area of concern in our study. More interns were confident about conducting general anaesthesia than about performing an endotracheal intubation. Does this reflect a lack of insight into the nature of general anaesthesia? Alternatively, it might imply that the importance of airway management was inadequately emphasised during the intern training.

Conclusion

The training outcome assessments by interns at Pietermaritzburg complex could not be accounted for by the training year, undergraduate study, age or gender in our study. Many interns were found to be competent to administer anaesthesia using the current assessment method in Pietermaritzburg. Whether this was owing to the fact that all of the interns were capable of providing simple anaesthesia relevant to a district hospital, or whether the assessment tool was not discriminatory enough for assessment purposes, could not be ascertained from these data. Further research that may assist with delineating these outcomes is suggested, and specifically a competency-based study that follows these interns into their community service year to assess their performance. Also, more objective validation methods need to be developed for intern assessments at this training site.

Although the original hypotheses of the study were found not to be true, the analysis enabled constructive feedback on the intern training programme of the Department of Anaesthesia, Pietermaritzburg complex.

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