

Exposure to key surgical procedures during specialist general surgical training in South Africa

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Background. The logged experience of specialist general surgical trainees has made it possible to analyse their surgical procedural exposure.

Objective. To evaluate the exposure to key surgical procedures of South African (SA) trainees in general surgery from logbooks submitted to the Colleges of Medicine of South Africa (CMSA).

Methods. Logbooks submitted and meeting the minimum requirements for the six final examinations for the fellowship of the College of Surgeons of the CMSA between August 2010 and March 2013 were selected. Consolidated surgical procedural experience was analysed according to procedural category, extent of supervision, procedure complexity and university at which the trainee performed the procedures.

Results. The 95 logbooks entered into the study recorded 144 499 procedures, 60.6% of which were unsupervised, 18.5% supervised and 20.9% assisting another surgeon. Major and minor procedures made up 40.4% and 54.6%, respectively, with the remaining 5% categorised as 'other'. A breakdown of procedural exposure per category, including the main contributing or key procedure for each category, is presented.

Conclusion. Large numbers of procedures are logged by trainees during their surgical training. Inter-university and trainee key procedural exposure in SA differ to a small degree but are striking in some categories. Exposure to key procedures is insufficient in some categories. We are currently unable to assess the quality of training and quality of surgical skills from such logbooks. A standardised electronic logbook will facilitate future analyses of trainee procedural exposure, but other tools will be required to assess the quality of surgical skills training.

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Logbooks that document surgical procedures to which a specialist general surgical trainee has been exposed have been a prerequisite to enter the final examination of the Fellowship of the College of Surgeons of the Colleges of Medicine of South Africa (CMSA)

since 2002. The requirement that this exposure be documented in a consolidated and standardised format,^[1] introduced in 2008, has made it possible to analyse the exposure of specialist general surgical trainees in South Africa (SA) to surgical procedures since then. The experience is logged using a standardised nomenclature of 279 procedures divided into 24 anatomical and procedural categories. In addition, the extent of supervision in the performance of the logged experience is specified as unsupervised (US), supervised (S), or assisting (A) another surgeon.

The aim of this study was to evaluate the exposure to key surgical procedures of SA specialist general surgical trainees retrospectively from logbooks submitted to the CMSA during the period August 2010 - March 2013.

Methods

Logbooks submitted for the six final examinations for the Fellowship of the College of Surgeons of the CMSA between August 2010 and March 2013 and that met the minimum requirements of the College of Surgeons were initially selected for this study. Logbooks submitted by trainees from universities with fewer than five candidates during the study period were then excluded.

Of the 143 logbooks submitted to the College of Surgeons during the study period, 95 met the requirements for entry into the study.

This included logbooks from the following five faculties of health sciences (of eight in SA): University of KwaZulu-Natal ($n=28$), University of Cape Town ($n=26$), University of the Witwatersrand ($n=24$), Stellenbosch University ($n=10$) and University of Pretoria ($n=7$). These institutions were randomly named U1 to U5.

The consolidated surgical procedural experience of the remaining logbooks was entered into an Excel template, and pivot tables were used for analyses. For inter-university comparisons, non-parametric Kruskal-Wallis tests were done using STATISTICA 12, and a p -value of <0.05 was considered significant. In order to ensure that every available procedure was used in the evaluation, procedures not categorised into the 279 named procedures included in the standardised nomenclature were entered as 'other' under the relevant category. Analysis was then performed according to procedural category, extent of supervision (US, S or A), complexity of the procedure (according to the BUPA classification into major and minor), and the university at which the trainee performed the procedures.

Results

The 95 logbooks from the five faculties recorded 144 499 procedures, of which 60.6% were US ($n=87\ 560$), 18.5% S ($n=26\ 776$) and 20.9% A ($n=30\ 163$). The extent of supervision was similar across all five universities.

The experience included 279 named procedures. Major and minor procedures made up 40.4% and 54.6%, respectively (the remaining 5% fell into the category 'other' and could therefore not be classified). Here too the experience was similar at all the universities. The

Table 1. Surgical procedural exposure per category per trainee

| Category Key procedure | % of all procedures | % in category | Supervision, % | | | Mean procedures per trainee, <i>n</i> (95% CI) |
|--|------------------------|------------------|----------------|----|----|---|
| | | | US | S | A | |
| Endoscopy | 15 | | | | | |
| Gastroscopy | | 65 | 76 | 21 | 3 | 154 (118 - 190) |
| Laparoscopy | 4 | | | | | |
| Cholecystectomy | | 59 | 13 | 36 | 51 | 30 (27 - 34) |
| Peritoneal cavity | 11 | | | | | |
| Laparotomy | | 73 | 62 | 18 | 20 | 134 (114 - 155) |
| Small bowel, appendix and colon | 11 | | | | | |
| Appendicectomy | | 38 | 78 | 11 | 11 | 51 (45 - 57) |
| Biliary tract and pancreas | 4 | | | | | |
| Cholecystectomy (open and lap.) | | 83 | 15 | 34 | 50 | 41 (37 - 45) |
| Cholecystectomy (open) | | 22 | 21 | 31 | 47 | 11 (9 - 13) |
| Hernias | 6 | | | | | |
| Inguinal hernia | | 47 | 48 | 23 | 29 | 35 (31 - 39) |
| Breast | 7 | | | | | |
| Excision biopsy of benign lesions | | 33 | 82 | 11 | 7 | 28 (22 - 34) |
| Mastectomy | | 30 | 32 | 27 | 41 | 26 (22 - 29) |
| Vascular | 6.5 | | | | | |
| Varicose veins | | 5 | 30 | 30 | 40 | 3.6 (2.6 - 4.5) |
| Endocrine | 1 | | | | | |
| Thyroidectomy | | 82 | 3 | 25 | 72 | 12 (10 - 14) |
| Amputations | 5 | | | | | |
| BKA and AKA | | 64 | 83 | 8 | 9 | 44 (36 - 52) |
| Stomach and duodenum | 2 | | | | | |
| Perforated peptic ulcer | | 29 | 79 | 10 | 11 | 7 (5 - 9) |
| Rectum and anus | 4 | | | | | |
| Major procedures | | 14 | 8 | 12 | 80 | 8 (7 - 9) |
| Integumentary system | 14 | | | | | |
| Major debridements of wounds, sloughectomy or secondary suture | | 23 | 90 | 5 | 5 | 41 (31 - 51) |
| Burns | 2 | | | | | |
| Minor/moderate burns | | 52 | 81 | 9 | 11 | 14 (9 - 20) |
| Intensive care | 9 | | | | | |
| Trauma resuscitation | | 33 | 58 | 35 | 7 | 40 (12 - 68) |
| Lymphoreticular system | 2 | | | | | |
| Lymph node biopsy | | 68 | 88 | 10 | 2 | 17 (13 - 21) |
| Urogenital and renal | 3 | | | | | |
| Circumcision | | 53 | 84 | 10 | 6 | 22 (16 - 28) |
| Paediatric | 2 | | | | | |
| Inguinal and femoral hernia | | 28 | 37 | 34 | 28 | 9 (6 - 12) |
| Cardiothoracic | 1.5 | | 27 | 36 | 38 | 30 (11 - 50) |
| Hands | 0.2 | | 82 | 7 | 11 | 2.3 (1.0 - 3.7) |

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Table 1. (continued) Surgical procedural exposure per category per trainee

| Category Key procedure | % of all procedures | % in category | Supervision, % | | | Mean procedures per trainee, <i>n</i> (95% CI) |
|---------------------------|------------------------|------------------|----------------|------|------|---|
| | | | US | S | A | |
| Oesophagus | 0.6 | | 45 | 28 | 27 | 42 (28 - 56) |
| Liver | 0.6 | | 55 | 11 | 34 | 13 (5 - 20) |
| Central nervous system | 0.0 | | 0 | 14 | 86 | 0.2 (0.0 - 0.4) |
| Neck | 0.3 | | 30 | 25 | 45 | 4.2 (3.2 - 5.1) |
| Other – unspecified | 5 | | 78 | 9 | 13 | 69 (55 - 83) |
| Total (no exclusions) | 100 | | 60.6 | 18.5 | 20.9 | 1 521 (1 326 - 1 716) |
| Total (with exclusions) | 83 | | 59.5 | 17.0 | 23.5 | 1 257 (1 103 - 1 411) |

US = unsupervised; S = supervised; A = assisting; CI = confidence interval; lap. = laparoscopic; BKA = below-knee amputation; AKA = above-knee amputation.

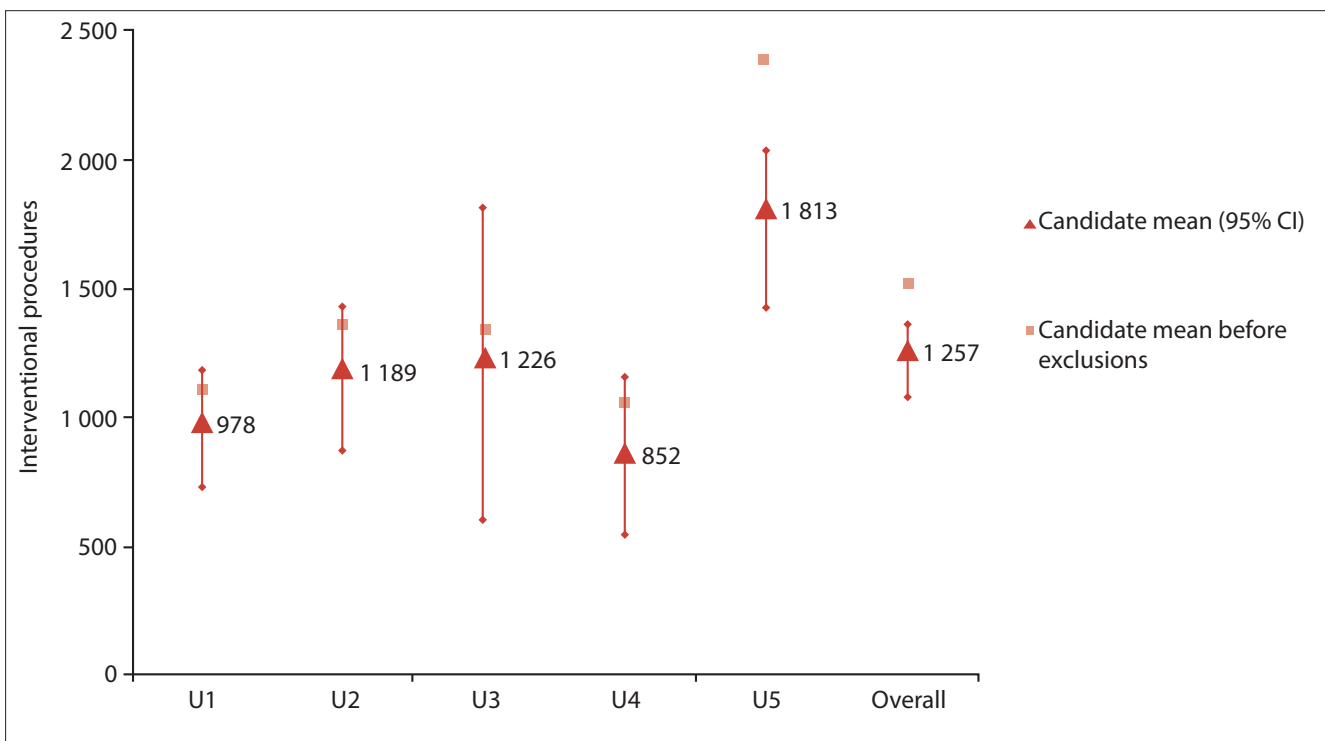


Fig. 1. Mean number of surgical procedures per trainee at the five universities, and the SA average. (SA = South African; squares = total experience; triangles = experience excluding trauma resuscitation and endoscopy procedures; CI = confidence interval; U1 - U5 = the five faculties of health sciences studied, numbered randomly.)

number of US major procedures performed (49% of the major procedures) compared with the number of US minor procedures performed (70% of the minor procedures) was statistically significant ($p=0.003$).

The trainees from U5 logged 66% of all trauma resuscitations (in the category 'intensive care') and 51% of the endoscopy procedures (in the category by that name). Analysis of inter-university experience is therefore performed using both the total number of procedures logged and the number of procedures logged after exclusion of the above two procedures (Fig. 1). Table 1 shows

a breakdown of procedural exposure per category for all trainees. In addition, the data for the main contributing or key procedure for each category are presented. Table 2 shows an inter-university comparison of procedural exposure per category. The overall surgical procedural exposure at U5 was significantly higher than at the other universities, with the exception of U3 (Fig. 1 and Table 2); however, none of the other universities showed significant overall inter-university differences. Although mean surgical procedural exposure differs significantly between universities for most of the category entries shown (see

p -values in Table 2), multiple comparative analyses show that in only a few cases is this difference accounted for by more than one university mean.

Discussion

Surgical trainee logbooks submitted to the recent final fellowship examination of the College of Surgeons (FCS) final examinations now make it possible to analyse surgical procedural experience in SA. This study demonstrates that a large number of procedures are logged by trainees during their surgical training (1 200 per trainee,

Table 2. Inter-university comparison of surgical procedural exposure per category

| Category Key procedure | Mean procedures per trainee, <i>n</i> | | | | | | <i>p</i> -value* |
|--|---------------------------------------|-----|-----|-----|-----|-----|------------------|
| | Overall (95% CI) | U1 | U2 | U3 | U4 | U5 | |
| Endoscopy | | | | | | | |
| Gastroscopy | 154 (118 - 190) | 85 | 78 | 85 | 169 | 323 | <0.0001 |
| Laparoscopy | | | | | | | |
| Cholecystectomy | 30 (27 - 34) | 24 | 31 | 38 | 32 | 32 | |
| Peritoneal cavity | | | | | | | |
| Laparotomy | 134 (114 - 155) | 97 | 166 | 91 | 53 | 186 | <0.0001 |
| Small bowel, appendix and colon | | | | | | | |
| Appendicectomy | 51 (45 - 57) | 39 | 49 | 68 | 57 | 59 | 0.02 |
| Biliary tract and pancreas | | | | | | | |
| Cholecystectomy (open and lap.) | 41 (37 - 45) | 34 | 42 | 57 | 46 | 42 | 0.045 |
| Cholecystectomy (open) | 11 (9 - 13) | 8 | 12 | 19 | 14 | 9 | 0.007 |
| Hernias | | | | | | | |
| Inguinal hernia | 35 (31 - 39) | 33 | 30 | 44 | 37 | 39 | |
| Breast | | | | | | | |
| Excision biopsy of benign lesions | 28 (22 - 34) | 35 | 30 | 9 | 23 | 25 | |
| Mastectomy | 26 (22 - 29) | 20 | 19 | 39 | 31 | 34 | 0.002 |
| Vascular | | | | | | | |
| Varicose veins | 3.6 (2.6 - 4.5) | 3.6 | 3.9 | 3.4 | 6.9 | 1.8 | 0.006 |
| Endocrine | | | | | | | |
| Thyroidectomy | 12 (10 - 14) | 9 | 17 | 19 | 10 | 8 | 0.0006 |
| Amputations | | | | | | | |
| BKA and AKA | 44 (36 - 52) | 43 | 42 | 48 | 31 | 51 | |
| Stomach and duodenum | | | | | | | |
| Perforated peptic ulcer | 7 (5 - 9) | 4 | 5 | 13 | 6 | 12 | 0.005 |
| Rectum and anus | | | | | | | |
| Major procedures | 8 (7 - 9) | 9 | 5 | 8 | 5 | 11 | 0.007 |
| Integumentary system | | | | | | | |
| Major debridements of wounds, sloughectomy or secondary suture | 41 (31 - 51) | 28 | 31 | 37 | 27 | 74 | 0.0006 |
| Burns | | | | | | | |
| Minor/moderate burns | 14 (9 - 20) | 14 | 8 | 9 | 3 | 29 | 0.002 |
| Intensive care | | | | | | | |
| Trauma resuscitation | 40 (12 - 68) | 4 | 13 | 8 | 2 | 137 | <0.0001 |
| Lymphoreticular system | | | | | | | |
| Lymph node biopsy | 17 (13 - 21) | 11 | 22 | 16 | 9 | 20 | |
| Urogenital and renal | | | | | | | |
| Circumcision | 22 (16 - 28) | 10 | 43 | 0 | 1 | 26 | <0.0001 |
| Paediatric | | | | | | | |
| Inguinal and femoral hernia | 9 (6 - 12) | 4 | 2 | 5 | 4 | 24 | <0.0001 |
| Cardiothoracic | 30 (11 - 50) | 29 | 55 | 6 | 7 | 19 | 0.002 |
| Hands | 2.3 (1.0 - 3.7) | 0.5 | 0.9 | 2.3 | 0.1 | 6.8 | 0.0008 |

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Table 2. (continued) Inter-university comparison of surgical procedural exposure per category

| Category Key procedure | Mean procedures per trainee, <i>n</i> | | | | | | <i>p</i> -value* |
|---------------------------|---------------------------------------|-------|-------|-------|-------|-------|------------------|
| | Overall (95% CI) | U1 | U2 | U3 | U4 | U5 | |
| Oesophagus | 42 (28 - 56) | 12 | 36 | 13 | 9 | 103 | <0.0001 |
| Liver | 13 (5 - 20) | 7 | 14 | 5 | 4 | 24 | <0.0001 |
| Central nervous system | 0.2 (0.0 - 0.4) | 0.5 | 0.1 | 0.4 | 0.0 | 0.2 | |
| Neck | 4.2 (3.2 - 5.1) | 3.2 | 2.8 | 4.4 | 3.8 | 6.8 | 0.03 |
| Other – unspecified | 69 (55 - 83) | 70 | 113 | 51 | 21 | 47 | 0.002 |
| Total (no exclusions) | 1 521 (1 326 - 1 716) | 1 111 | 1 360 | 1 346 | 1 057 | 2 398 | <0.0001 |
| Total (with exclusions) | 1 257 (1 103 - 1 411) | 978 | 1 189 | 1 226 | 862 | 1 813 | 0.0001 |

U1 - U5 = the five SA faculties of health sciences studied, numbered randomly; lap. = laparoscopic; BKA = below-knee amputation; AKA = above-knee amputation.

*Overall *p*-value comparing mean trainee numbers between universities; **bold font** indicates multiple significant inter-university differences.

excluding trauma resuscitations and endoscopic procedures). In this study, this experience was gained on average over 4.3 years of training (range 2.8 - 7.4), with no significant difference in training periods between universities. Approximately 40% of the experience is gained on major procedures. The majority of all procedures performed by trainees are unsupervised (59.5%). Of the remaining 40.5%, 17% are performed by the trainee under supervision and a further 23.5% as an assistant. The current format of the logbooks does not allow us to provide any meaningful explanation on the level of supervision. The relatively high proportion of emergency procedures and the complexity of major elective surgery may be factors explaining the level of supervision.

Overall exposure to surgical procedures differs to a small degree between the universities. In most procedural categories, experience between universities is also consistent. Larger procedural exposure differences between the universities are striking with regard to exposure to endoscopy, trauma resuscitations, laparotomy, circumcisions and varicose vein procedures. While the number of surgical procedures appears to be adequate in some of the procedural categories, it is not in others. In particular, numbers seem insufficient for the following procedure categories: vascular (especially venous), major rectum and anus, burns, oesophagus and liver.

Using the current format of the submitted logbooks, it is not possible to assess the surgical skill of these trainees. This has been well documented by others.^[2-5]

Study limitations

Limitations of this study include that the accuracy of the results from the overall consolidation sheets are only as accurate as the logging done by the trainees themselves. Also, no distinction can be made between emergency and elective procedures, or between procedural exposure during the junior v. the senior rotation of the training period. The data have also not been normalised for the training time of each trainee.

Recommendations

The study shows that changes need to be made to the current system of evaluating general surgical trainee skills in SA. Firstly, the method of logging data relies on the trainee supplying the data in a non-uniform manner, and the evaluation of data is manual so analysis is tedious.

The current system also does not verify that formative assessment has occurred, and verification of the data outside of such a process is not possible. What should be considered is specific procedure-based in-course assessments as are used by other colleges, such as the Royal Colleges of Surgeons in the UK, which allows them to adequately assess surgical skills of a trainee to perform key procedures.^[6] If the data currently logged in the College of Surgeons of the CMSA logbook will still be used, the recommendations made by members of the Royal Australasian College of Surgeons for surgical trainee logbooks should also be considered. They emphasise the importance of reporting procedural outcome, not only to aid self-learning from individual cases, but also to teach trainees the lifetime practice of effective surgical audit.^[4]

Conclusion

In conclusion, inter-university and trainee key procedural exposure in SA, even when the numbers seem adequate, vary in many categories. Confidence intervals for the numbers of procedures could guide in establishing minimum criteria for key procedures during surgical training. Limitations of the surgical trainee logbooks in assessing the quality of training and the quality of surgical skills are also evident.

Future analyses of procedural exposure of trainees in SA will be facilitated with the use of a standardised electronic logbook. Such a logbook should also allow quality of surgical skills training to be assessed, possibly by documenting regular formative procedure-based assessments that would be a requirement for progression through the various stages of general surgical training.

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