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SURVEY

Procedures most frequently performed by South African-trained general surgeons – implications for training and assessment

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Background: Workplace-based assessment (WBA) is being introduced across postgraduate training in South Africa. This study was undertaken to inform the selection of the core procedures for WBA, by determining the most frequently performed procedures in general surgery practice. These findings may also assist academic centres undertaking curriculum review to determine whether or not they are training surgeons who are competent to meet the current local needs of society.
Methods: This study was a cross-sectional observational study using a self-administered survey. General surgeons who passed the final fellowship examinations of the College of Surgeons of South Africa between 2017–2022, working in full-time specialist practice, were eligible for participation.
Results: The study included 111 surgeons of which the majority (53%) were working full time in government practice, 23% were in private practice and 24% were in a combination of both government and private practice. The 10 most frequently listed procedures were – hernia repair (95%), appendicectomy (91%), emergency laparotomy (88%), laparoscopic cholecystectomy (80%), gastroscopy (80%), colonoscopy (61%), colectomy (55%), lower limb amputation (48%), mastectomy (40%) and intestinal stoma formation (31%). Fifty-seven (51%) participants reported that they felt prepared to independently perform the full range of most frequently listed procedures. Of the 49% who reported feeling unprepared for one or more procedures on completion of training, the most frequently listed procedure was colonoscopy.
Conclusion: This study identified a list of procedures that may be considered as core procedural activities for WBA of South African general surgery trainees.
Keywords: surgical education, surgical training, entrustable professional activities, workplace-based assessment

Introduction

The traditional approach to training and assessment has focused on lists of knowledge objectives.[1] This contrasts with the newer competency-based medical education (CBME) approach, which aims to ensure that all graduates attain the minimum required standards for unsupervised practice in their field.[2] Workplace-based assessment (WBA) has been defined as "the assessment of working practices based on what trainees actually do in the workplace, and predominantly carried out in the workplace itself."[3] To facilitate WBA within a CBME context, the concept of entrustable professional activities (EPAs) were introduced by Ten Cate in 2005.[4] One of their key characteristics is that they define the core activities that professionals of that discipline are expected to perform.[5] In a process driven by the SA Committee of Medical Deans and the Colleges of Medicine of South Africa (CMSA), the implementation of CBME is envisioned to begin with the introduction of WBA, using an EPA framework, across all postgraduate disciplines from 2024.[6,7]

Determining the most frequent procedures general surgeons are expected to perform upon qualifying is a key step in defining the core list of procedural EPAs that need to be assessed during training. Furthermore, this knowledge is also a critical consideration for the planning of relevant postgraduate curricula.[8] In the context of surgical disciplines, the decision of which procedural EPAs to include, especially when it comes to agreeing on such a list nationally, is challenging. In South Africa (SA), almost all postgraduate training occurs in government hospitals, however, a study by Dell et al. found that out of 894 specialist general surgeons in SA, 518 (58%) were working in the private sector.[9] As WBA will be a university and CMSA driven process, the list of EPAs that are decided upon may be skewed toward specialist academic hospitals and may not be relevant to the broader public or private sector, where most general surgeons practice.

The aim of this study was to determine the most frequent surgical procedures performed by general surgeons who graduated from South African training institutions. The findings would, therefore not only facilitate the choice of acceptable and realistic core procedural EPAs but could assist academic centres to evaluate whether they are producing surgeons that are competent to meet the needs of society.

Methods

Study design and participants

This study was a cross-sectional observational study using a self-administered questionnaire. General surgeons who passed the final examination and were admitted as Fellows of the College of Surgeons (FCS) in the CMSA from 2017–2022 and were in full-time clinical practice in either private or government settings, both in SA and abroad, were eligible to participate in the study. The choice of study period was to ensure that the data was relevant to new graduates, as more senior surgeons may develop special interest areas with time, which may have skewed the data away from what the job requires of a day one graduate. Being admitted as a FCS is analogous to becoming a member of the Royal College of Surgeons in the United Kingdom (UK) or obtaining board certification as a general surgeon in the United States. Participants were excluded if they were subspecialists or in the process of sub-specialising or were not in full time clinical practice for any reason. Potential participants were identified from the CMSA database of successful FCS final examination candidates. Contact details were obtained from the CMSA after special motivation to ensure adherence to the Protection of Personal Information Act. Attempts were made to contact all qualifiers during the specified time period. Invitations to participate in the study were sent via email and/or mobile phone. Data collection took place between 10 October and 18 December 2022.

Survey design

In preparing the survey tool, the authors developed a list of procedures which, based on their clinical experience, were felt to be a reasonable representation of the most frequent procedures performed across government and private practice in SA (Addendum). Simple procedures such as abscess drainage or soft tissue biopsy/excision were not included in the list. The list of procedures was generated through discussion between the researchers, followed by feedback from three surgeons in government practice in the Western Cape province and three surgeons in private practice in both the Western and Eastern Cape, to ensure that it contained a reasonable representation of the procedures most likely to be selected by participants as belonging in their top 10 most frequently performed procedures. There is currently no data on the ideal number of index procedures to include in a WBA strategy for general surgery. However, the researchers felt that 10 would be a reasonable number to start with, based on the number of procedural EPAs implemented in other contexts such as the USA, Australia, Netherlands and UK. Ethical approval was obtained from the Human Research Ethics Committee of the University of Cape Town (UCT HREC 477/2022).

Data collection

Information was obtained through the survey on participant gender, qualifying institution, current geographical location in SA or abroad, and nature of current practice, i.e., whether in government only, private only or a combination of both. To determine the most frequently performed procedures, participants were asked to select the 10 most frequently performed procedures in their practice from the list provided. In addition, they were asked to select from the list which of these procedures, if any, they felt underprepared to safely perform without supervision on completion of training.

Data analysis

Data analysis was performed using R (R Core team, 2022) for statistical computing. Categorical variables were compared using the chi-squared and Fisher's exact test where appropriate. A *p*-value of 0.05 or less was considered to be statistically significant.

Results

Study participation

Of 286 general surgeons who had passed the fellowship of the College of Surgeons final examination between 2017–2022, 193 were contactable and were invited to participate (contact rate 67%). Of the 176 who responded (91% response rate of those who could be contacted), 63 were excluded as they were either in the process or had completed a sub-specialty or were not in full time practice. Of the 113 who were eligible, 111 agreed to participate and were included in the study (Figure 1).

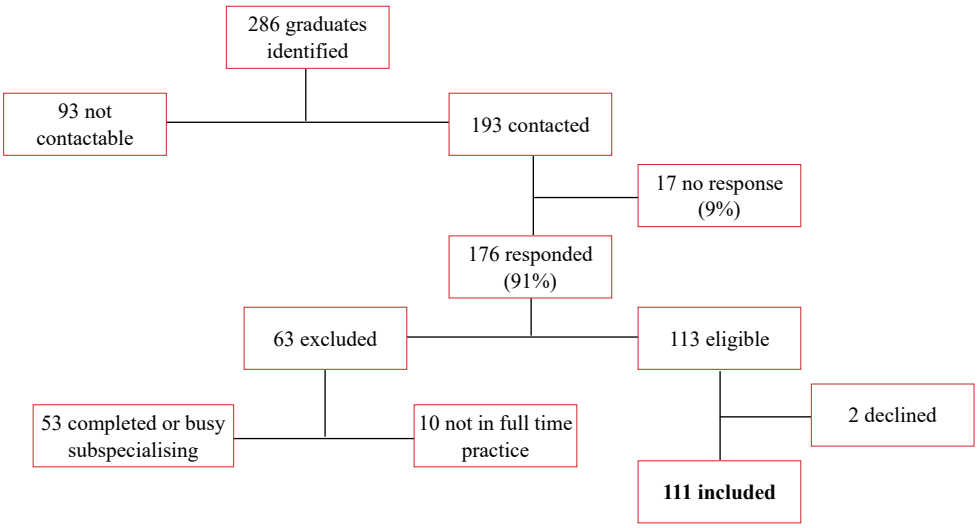

Figure 1: Flowchart of participant recruitment

Participant characteristics

Of the 111 included participants, 81 (73%) were male and 30 (27%) female with broad representation of general surgeons from eight of nine South African medical schools currently training general surgeons. The medical school that was not represented in this study enrols fewer postgraduate trainees than other institutions represented in the study. More than half (53%) of participants were working full time in government practice, 23% were in private practice and 24% were in a combination of both government and private practice. Of the 111 participants, 88 (79%) were currently practicing in SA.

Most frequently performed procedures

The 10 most frequently performed procedures by general surgeons who recently trained at South African institutions are shown in Table I.

Looking only at the cohort of surgeons currently working in SA, the most frequently performed procedures according to practice (government vs private), are shown in Table II. The differences between government, combination of government and private practice, and private practice only were analysed statistically.

Table I: Top 10 most frequently performed procedures in South Africa

Number	Procedure	Percentage surgeons who included procedure in their list of top 10 most frequently performed procedures
1	Hernia repair	95%
2	Appendicectomy	91%
3	Emergency laparotomy	88%
4	Laparoscopic cholecystectomy	88%
5	Gastroscopy	80%
6	Colonoscopy	61%
7	Colonic resection +/- anastomosis/stoma	55%
8	Major lower limb amputation (AKA/BKA)	48%
9	Mastectomy +/- ALND/SLNB	40%
10	Stoma formation	31%

AKA – above knee amputation, BKA – below knee amputation, ALND – axillary lymph node dissection; SLNB – sentinel lymph node biopsy

Preparedness to perform frequent procedures

Fifty-seven (51%) study participants reported that they felt prepared to independently perform the top 10 procedures in their practice upon admission to the general surgery fellowship. Of the 49% who reported feeling underprepared for one or more of the top 10 procedures, the most frequently listed procedure was colonoscopy (Table III). With the exception of colonoscopy, gastroscopy and laparoscopic cholecystectomy, most of the procedures which general surgeons felt underprepared to perform independently at the time of admission do not appear on the list of top 10 procedures most frequently performed by South African-trained general surgeons (Table I).

In terms of year of graduation, preparedness to independently perform one or more of the 10 most frequently performed procedures in practice is shown in Table IV. Although the numbers were too small to allow for statistical comparison, the impact of the COVID-19 pandemic in 2020 is clearly seen.

In terms of surgeons practicing full time in SA, preparedness to independently perform one or more of the 10 most frequently performed procedures in practice (government vs private) is shown in Table V.

Discussion

This study sought to determine surgical procedures most frequently performed by general surgeons who recently completed training in SA.

Most frequently performed procedures

The top 10 most frequently performed procedures included elective, emergency, open, laparoscopic, and endoscopic procedures. Comparisons to other settings is difficult due to a lack of data on number of procedures post-completion of training, the heterogeneous categorisation of procedures, and variation in the scope of general surgery practice globally. However, studies assessing procedure logs of general surgeons in the United States of America (USA) and Canada reveal similarities to this study.[10,11] Hernia repair, laparoscopic cholecystectomy, appendicectomy, gastroscopy, colonoscopy and mastectomy/lumpectomy featured as the most frequently performed procedures, whereas emergency laparotomy, colonic resection/stoma formation and amputation were less often performed. These differences may be due to increasing sub-specialisation with up to 80% of trainees in the USA pursuing subspecialist

Table II: Procedures most frequently performed by recently qualified surgeons practicing in government vs private in South Africa

Procedure	Government only (*n* = 47)	Government and private (*n* = 20)	Private only (*n* = 20)	*p*-value
Hernia repair	43 (91%)	19 (95%)	20 (95%)	0.99
Appendicectomy	41 (87%)	18 (90%)	21 (100%)	0.32
Emergency laparotomy	46 (98%)	19 (95%)	13 (62%)	**0.0001**
Laparoscopic cholecystectomy	36 (77%)	19 (95%)	21 (100%)	**0.01**
Gastroscopy	42 (89%)	17 (85%)	21 (100%)	0.23
Colonoscopy	25 (53%)	13 (65%)	21 (100%)	**0.0001**
Colonic resection +/- anastomosis/stoma	31 (66%)	8 (40%)	8 (38%)	**0.04**
Major lower limb amputation (AKA/BKA)	34 (72%)	6 (30%)	2 (10%)	**< 0.0001**
Mastectomy +/- ALND/SLNB	23 (49%)	9 (45%)	3 (5%)	**0.02**
Stoma formation	20 (43%)	5 (25%)	1 (5%)	**0.004**

Table III: Procedures surgeons felt underprepared for on admission to the College of Surgeons of South Africa

Number	Procedure	Percentage surgeons who felt underprepared for procedure at graduation
1	Colonoscopy	23%
2	Laparoscopic cholecystectomy	9%
3	Vascular access	9%
4	Gastroscopy	8%
5	Parathyroidectomy	8%
6	Thyroidectomy (lobectomy/total)	7%
7	Fundoplication	7%
8	Haemorrhoidectomy/banding	6%
9	Gastrectomy	5%
10	Varicose vein procedure	5%

Table IV: Proportions of surgeons, by year of graduation, who felt underprepared to perform one or more of the 10 most frequent procedures in their practice

Year of graduation	Total study participants admitted to college	Number (%) who felt underprepared for 1 or more most frequent procedure
2017	12	4 (33%)
2018	13	5 (38%)
2019	14	6 (43%)
2020	19	15 (79%)
2021	37	17 (46%)
2022	16	7 (44%)

Table V: Proportions of South African surgeons, government vs private, who felt underprepared to perform one or more of the 10 most frequent procedures in their practice

Practice type	Total participants	Number (%) who felt underprepared for 1 or more most frequent procedure
Full time state only	47	20 (43%)
Combination state and private	20	10 (50%)
Full time private only	21	12 (57%)

training.[12] In the South African setting, inadequate access to healthcare results in patients more often presenting with advanced disease requiring emergency surgery, which is primarily rendered by general surgeons.[13]

Differences in practice types within SA

A statistically greater proportion of surgeons in the government sector listed emergency laparotomy as one of their most frequent procedures (98% vs 62%). This may be explained by the higher burden of trauma and greater number of trauma laparotomies performed in government hospitals, as "emergency laparotomy" included both trauma and non-trauma surgery.[14] In terms of amputations, late presentation in the government sector and easier access to subspecialist vascular surgeons in private practice may account for the differences observed between the groups. Another striking difference between private and government surgeons working in SA, is that all private surgeons listed colonoscopy as one of their most frequent procedures, as compared to 53% who work in government-only practice. In many respects, the list of most frequently performed procedures by private general surgeons working in SA is similar to general surgeons in North America, where colonoscopy is the procedure most frequently performed by non-subspecialist general surgeons.[10,11]

Implications for procedural training

In SA, 76% of the population have no private health insurance and rely on public healthcare services.[15,16] Only 17% of the population have private medical insurance and a further 7% are estimated to use private healthcare services without insurance. In this study, we recruited the opinion of general surgeons working in the private and public sector and so the healthcare needs of all South Africans are broadly represented. The data gathered in this study can therefore be used to reflect on the implications for procedural training of general surgeons practicing in SA.

Overall, 49% of participants reported that they felt underprepared to independently perform one or more of the frequently performed procedures in their practice upon admission to the CMSA. This finding is in keeping with international studies, often reporting a sense of underpreparedness for expected operative competency following completion of general surgery training.[12,17-19] Although the COVID-19 pandemic certainly contributed, at least a third of participants, both before the pandemic started and after it settled, reported feeling underprepared to independently perform at least one of the top 10 most frequent procedures in their practice (Table IV).

It is reassuring that most of the procedures recently qualified general surgeons felt underprepared to perform do not appear on the list of most frequently performed procedures. This finding, however, must be interpreted with caution because it reflects self-perceived competence. Nonetheless, despite the documented limitations of self-assessment[20] and the small sample size of this study, it is of concern that almost a quarter of participants listed colonoscopy as a procedure they felt underprepared to perform independently. The consequences of poorly performed colonoscopy are well known in the literature and improving the training for this procedure should be considered a priority.[21]

Implications for assessment

As WBA is implemented in postgraduate training programmes in SA, the findings of this study provide insights which can inform the selection of procedural EPAs.[6] As outcomes define decisions regarding both training and assessment in the CBME era, lists of procedures most frequently performed should inform the choice of core procedural EPAs for WBA.[2] Although the most frequently performed procedures ought to align with the desired outcomes of training, it does not necessarily mean that all of these procedures are suitable for WBA. To achieve an "adequate number supervised in training (ANSIT)", a procedural EPA needs to meet two

criteria. First, the procedure should be sufficiently frequently performed by trainees to allow multiple observations by more than one supervisor, and second, routine supervision for the specific procedure in clinical practice should occur frequently. The number of direct observations required per procedure is challenging to define and has been described to range from 3–60, depending on the context, assessment tool and type of procedure.[22-24] However, the prevailing thinking is that it should be at least 3–5.[22]

In a study by Kruger et al. the logbooks of general surgery trainees applying for the final CMSA examination were reviewed to assess the mean number of procedures performed and the level of supervision provided.[25] The procedures (n = mean number) that were most frequently performed *under supervision* were – gastroscopy (n = 32), laparotomy (n = 24), hernia repair (n = 19), laparoscopic cholecystectomy (n = 11), intestinal stoma/anastomosis (n = 11), mastectomy (n = 7), colonoscopy (n = 7) and appendicectomy (n = 6). All of these most frequently supervised procedures reflect on the list of 10 most frequently performed in practice, suggesting that they represent a feasible and relevant list of core procedures for WBA in SA. Amputations, although frequently performed in practice and during training, are mostly unsupervised as they are usually performed afterhours and not considered to be difficult or high risk. This makes amputation less feasible to include in the initial phase of a local WBA strategy, despite it being an important surgical procedure for trainees to master. The list of core procedural EPAs recommended from the findings of this study overlaps somewhat with similar lists from the USA, the Netherlands, Australia and the UK, but is unique to the South African training context.[26-29]

There is often an imbalance between educational aims and the reality of clinical practice, which partly explains the dissatisfaction with WBA in settings where it has been in use for several years.[30,31] It is critically important to understand that a list of core procedural EPAs does not define the full scope of a general surgeon's practice, nor does it define the only important procedural exposures required during training. Rather, EPAs may serve to identify key index procedures from which it should be possible to determine readiness for safe, independent practice. Thus, the authors are of the opinion that WBA should be complemented by the ongoing use of logbooks, which aim to record the broader procedural experience of postgraduate trainees. Furthermore, individual institutions should be able to cautiously add additional procedures meeting ANSIT criteria as institution-specific "elective" EPAs.[8]

This study aimed to identify a list of specific procedures for WBA in line with current thinking that these procedures need to be observed enough times for trainees to be declared competent. However, this approach to training creates concerns that trainees will only focus on a given list of procedures at the risk of neglecting others. Omission of less frequently performed procedures also limits trainees' opportunity to get formal feedback on these, as they are "not on the list".[32] On the other hand, long lists of procedures create a burdensome system which is neither feasible nor sustainable.[31] More work is needed to find innovative solutions to this dilemma.

Limitations

In many countries surgeons are required to keep accurate logbooks of procedures for recertification and auditing, which is not the case in SA. Therefore, in this study the most frequently performed procedures were based on surgeons' self-reporting of their practice, which is prone to recall bias. Second, it is likely that the inability to contact 33% of potential participants may have skewed the data in favour of general surgeons remaining to practice in SA. Thus, the results of this study must be applied with caution to recently qualified general surgeons who go on to practice in other countries where the scope of practice may be different. It is also important to note that the data regarding number of procedures performed under supervision in training is based on a study done in 2014. While the authors do not believe it likely that the numbers are very different now, a repeat review of general surgery trainee logbooks is warranted to determine if procedural exposures and supervision patterns have changed significantly in the last few years. A potential example could be that trainees are getting to do fewer colonoscopies under supervision, due to in increasing emphasis on subspecialist fellow training in some centres. Finally, the number of participants was small, and the study period included the COVID-19 pandemic, which undoubtedly impacted training and contributed to the lack of preparedness reported by participants.[33] Ideally, the findings of this study should be verified in post-pandemic conditions recruiting a larger number of participants.

Conclusion

The findings of this study document procedures most frequently performed by general surgeons who had recently completed training in SA. If core general surgery procedures are to be chosen as EPAs for WBA in South African training institutions, the following list of eight index procedures may be considered for inclusion on the basis of this study – hernia repair, appendicectomy, laparotomy, laparoscopic cholecystectomy, gastroscopy, colonoscopy, mastectomy, and intestinal anastomosis/stoma formation. This ensures inclusion of procedures that are both frequently performed by surgeons in real-world practice, as well as supervised frequently enough during training to facilitate assessment.

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Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

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REFERENCES

1. Polavarapu HV, Kulaylat AN, Sun S, et al. 100 years of surgical education - the past, present, and future. Bull Am Coll Surg. 2013;98(7):22-7.
2. Frank JR, Snell LS, Cate OT, et al. Competency-based medical education: theory to practice. Med Teach. 2010;32(8):638-45. https://doi.org/10.3109/0142159X.2010.501190.
3. Beard J. Workplace-based assessment: the need for continued evaluation and refinement. Surgeon. 2011;9:S12-3. https://doi.org/10.1016/j.surge.2010.11.014.
4. Ten Cate O. Entrustability of professional activities and competency-based training. Medical Education. 2005;39:1176-7. https://doi.org/10.1111/j.1365-2929.2005.02341.x.
5. Ten Cate O, Taylor DR. The recommended description of an entrustable professional activity: AMEE Guide No. 140. Med Teach. 2021;43(10):1106-14. https://doi.org/10.1080/0142159X.2020.1838465.
6. Nel D, Burch V, Adam S, et al. The introduction of competency-based medical education for postgraduate training in South Africa. S Afr Med J. 2022;112(9):742-3. https://doi.org/10.7196/SAMJ.2022.v112i9.16717.
7. Nel D, Cairncross L, Burch V, et al. Workplace-based assessment - a new era of surgical training competency assessment in South Africa. S Afr J Surg. 2022;60(4):227-8. https://doi.org/10.17159/2078-5151/SAJS3972.
8. Ten Cate O, Chen HC, Hoff RG, et al. Curriculum development for the workplace using entrustable professional activities (EPAs): AMEE Guide No. 99. Med Teach. 2015;37(11):983-1002. https://doi.org/10.3109/0142159X.2015.1060308.
9. Dell A, Kahn D. Where are general surgeons located in South Africa? S Afr J Surg. 2018;56(1):12-20. https://doi.org/10.17159/2078-5151/2018/v56n1a2393.
10. Cortez AR, Ibáñez B, Winer LK, et al. Are general surgery residencies preparing graduates for the practice of today's general surgeon? An analysis of American Board of Surgery data from applicants and re-certifying surgeons. Ann Surg. 2021;277(1):e197-203. https://doi.org/10.1097/SLA.0000000000004957.
11. Schroeder T, Sheppard C, Wilson D, et al. General surgery in Canada: current scope of practice and future needs. Can J Surg. 2020;63(5):E396-408. https://doi.org/10.1503/cjs.004419.
12. Mattar SG, Alseidi AA, Jones DB, et al. General surgery residency inadequately prepares trainees for fellowship: Results of a survey of fellowship programme directors. Ann Surg. 2015;261(1):e6.
13. Mayosi BM, Benatar SR. Health and health care in South Africa - 20 years after Mandela. N Engl J Med. 2014 Oct 2;371(14):1344-53.http://dx.doi.org/10.1056/nejmsr1405012. https://doi.org/10.1056/NEJMsr1405012
14. Moodley NB, Aldous C, Clarke DL. An audit of trauma-related mortality in a provincial capital in South Africa. S Afr J Surg. 2014;52(4):101-4. https://doi.org/10.7196/sajs.1995.
15. Statistics South Africa. General Household Survey 2017, Statistical release P0318. Pretoria, South Africa: Statistics South Africa; 2017. Available from: https://www.statssa.gov.za/publications/P0318/P03182017.pdf/. Accessed 20 November 2023.
16. Pretorius L. Does SA's private healthcare sector only provide care for 16% of the population? Mail and Gaurdian. 2017 Aug 8. Available from: https://mg.co.za/article/2017-08-08-does-sas-private-healthcare-sector-only-provide-care-for-16-of-the-population/. Accessed 20 November 2023.
17. Coleman JJ, Esposito TJ, Rozycki GS, et al. Early subspecialisation and perceived competence in surgical training: Are residents ready? J Am Coll Surg. 2013;216:764-71. https://doi.org/10.1016/j.jamcollsurg.2012.12.045.
18. Fitzgerald JE, Milburn JA, Khera G, et al. Clinical fellowships in surgical training - analysis of a national pan-specialty workforce survey. World J Surg. 2013;37(5):945-52. https://doi.org/10.1007/s00268-013-1949-1.
19. Nadler A, Ashamalla S, Escallon J, et al. Career plans and perceptions in readiness to practice of graduating general surgery residents in Canada. J Surg Educ. 2015;72(2):205-11. https://doi.org/10.1016/j.jsurg.2014.10.001.
20. Nayar SK, Musto L, Baruah G, et al. Self-assessment of surgical skills: A systematic review. J Surg Educ. 2020;77(2):348-61. https://doi.org/10.1016/j.jsurg.2019.09.016
21. Ko CW, Dominitz JA. Complications of colonoscopy: magnitude and management. Gastrointest Endosc Clin. 2010;20(4):659-71. https://doi.org/10.1016/j.giec.2010.07.005.
22. Williams RG, Kim MJ, Dunnington GL. Practice guidelines for operative performance assessments. Ann Surg. 2016;264(6):934-48. https://doi.org/10.1097/SLA.0000000000001685.
23. Beard J, Marriott J, Purdie H, Crossley J. Assessing the surgical skills of trainees in the operating theatre: A prospective observational study of the methodology. Clin Gov: An International Journal. 2011;16(3). https://doi.org/10.1108/cgij.2011.24816caa.002.
24. Williams RG, Swanson DB, Fryer JP, et al. How many observations are needed to assess a surgical trainee's state of operative competency? Ann Surg. 2019;269(2):377-82. https://doi.org/10.1097/00001665-900000000-94882.
25. Kruger D, Veller MG. Exposure to key surgical procedures during specialist general surgical training in South Africa. S Afr J Surg. 2014;52(4):96-100. https://doi.org/10.7196/sajs.2162.
26. American Board of Surgery. Entrustable professional activities. 2023. Available from: https://www.absurgery.org/default.jsp?epahome. Accessed 20 November 2023.
27. Australian Board of General Surgery. EPAs and PBAs. 2023. Available from: https://www.generalsurgeons.com.au/education-and-training/gset/epas-and-pbas. Accessed 20 November 2023.
28. Dutch College of General Surgery. Scherp. 2.1. 2022. Available from: https://heelkunde.nl/themas/thema?dossierid=32768000&title=SCHERP. Accessed 20 November 2023.
29. Intercollegiate surgical programme. The surgical curriculum. 2021. Available from: https://www.iscp.ac.uk/iscp/curriculum-2021/. Accessed 20 November 2023.
30. Pereira EA, Dean BJ. British surgeons' experiences of a mandatory online workplace-based assessment portfolio re-surveyed three years on. J Surg Educ. 2013;70(1):59-67. https://doi.org/10.1016/j.jsurg.2012.06.019.
31. Beamish AJ, Rabie M, Johnston MJ, et al. Real-world use of workplace-based assessments in surgical training: A UK nationwide exploration of trainee perspectives and consensus

recommendations from the Association of Surgeons in Training. Br J Surg. 2021;108(Supplement_7). https://doi.org/10.1093/bjs/znab361.031.
32. Nel D, Jonas E, Burch V, et al. Entrustable professional activities in postgraduate general surgery training: A scoping review. 2023. [Manuscript in preparation] https://doi.org/10.1097/SLA.0000000000006400.
33. Patel RR, Nel D, Coccia A, et al. General surgery training: During the COVID 19 pandemic and beyond authors. Surg Innov. 2021;28(2):245-6. https://doi.org/10.1177/15533506211008066.

Addendum: List of procedures used in questionnaire

No.	Procedure listed in survey
1	Appendicectomy
2	Lap chole
3	Hernia - inguinal/groin*
4	Hernia – ventral*
5	Gastroscopy – diagnostic**
6	Gastroscopy - interventional (PEG, stent, control of UGIB, variceal banding) **
7	Colonoscopy
8	Trauma laparotomy***
9	Emergency non-trauma laparotomy (e.g. adhesiolysis, omental patch)***
10	Major lower limb amputation (AKA/BKA)
11	Mastectomy +/- ALND/SLNB
12	Breast wide local excision +/- ALND/SLNB
13	Fistulotomy/seton
14	Haemorrhoidectomy/banding
15	Stoma formation
16	Colonic resection +/- anastomosis/stoma
17	Fundoplication (Nissen or variation)
18	Gastrectomy
19	Thyroidectomy (lobectomy/total)
20	Parathyroidectomy
21	Varicose vein procedure
22	Arterial bypass
23	Embolectomy
24	AVF creation****
25	Permcath/chemo port****
26	Peritoneal dialysis catheter insertion/revision
27	Skin graft
28	Liver/pancreas resection
29	ERCP

Merged and recorded in the results as: *Hernia repair, **Gastroscopy, ***Emergency laparotomy, ****Vascular access