

The introduction of Workplace-Based Assessment for General surgery training at a South African university

By

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2. Nel D, Cairncross L, Burch V, Burch E, Green-Thompson L, Koto ZM, Montwedi OD, Fagan J, Jonas E. Workplace-based assessment-a new era of surgical training competency assessment in South Africa. *South African Journal of Surgery*. 2022 Dec;60(4):227-8.
3. Nel D, McNamee L, Wright M, Alseidi AA, Cairncross L, Jonas E, Burch V. Competency Assessment of General Surgery Trainees: A Perspective From the Global South, in a CBME-Naive Context. *Journal of Surgical Education*. 2023 Oct 1;80(10):1462-71.
4. Nel D, Jonas E, Burch V, Cairncross L, Nel A, Alseidi A, George B, Ten Cate O. Entrustable Professional Activities in Postgraduate General Surgery Training: A Scoping Review. *Ann Surg*. 2024 Jun 17. Epub ahead of print.
5. Nel D, Burch V, Beley K, Ebrahim Z, Brand M, Montwedi D, Cairncross L, Jonas E. Procedures most frequently performed by South African-trained general surgeons - implications for training and assessment. *South African Journal of Surgery*. 2024 Sep 1;62(3):242-8.
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Abstract

The introduction of Workplace-Based Assessment for General surgery training at a South African university

Daniel Nel, November 2024

Background

Assessment in postgraduate training in South Africa has traditionally focused solely on knowledge objectives. There is currently a movement to introduce Workplace-Based Assessment (WBA) to evaluate trainee clinical competence. However, concerns have been raised regarding the feasibility of this approach in a South African context. Similar concerns about feasibility and other issues with WBA implementation have been identified in General surgery in different settings. The aim of this study was to determine if it was possible to introduce WBA and to identify the characteristics of a WBA strategy that would ensure successful implementation at a South African university.

Methods

The design-based research methodology was used to define the educational problem, generate guiding principles for a solution, test the solution through cycles of implementation and refinement, and finally reflect on the implementation process to derive a final set of design principles. The study was conducted in the Division of General Surgery at the University of Cape Town from 2022 to 2023. The planning of the design and the interpretation of the findings were considered in the context of socio-cultural learning theory.

Results

Fifteen guiding principles, underpinned by theory, were used to design the WBA strategy. Three cycles of testing and refinement showed relatively high perceived feasibility, acceptability, and appropriateness among trainees and supervisors. The lessons learned from each cycle enabled the solution and design principles to be modified, in consultation with a stakeholder team, to further enhance participant perceptions and implementation. This process resulted in 15 final design principles, of which six were substantive and nine were procedural. The substantive principles related to the selection of EPAs, assessment tools, the supervisor base, and the digital platform. The procedural principles related to the pace of

introduction, team development, managing the formative-summative tension, and change management approach.

Conclusion

WBA can be introduced for postgraduate General surgery training at a South African university. Design principles have been identified to ensure a feasible introduction in this context. These principles may assist others in implementing new, or refining existing WBA strategies.

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Finally, to my Heavenly Father, thank you for blessing me with the abilities and many opportunities I have had.

Dedication

I dedicate this thesis, first and foremost, to my wife Amy. Thank you for supporting me through my years of training and standing by me through thick and thin, in sickness and in health. You make our house a home and us, a family. The achievement of this thesis is as much yours, as it is mine.

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Finally, to those living with axial spondyloarthritis or related conditions that cause chronic pain and functional limitations, for finding the courage to continue daily. And also, to their families, friends, and healthcare workers who shoulder the burden with them.

Abbreviations

- AIM - Acceptability of Intervention Measure
- CBE - Competency-Based Education
- CBME - Competency-Based Medical Education
- CC - Competence Committee
- CMSA - Colleges of Medicine of South Africa
- DBR - Design based research
- EPA - Entrustable Professional Activities
- HIC - High-income country
- HOD - Head of Division/Department
- HPCSA - Health Professions Council of South Africa
- IMG - International medical graduate
- LMIC - Lower-middle income country
- PA - Programmatic Assessment
- SA - South Africa
- ST - Stakeholder team
- UK - United Kingdom
- UCT - University of Cape Town
- USA - United States of America
- US - United States
- WBA - Workplace-Based Assessment
- WBO - Workplace-Based Observations

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Chapter 1. Introduction

1.1 Rationale for the PhD

After obtaining my qualification as a General surgeon, I decided to pursue a career in surgical education. Recognizing the necessity for rapid expansion of my knowledge, skills, and legitimacy in the field, I reached out to some of the foremost clinician-educators in South Africa. Encouraged by their advice, I decided to embark on a PhD within the field.

One of the thesis ideas I considered involved introducing an assessment of surgical skills ability for postgraduate trainees at the conclusion of their General surgery training. This concept stemmed from my observation that the COVID-19 pandemic resulted in reduced operating time and experience for trainees in our program. The General surgery training program exit examination did not assess technical competency and access to the examination only required sign-off from the head of the department, confirming completion of all clinical rotations. Additionally, while logbooks were submitted, there was no national minimum number required for any procedures. I noticed candidates who had recently passed the exam but were considered incompetent by more senior colleagues in performing tasks, particularly surgical procedures, required of a General surgeon. It was evident that this was a significant problem requiring attention.

At the time, I had two ideas on how competency assessment could be achieved. The first involved using a virtual reality simulator, and the second relied on external review of video-recorded procedures. During discussions with an expert in health professions education assessment, a third and more promising concept, Workplace-Based Assessment (WBA), was discussed, which was a concept I had not encountered before. Unbeknownst to me, WBA was at the time being explored by the Colleges of Medicine of South Africa (CMSA) and the South African Committee of Medical Deans (SACOMD) as a means to address the issue of clinical competence on a national scale.

The drive to incorporate WBA into postgraduate clinical training in South Africa began around 2017 when the then president of the CMSA published an editorial in the South African Medical Journal on the topic (Sathekge 2017). While there were proponents of WBA, some questioned its feasibility and trustworthiness in our context. Nevertheless, key leadership within the CMSA and SACOMD believed that the advantages of WBA, including

its formative value and ability to confirm clinical competence, necessitated consideration to be included as a required component of postgraduate training and certification. The COVID-19 pandemic severely slowed the pace of the national WBA implementation drive, but towards the end of 2021 the conversation was restarted. At that time, WBA had been implemented in a handful of postgraduate disciplines but not in General surgery. Furthermore, there was no South African team that had introduced WBA in a scholarly manner and reported evidence-based guidance for others wishing to do the same.

Therefore, the rationale for this PhD was to evaluate whether WBA in General surgery could be successfully introduced at a South African university and, to describe how it could be designed and implemented in this context.

1.2 The local context

As the focus of the PhD is related to the local training context, it is important to sketch the background to understand the current scenario in General surgery training in South Africa. This is also important for others to understand the output of the study and how it can be applied locally, depending on differences and similarities to their own context.

1.2.1 Education and healthcare in South Africa

The Bantu Education Act, introduced by the Apartheid regime in 1953, mandated racially segregated educational facilities for white and non-white learners (Ndimande 2013). Universities situated in non-white areas received significantly less funding and support for human resources and infrastructure development compared to those in wealthier white regions, maintaining standards achievable in well resourced health environments (Ndimande 2013). Despite the abolition of Apartheid almost 30 years ago, healthcare expenditure remains racially disparate, with persistent inequalities (Mayosi and Benatar 2014).

An illustrative case is the Eastern Cape Province, where many Black South Africans resided or were forcibly moved to during the implementation of Apartheid's racial segregation policies. State hospitals in this province, where specialist training occurs, often show significant deterioration and dysfunction, reflecting similar trends in other previously disadvantaged provinces (Treatment Action Campaign and Section 27 Catalysts for Social Justice 2013).

Beyond mere infrastructure disparities among hospitals in different provinces, many senior specialists bear memories or personal experiences of being disadvantaged by Apartheid policies. These deep-seated wounds continue to impact institutions and interactions between individuals associated with historically White and Black universities.

Another dimension of healthcare inequality in South Africa is the gap between the state/government and the private sector. The state sector, where all postgraduate training of medical specialists takes place, mandates hospitals to be affiliated with one of the ten universities in South Africa which have medical schools. However, 70% of all South African doctors work in the private sector, which only serves 20% of the population. This includes 16% who have private medical insurance and around 5% who pay out-of-pocket for private care (Health Justice Initiative 2022).

Regarding General surgery, a study by Dell revealed that almost 60% of South African surgeons were working in the private sector (Dell and Kahn 2018). While some surgeons in the private sector operate in group practices, many work individually, potentially with little or no oversight. South Africa lacks a recertification program for specialists, and continued registration with the Health Professions Council of South Africa depends on earning a certain number of Continuous Professional Development (CPD) points per year, attainable through conference attendance, workshop participation, or completing short online tests.

1.2.2 Certification as a General surgeon

The examination and certification of medical specialists in South Africa is administered by the Colleges of Medicine of South Africa, serving as an external examination body (Colleges of Medicine of South Africa 2024). To be admitted as a fellow of the College of Surgeons of South Africa as a General surgeon, a trainee must successfully navigate the part one and part two (intermediate and final) exams of the CMSA (College of Surgeons of South Africa 2024). The part one exam evaluates fundamental knowledge in basic sciences, encompassing anatomy, physiology, and pathology. The intermediate exam necessitates clinical exposure in critical care, trauma, and General surgery, incorporating both written and oral assessments in these fields. For the final exam, a minimum of four years of clinical exposure within a General surgery program is mandated. The assessment encompasses an online theory component with multiple-choice or single best answer questions, and an online structured oral exam including multiple clinical cases and two topic-based examinations concentrating on surgical pathology, anatomy and operative technique. The final exam also includes an online written OSCE examination.

Candidates seeking entry to the exit examination must submit their portfolio, logbook, and a letter of endorsement from the head of the department. All trainees, including those specialising in General surgery, must maintain active registration with a South African university while training. Additionally, before being authorised for independent practice as a General surgeon in South Africa, trainees must register as a specialist with the Health Professions Council of South Africa (HPCSA), the accreditation body overseeing the medical and dental boards (College of Surgeons of South Africa 2024).

1.2.3 General surgery at the University of Cape Town

The Division of General surgery at UCT comprises approximately 45 trainees, 20 full-time consultants, and nine part-time consultants. Additionally, there are approximately 10 surgeons actively pursuing advanced training in various General surgery subspecialties e.g. hepatobiliary surgery, colorectal surgery, etc. The program adheres to a five-year structure, as mandated by the HPCSA. Each year encompasses four three-month rotations, and the five years are organised in three distinct phases.

The inaugural phase, typically completed in the first year, involves the junior rotation, including intensive care, front-room trauma, and a relief rotation where trainees fill platform staffing gaps due to annual leave, study leave, sick leave or maternity/paternity leave. Subsequently, the cutting rotation includes years two and three, during which trainees rotate through acute care surgery, trauma surgery, and three community-based secondary level hospitals with a blend of acute care and trauma surgery.

The final phase of training includes a sub-specialist rotation, where trainees rotate through paediatric, vascular, hepato-pancreato-biliary, colorectal, endocrine, upper gastrointestinal, and transplant surgery. While all training occurs under consultant supervision, their presence is not mandatory at every clinical activity. This means trainees may autonomously lead ward rounds, manage clinics, or undertake elective and emergency operations if consultants deem them capable of doing so unsupervised.

The University of Cape Town ranks among the top 200 universities globally and is the foremost university in Africa, attracting numerous international trainees primarily from other African countries and the Middle East (University of Cape Town 2024). Approximately three-quarters of the trainees are South Africans, and the remaining quarter consists of international medical graduates (IMGs), usually funded, at least partially, by their home

countries. Aside from cultural and language variations, there are clinical experience disparities between IMGs and local trainees. Many local trainees, having completed a mandatory two-year internship and one year of community service, spend an additional two to three years as full-time medical officers in surgical teams. During this period, they function essentially as registrars but are not in formal training posts, and may be trusted to perform common general surgical procedures without hands-on supervision. This experiential gap for IMGs complicates the endeavour to ensure that all trainees attain a consistent level of clinical competence by the end of a 5-year postgraduate training program.

In the South African healthcare system, doctors that are undergoing specialist postgraduate training are commonly referred to as 'registrars', a term that is analogous to 'residents'. Clinicians who have completed specialist training are referred to as 'consultants', a term that is analogous to 'attendings'. To avoid confusion, the term 'trainees' will generally be used to refer to registrars and the term 'supervisors' will be used to refer to consultants for the remainder of the thesis.

1.3 Expert meetings

Undoubtedly, one of the primary steps in initiating this thesis involved conducting a comprehensive literature review, with a specific focus on WBA in General surgery. Given that WBA was still in its infancy in South Africa and my understanding of it was limited, I commenced the process by interviewing several experts in the field. This approach also aimed at establishing a network of like-minded colleagues and integrating into a community of practice that had progressed years ahead of our current status in South Africa. Beyond merely gaining insights into WBA and its role in competence assessment, my objective was to capture these experts' personal reflections on effective practices and challenges. This endeavour aimed to shape the design of our local WBA strategy.

In a preliminary review of the literature I discovered that a surgeon in the United Kingdom (UK), who had visited our department years earlier, had authored several early papers on WBA in surgery. The informal interview series commenced with this individual and snowballed organically based on referrals from interviewees and the identification of other pivotal authors in the field.

1.3.1 Professor Jonathan Beard

Jonathan Beard is a vascular surgeon and Professor of Surgical Education at the Royal College of Surgeons of England. The discussion on WBA began with him emphasising the paramount importance of prioritising teaching over testing. Challenges in ensuring the reliability of procedure-based assessments, the cornerstone tool for WBA in their setting, and the potential drawbacks of setting minimum numerical targets were discussed. A call for a more flexible approach was made, enabling trainees to demonstrate readiness through their initiative. He stressed the need to strike a balance between scheduled and ad hoc assessments. Role clarification during assessments to ensure validity was also highlighted.

Prof. Beard provided insights into the UK's assessment strategy in training programs for surgeons, recognizing the shift towards the assessment of Entrustable Professional Activities (EPAs) and expressing concerns about assessment reliability. The conversation continued with practical advice, advocating for a measured approach, starting small, leveraging existing frameworks, and avoiding fixation on numerical targets. Thorough training of educational supervisors was emphasised. Prof. Beard cautioned against bureaucratic entanglements and urged a pragmatic stance in implementing WBA. The importance of gaining trainee buy-in emerged as a crucial element, emphasising active involvement in improving the assessment system. He warned against imposing assessments without wide consultation, drawing from experiences of initial resistance in the UK. The discussion delved into challenges related to perceptions, potential gaming of the system by trainees, and the need for a positive approach to avert negative attitudes towards WBA. Considering time constraints in UK training programs, examples from successful international competency-based models, notably Canada's, were referenced. Prof. Beard thus recommended further discussions with Prof. Richard Reznick.

1.3.2 Professor Richard Reznick

Professor Reznick, at the time serving as the President of the Royal College of Physicians and Surgeons of Canada, is a highly esteemed surgeon-educator with significant contributions in implementing Competency-Based Medical Education (CBME). Although I was armed with a 30-slide presentation and various specific questions about WBA logistics, our discussion swiftly shifted from WBA to CBME. Prof. Reznick astutely recognized my need to grasp the broader picture.

Contrary to my initial discussion with Prof. Beard, which focused primarily on WBA, my conversation with Prof. Reznick provided the necessary context of WBA within CBME. He clarified that CBME encompasses not only assessment reform but also broader curricular reform. Emphasising a departure from time-based training, Prof. Reznick further explained that specialties could be defined based on local needs using EPAs. Consequently, WBA could gauge trainees' proficiency in performing these locally relevant professional activities. This insight was crucial, as my interpretation of literature from the UK portrayed WBA and EPA assessments as distinct entities. Prof. Reznick further detailed the shift in CBME from single high-stakes exit examinations to continuous, frequent observations of advancing competence. Stressing the paramount importance of faculty development for these changes, he provided practical advice, urging the formulation of a clearly documented strategy and commitment to secure leadership support which is critical for success. Throughout the discussion, he imparted sage advice for a newcomer in the field. For more detailed inquiries, he directed me to two Canadian colleagues, Jason Frank and Brent Toma.

1.3.3 Professor Jason Frank

At the time of our meeting, Professor Frank, an emergency physician and internationally renowned medical educator, held the position of the Director of Specialty Education Strategy and Standards at the Royal College of Physicians and Surgeons of Canada. I began by providing background information on WBA in South Africa, along with details about my PhD topic and plan. Subsequently, I posed specific questions related to tools for assessment of EPAs, seeking guidance on the best tools for assessing procedures, in inpatient clinical encounters, and outpatient scenarios. My perspective at this stage had been significantly influenced by the UK surgery WBA strategy, which was my initial encounter with the concept. Prof. Frank explained that the Royal College recommended the use of four assessment templates. Tools for direct observation included a brief context description followed by a global rating using an entrustment-supervision scale, and a more detailed rating of milestones related to the EPA.

I inquired about the consequences if a trainee failed to complete the required observations for a summative judgement. Prof. Frank clarified that non-compliance would result in repercussions for the trainee's progression and ability to continue in the program. Additionally, programs failing to ensure that their trainees achieved the required entrustment during training would face consequences for ongoing licensing and the training of residents. He emphasised the significance of faculty development, and our discussion covered logistics around Competence Committee (CC) decision-making.

Shortly before our meeting, I came across an implementation guide for WBA crafted for the Competence by Design strategy in Canada. A moment of realisation occurred as I read the section on how a CC utilises individual WBAs or 'observations', as they were then referred to in Canada, to make high-stakes summative decisions. Prof. Frank played a pivotal role in clarifying my lingering confusion, enabling me to construct a more comprehensive understanding of the concept of programmatic assessment within CBME.

1.3.4 Professor Brent Thoma

Professor Thoma, an emergency physician in Canada with a focus on postgraduate medical education, completed his PhD on visualising assessment data for personal and organisational development in an educational context. At this juncture, my understanding of WBA, programmatic assessment, and CBME had significantly improved. Unlike previous meetings where substantial gaps in understanding existed, our discussion could focus on specific issues that still required clarification.

Firstly, the notion of time-variable training didn't seamlessly translate into practice, a concern I had raised due to the influence of fixed-term hospital contracts on training duration in South Africa. Prof. Thoma explained that this concept didn't truly manifest as a time-variable approach, even in Canada. Another noteworthy takeaway message centred on the tools used for WBA. I had expressed interest in certain tools based on a preliminary overview of the literature, and Prof. Thoma advised on simplifying the approach. He believed the optimal tool should comprise a global rating based on an entrustment supervision scale, accompanied by a narrative description of the trainee's performance and the context of the encounter, concluding with areas for improvement. While acknowledging the utility of milestones in describing trainee development, he felt that their addition made individual observations a bit cumbersome.

Finally, he underscored the value of a digital platform, not only for capturing assessment events but also for describing data for analysis by the CC. This aspect was related to the work he did for his PhD thesis. Both he and Prof. Frank had discussed concerns around the digital WBA platforms used in Canada. Despite significant investment by the Royal College in developing a platform, many universities had opted to create and implement their own. The associated costs of designing and implementing such platforms were discussed, highlighting the importance of addressing this aspect in our local strategy.

1.3.5 Professor Olle ten Cate

One of my PhD supervisors recommended a meeting with Professor Olle ten Cate. He is a globally renowned figure in medical education and is acknowledged as the pioneer of EPAs, a widely adopted framework for assessment in CBME. Our discussion naturally centred around EPAs. Initially, I enquired about the correct implementation of EPAs and the potential pitfalls in defining and executing them. He stressed the importance of focusing on tasks and elucidated common errors in identifying and describing EPAs. We also delved into the practicalities of using broad or narrow EPAs, discussed the challenges of managing a large number versus defining the core activities of a specialty. He clarified the concept of elective EPAs versus core EPAs and addressed the issue of including simulation-based activities as EPAs. He expressed his view that they technically should not be included, but they could be useful in preparing trainees for real practice.

Towards the end of our discussion, he highlighted a critical aspect of my thesis and the national effort, change management. This marked the first instance where the significance of change management had been underscored by anyone. He referred me to a key reading (AMEE Guide No. 10) which outlines a framework for change in medical education. This advice played a pivotal role in shaping further reading and strategies to enhance implementation, particularly concerning change theory.

1.3.6 Professor Brenessa Lindeman

Professor Lindeman is a US-based endocrine surgeon and medical educator, who played a leading role in the development and implementation of EPAs for assessment. The discussion commenced with an intriguing overview of the US WBA strategy, delving into the initial thinking that led to a national pilot using five EPAs. The conversation unveiled the rationale for opting for a broad approach, choosing disease presentations over specific conditions or procedures for EPAs, aiming to prevent premature closure in trainees' diagnostic thinking. Notably, the discussion traversed the connections between EPAs, milestones, and domains of competence, illustrating their symbiotic relationship in assessing surgical proficiency. The conversation delved into the complexities surrounding the reliability of EPA assessments, acknowledging the ongoing challenges in determining a specific target number of assessments required for making summative entrustment decisions. The focus then shifted to the tools used for assessment, specifically the Society for Improving Medical Professional Learning (SIMPL) platform that was favoured for General surgery training in the US. The online conversation concluded with a comparison of different international models, raising

questions about striking the right balance between educational fidelity and feasibility in EPA implementation. She emphasised the need for more longitudinal information and restructuring if certain training programs were not meeting EPA requirements, highlighting the importance of a nuanced and adaptive approach. Finally, she acknowledged the ongoing exploration of various different approaches and emphasised the importance of time and experience in evaluating the effectiveness of these.

The conversation was continued in March 2023 when Prof Lindeman visited as a guest speaker at the annual Cape Town surgical update conference. By this time, we had commenced implementation of our WBA strategy and could compare notes on implementation. She demonstrated the SIMPL smartphone app, and much of the discussion focused on ensuring feasibility, including the pros and cons of choosing EPAs based on disease processes, which required the separate assessment of pre-, intra-, and postoperative care processes.

1.4 Literature review: WBA in General surgery

1.4.1 Traditional approach to training

During the 20th century, surgical training continued to be based on the Halstedian apprenticeship model, where learning occurs through prolonged, unstructured immersion of the trainee in a time-based system with constant exposure to expert surgeons (Polavarapu et al. 2013). In this traditional model, final certification depended on written and/or oral examinations which focused primarily on knowledge objectives and were generally administered by an independent professional certification body (Polavarapu et al. 2013; Szasz and Grantcharov 2019).

However, several changes to healthcare environments have resulted in the traditional apprenticeship model no longer being a sustainable strategy for training surgeons. Increasing sub-specialization, and more trainees meant that it was not possible to maintain a model of a 1:1 apprentice to supervisor ratio. Furthermore, increasing pressures on operating room availability, ethical concerns of trainees training on patients, and the escalation of litigation for medical errors meant that training programs and examining bodies need to develop robust new strategies to facilitate and prove the achievement of clinical competence of newly qualified surgeons (Szasz and Grantcharov 2019).

1.4.2 Competency-based medical education

The traditional approach, where training and assessment focus on knowledge objectives, stands in contrast to the modern outcomes-based education (OBE) framework, where outcomes guide all curriculum and assessment decisions (Harden 1999).

Competency-based medical education can be seen as a form of OBE, aiming to ensure that all graduates attain the minimum standards for unsupervised practice in their field (Frank et al. 2010). The five core components of CBME curricula are outcome competencies, sequenced progression, tailored learning experiences, competency-focused instruction, and programmatic assessment (Van Melle et al. 2019).

Programmatic assessment (PA) intends to address the many documented problems with assessment practices in the 20th century. Some key elements of PA include a greater emphasis on WBA, the assessment of multiple domains of competence, the use of many raters and multiple assessment methods over time, using assessment for learning, and the idea that summative decisions within a training program should be made by a group (e.g., a Competence Committee), not an individual, using a collated set of assessment data to provide a more holistic overview of learner progress (Bok et al. 2013).

Although CBME was proposed over 50 years ago, it has only come to the fore in the last 20 years, which can be attributed to a number of forces and trends (Frank et al. 2010). The first is greater public accountability, meaning that medical curricula have to ensure that graduates are competent in all essential domains. The second is a greater emphasis on skills and attitudes, and their inclusion into observable competencies, rather than a pure emphasis on knowledge objectives. The third is a de-emphasis on time-based training, recognizing that learners progress at different rates and achieve threshold competencies at their own pace. Finally, there is an increasing desire to promote greater learner-centeredness by providing learners with a curriculum of competencies that delineate clear goals for them to achieve (Frank et al. 2010).

The practical steps to the implementation of CBME begin with the identification of the abilities needed by graduates in a specific context, followed by defining the required competencies and their components. In the last two decades, various competency frameworks have been described by a number of High-Income Countries and now form the basis of training for the majority of learners in these settings (Accreditation Council on Graduate Medical Education (ACGME) 1999; General Medical Council (UK) 2017; Jason R. Frank, Snell, and Sherbino 2015). In 2014, the HPCSA published the list of South African

competencies for medical professionals, dentists, and clinical associates (Health Professions Council of South Africa 2014). These were adapted from the CanMEDS physician competency framework (Frank, Snell, and Sherbino 2015) and include:

1. Healthcare Practitioner - the central, integrating role that defines the practitioner's clinical scope of practice through the application of knowledge, skills, and attitudes specific to their professional context.
2. Communicator - interacting with patients and patients' families.
3. Collaborator - working effectively within a team to achieve optimal patient/client care.
4. Leader and Manager - contributing to the healthcare system through cost-effective resource utilisation, improving efficiency, and enhancing patient safety.
5. Health Advocate - using expertise and influence in partnership with individuals, patient populations, and communities to improve their health.
6. Scholar - demonstrating a commitment to the creation, dissemination, application, and translation of knowledge.
7. Professional - ensuring ethical practice and high personal standards of behaviour.

Following the identification of competencies, instructional methods and educational activities are selected to aid learners in achieving competence in the specified competency domains. The next key component of planning CBME curricula is the selection of assessment tools to measure learners' progress in actually achieving the required competencies (Frank et al. 2010).

1.4.3 WBA

An early attempt to measure competence, specifically the ability to perform surgical procedures, was through the use of logbooks introduced in the 1990s (Balasundaram, Aggarwal, and Darzi 2010). However, logbooks only record exposure and not competence, thus having limited content validity; being present at a procedure does not necessarily mean that a trainee is competent to perform the task independently. Another early attempt at the objective assessment of competence in medical education was the OSCE (Schuwirth and van der Vleuten 2020). While a step in the right direction, it was found that the use of multiple independent assessors across different stations and tasks was more crucial than the attempt at "objective" structuring (Petruša 2002). This finding indicated that, with careful sampling, assessment could be taken back to the workplace, increasing its authenticity and validity through the measurement of performance during actual clinical practice (Schuwirth and van der Vleuten 2011).

Workplace-Based Assessment, defined as 'the assessment of working practices based on what trainees actually do in the workplace, and predominantly carried out in the workplace itself,' provides the opportunity for a direct assessment of trainees' actions in the clinical environment, offering greater face validity than other assessment methods for measuring real-world competence (Beard 2011). Evidence for its validity, acceptability, and educational impact in surgery is growing, leading to its increasing global adoption (Aryal, Hamed, and Currow 2021).

An essential aspect of WBA in the context of CBME and PA is that individual assessments, also termed observations, are low stakes and primarily intended to be formative. Thus, workplace assessment is used for learning, not just as an assessment of learning (Bok et al. 2013; J. Norcini and Burch 2007). Central to this formative strategy is the delivery of timely feedback to the trainee after each observation of an activity by supervisors. High-stakes decision-making, such as progression through training and eligibility for specialist and subspecialist certification examinations, is done by a group of faculty surgeons, often referred to as a 'Competence Committee.' Such committees typically meet every 3-6 months to review trainees' portfolios of learning, including WBA observations and other relevant documentation, to evaluate progression towards competence across the prescribed domains of surgical practice.

A large number of different tools for WBA have been described (Norcini and Burch 2007). More commonly used WBA tools in surgery include the mini-clinical evaluation exercise (Mini-CEX), multisource feedback (MSF), direct observation of procedural skills (DOPS), case-based discussion (CBD), objective standardised assessment of technical skills (OSATS), Ottawa Surgical Competency in the Operating Room Evaluation (O-SCORE), Ottawa Clinic Assessment Tool (OCAT), procedure-based assessment (PBA) and Zwisch scale (Shalhoub et al. 2015; Gofton et al. 2012; Rekman, Hamstra, et al. 2016; Zwischenberger et al. 2023). The implementation of WBA and the choice of specific assessment tool(s) varies by country and institution. Since 2007, WBA has been an important component of the UK national surgical training program. PBAs were the most common type of WBA, showing greater reliability than OSATS in that context (Beard et al. 2009; Beard et al. 2011; Shalhoub et al. 2015). The most common non-procedural type of WBA used in the UK is CBD, followed by the Mini-CEX (Shalhoub et al. 2015).

However, early WBA tools were somewhat limited in assessing the broader range of competencies specified by competency frameworks. Unfortunately, these competencies, e.g.

'professionalism', can feel somewhat detached from the clinical environment in which they are applied, making it challenging for them to be practically taught and assessed. Initial attempts to confirm the attainment of various competencies specified by these frameworks depended on directly assessing long lists of individual competencies (Frank, Snell, and Sherbino 2015). Thus, EPAs were introduced to make the connection between competencies (characteristics/abilities of learners) and the professional activities to be entrusted to them on graduation (Ten Cate and Taylor 2021).

1.4.4 Entrustable Professional Activities

Entrustable Professional Activities were first described by ten Cate in 2005 and have since become increasingly favoured for use across multiple training platforms, including undergraduate and postgraduate programs across a range of specialties (Tobin 2019). EPAs are defined as "units of professional practice (tasks or bundles of tasks) that can be fully entrusted to an individual once they have demonstrated the necessary competence to execute them unsupervised." Guidelines for the correct description and implementation of EPAs have been published, including a description of the relevant competency domains, as well as the knowledge, skills, and attitudes required to execute that specific professional activity (Ten Cate and Scheele 2007; Ten Cate and Taylor 2021).

For postgraduate medical training, EPAs break down a specialty into units of practice that can be supervised, assessed, monitored, and certified. Therefore, EPAs facilitate WBA within a CBME context. By describing the specific skills proficiency, knowledge, and higher-order abilities required to be entrusted to perform a specific activity, EPAs provide a framework for assessment tools to measure the degree to which a trainee can be entrusted to perform that activity unsupervised. Defining the units of practice that encompass a specialty also allows for the redesign of the curriculum and re-evaluation of training methods, with an emphasis on providing trainees with the knowledge and skills required to carry out these activities independently (Tobin 2019).

EPAs are the preferred framework for WBA in surgery in several countries, including the United States, Canada, Netherlands, Colombia, Australia, and Ethiopia (American Board of Surgery 2021; Canadian Association of General Surgery 2022; Het Concilium Chirurgicum 2021; Domínguez-Torres et al. 2021; Australian Board in General Surgery 2017; Amare, Siebeck, Sendekie, et al. 2022). Although some use entrustment-supervision (ES) scales for EPA assessments, others have adapted existing tools to retain most elements and simply included ES scales as a global rating at the end. The use of ES scales, rather than arbitrary

numerical scales to rate performance, is a key characteristic of EPAs, anchoring the assessment on the principle of entrustment. The evaluation of trainees according to the way that trainers already make day-to-day entrustment decisions around clinical activities improves the reliability of the assessment. The use of an ES scale also draws the focus towards the trainee's readiness to practise independently—the end goal of training (Rekman, Gofton, et al. 2016). EPAs are especially appropriate for surgical disciplines, where multiple competencies (e.g., decision-making, judgement, technical ability, clinical knowledge, teamwork) may be required for the successful completion of a specific task.

1.4.5 WBA for learning

WBA tools hold substantial formative value by providing regular, timeous opportunities for feedback to trainees (Szasz and Grantcharov 2019; Saedon et al. 2012). However, WBA is frequently employed solely for summative purposes, a practice demonstrated to be less advantageous for learning, as trainees tend to prioritise self-enhancement over self-improvement (Gaunt, Markham, and Pawlikowska 2018; Toale et al. 2022). Ongoing exploration of the summative-formative tension and strategies to enhance the learning impact of WBA are underway (A. Barrett 2016). Intriguingly, the inclination of a trainee to solicit feedback through a WBA tool has been found to correlate with performance; trainees who sought a greater number of evaluations exhibited higher autonomy and operative performance scores (Luckoski et al. 2022).

1.4.6 Perceptions of WBA

The perceptions of WBA by surgical trainees and trainers have been varied. A systematic review by Aryal and colleagues assessed the utility of specific WBA tools in multiple surgical disciplines, primarily in UK General surgery training programs (Aryal, Hamed, and Currow 2021). The evaluated tools included PBA, Mini-CEX, CBD, and DOPS. Several studies, which were survey and interview-based, reflected trainee and trainer perceptions. PBAs consistently emerged as the most useful, followed by CBDs (Phillips et al. 2015; Aryal et al. 2020). DOPS and Mini-CEX were considered less useful. Various barriers to the usefulness of WBA were identified in this review, including time constraints, lack of engagement by trainees and trainers, insufficient faculty development, concerns about validity, limited understanding of their purpose, delayed validation by assessors, a 'tick box' mentality, inadequate constructive feedback, and a focus on summative use rather than promoting learning (Aryal, Hamed, and Currow 2021).

Another review by Mughal specifically focused on surgical trainees' perceptions of WBA (Mughal et al. 2023). Almost all the included studies were from the UK, where WBA had been mandatory in surgical training for over a decade through the Intercollegiate Surgical Curriculum Programme (ISCP). Trainees and trainers had mixed feelings about the formative impact of WBA, with trainees reporting infrequent and low-quality feedback. Trainees faced challenges in securing willing assessors due to service provision pressures, often having to remind supervisors of pending requests, compounded by the perception that reports took too long to complete.

Several articles included in this review highlighted significant and widespread misuse of WBAs, with trainers complicit to a large degree. Practices such as inaccurate recording of information, trainers requiring trainees to pre-fill their own reports, or trainers completing WBAs without ever observing trainees were reported. These practices reflect an underlying perception that WBA is merely a tick box exercise. Bureaucratic burdens, stemming from a high quota of assessments required, contributed to WBA becoming a tick box exercise. The high number of required WBAs, aiming for improved reliability, has been described to vary from 3 to 60 observations, depending on the tool, procedure, and context (Beard et al. 2011; Williams et al. 2019; Williams, Kim, and Dunnington 2016).

A tick box mentality poses a major risk as it significantly diminishes the summative and educational value of WBA. Although most studies mandated 40 WBAs per year, opinions on a more reasonable number ranged from 20 to 40 (Mughal et al. 2023). Trainees, when surveyed alone, expressed a preference for less than 20, emphasising a focus on quality over quantity for improved educational benefits (Beamish et al. 2020; Pentlow and Field 2015). In response to these findings, the UK Joint Committee on Surgical Training (JCST) eliminated the minimum number requirement. However, a sufficient number of WBAs are still necessary for summative decision-making on 5 index procedures and 17 critical conditions for General surgery (Joint Committee on Surgical Training 2023). This leaves the required number at the discretion of the trainee and their educational supervisor. The impact of this change on the use of WBA and the perceptions of regulatory bodies regarding the reliability of summative decision-making with lower numbers of reports is yet to be determined.

Assessment of EPAs represent a relatively new transition for WBA in surgery. While there were no studies on EPA-based assessments in these reviews, their inclusion was deemed helpful for a more global professional assessment of trainees (Aryal, Hamed, and Currow 2021). However, it was suggested that established WBA tools should persist for evaluating specific skills. Initial reports from the EPA-based pilot run by the American Board of Surgery

revealed little to no concern among trainees about the impact of WBA on increasing workload or the availability of their competency scores to faculty. However, concerns were raised regarding transparency of assessment criteria and the reliability of EPA based assessments for summative purposes (Gupta et al. 2020). Other issues raised included a lack of knowledge and understanding, institutional policies limiting trainee autonomy, faculty non-submission of assessment reports, and inadequate formative feedback (Gupta et al. 2020; Amare et al. 2023; Kearsse et al. 2021).

Proposed solutions to improve participant attitudes toward WBA include more thorough trainee and faculty development, increased face-to-face validation and feedback, reduction of the high assessment burden, a shift toward formative rather than summative assessment, and the evaluation of complex tasks like operations instead of "box ticking" simple tasks (Aryal et al. 2020; Amare et al. 2023; Steinemann et al. 2021).

1.4.7 Method of delivery

Variation exists in the delivery of WBA tools. The predominant mode is digital, with specific website platforms created by various training bodies, such as the Joint Committee on Surgical Training in the UK (Beard 2011), the Australian Board of Surgery (Australian Board in General Surgery 2017) and the American Board of Surgery (Lindeman et al. 2021). While many platforms still necessitate clinical supervisors to record assessment reports on computers, this approach is unwieldy and does not seamlessly integrate into clinical workflow patterns (Marty et al. 2023). Smartphone-based applications have demonstrated feasibility and the ability to reduce the time elapsed between an assessment activity and faculty completion of the assessment form and feedback process. This helps mitigate the impact of recall bias and enhance the utility of feedback provision (Oh et al. 2020; Marty et al. 2023; Bohnen et al. 2016).

1.4.8 WBA and programmatic assessment

While there is growing enthusiasm for the implementation of WBA, it is not a magic bullet for assessment in surgery and it has limitations (Torsney, Cocker, and Slessor 2015). WBA cannot comprehensively address all facets of surgical education, and traditional tools like logbooks, global rating, and end-of-rotation assessments retain their relevance. WBA may be most effective when used to complement these methods, offering valuable in-training assessments of clinical competence (Szasz and Grantcharov 2019). In this context, WBA becomes a contributing element to assessment programs, as discussed earlier.

1.4.9 WBA and the local context

The South African General surgery final exit examination has undergone recent changes. In an attempt to evaluate the surgical skills and decision-making abilities of trainees, a national electronic logbook was introduced in 2018 (Koto 2019). However, as noted earlier, logbooks have inherent limitations in describing competence for technical procedures. Despite advocacy for the nationwide incorporation of mandatory WBA into specialist training since 2017, there has been limited progress in General surgery (Sathekge 2017).

1.5 Research question and objectives

Based on the literature review, the primary research question of this thesis was: What is an appropriate workplace-based strategy for assessing the clinical competence of South African General surgery trainees?

Based on the research question, the following primary objectives were identified:

1. To determine whether an acceptable, feasible and appropriate WBA strategy can be implemented for General surgery at a South African university.
2. To determine the characteristics of a General surgery WBA strategy that would facilitate successful implementation in a South African context.

A number of secondary objectives were also identified:

1. To evaluate trainee and supervisor (consultant surgeon) perceptions regarding the concept of clinical competence and the competencies required of South African-trained General surgeons.
2. To determine trainee and trainer attitudes regarding the need for, and potential methods to assess clinical competence in this context.
3. To identify the key activities performed by practising South African trained surgeons, for which competent practice needs to be confirmed in this societal context.
4. To design a local assessment strategy to assess clinical competence in the workplace, based on perceptions of local participants, societal requirements and an up to date review of the literature.
5. To implement a WBA strategy and refine it, based on feedback from participants.
6. To describe the key factors that may enhance successful design and implementation in similar settings.

1.6 Thesis outline

Chapter 1 provides an introduction to the thesis, commencing with a rationale and a description of the local context. This is followed by a report on meetings with experts in the field and a literature review that focuses on WBA in General surgery.

Chapter 2 describes the overall methodology for the thesis. Initially, it outlines the rationale for selecting a design-based research approach. It then delves into this approach in more detail, covering its history, characteristics, differences to related methods, outputs, disadvantages, and what constitutes high-quality design-based research.

Chapter 3 outlines the theoretical underpinnings of the thesis. It begins with a description of learning theories, including behaviourist, cognitive constructivist, and socio-cultural situated groups of theories. It then moves on to assessment theories and frameworks, specifically related to expertise development, psychometrics, and assessment for learning. The chapter then describes shifts in thinking around assessment, including the concept of authentic assessment, assessment in the workplace, and programmatic assessment.

Workplace-based assessment is considered from a socio-cultural perspective, specifically with the description of situated learning and communities of practice.

Chapter 4 describes the first phase of the design-based research approach to this study. It details a qualitative exploration using semi-structured interviews of trainees and supervisors in the Division of General Surgery at UCT. This chapter explores the perceptions of these participants towards the issue of clinical competence and its assessment in the workplace.

Chapter 5 marks the initiation of phase two of the design-based research (DBR) methodology, which aims to develop a solution to the educational problem - the lack of clinical competence assessment of trainees. This chapter is based on a scoping review of EPAs in postgraduate General surgery training. It includes a description of EPA use in various settings, as well as the facilitators and barriers to the implementation of EPAs in a program.

Chapter 6 further aids in the development of the proposed solution. It is based on a survey of the procedures most frequently performed by South African-trained General surgeons. The results informed the selection of relevant procedural EPAs.

Chapter 7 describes the solution that will be implemented. It also explains how the previous chapters contributed to the formation of a set of guiding principles for the design and implementation of the solution.

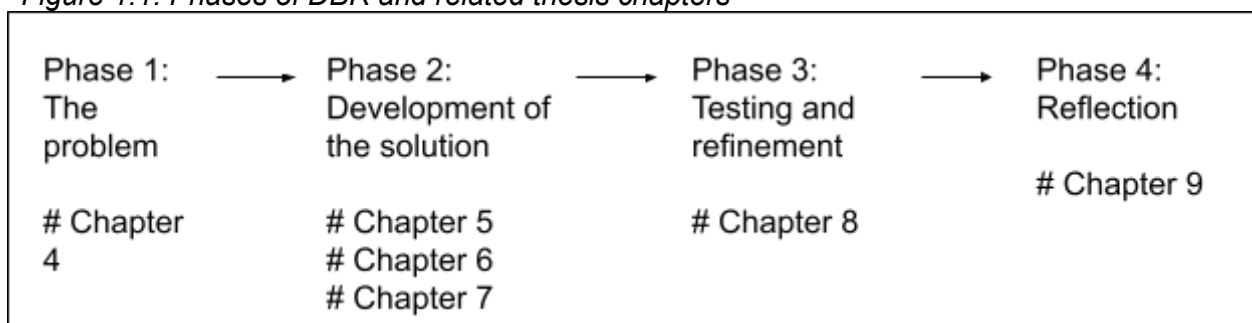
Chapter 8 signifies the start of the third phase of the DBR approach, which involves iterative cycles of testing and refinement. It outlines three cycles of implementation, the feedback received from participants, and how the strategy was modified based on this feedback.

Chapter 9 concludes with the fourth phase of the DBR process. This chapter reflects on the implementation cycle and how the guiding principles can be modified into a final set of design principles for introducing a WBA strategy into a South African postgraduate General surgery program. The relationship between the chapters and the overall DBR methodology is shown in Figure 1.1.

Chapter 10 addresses remaining practical and conceptual issues with WBA. This broader discussion looks beyond General surgery and identifies areas for future research on unresolved issues.

The thesis concludes with Chapter 11, which discusses the significance of the findings, implications, and contributions of the thesis to the field. Additionally, the limitations of the methodology are discussed, followed by a final reflection on the doctoral journey.

Figure 1.1: Phases of DBR and related thesis chapters



Chapter 2. Research framework and methodology

2.1 Rationale for the chosen methodology

The primary research question of the thesis pertained to describing an appropriate WBA strategy for assessing clinical competence in general surgical trainees at a South African university. The primary objectives were not only to determine whether such a strategy could be successfully implemented but also to interrogate the characteristics of such a strategy and how it could be designed to facilitate successful implementation.

Given the research question and objectives, coupled with the intricacies of introducing a new intervention into the existing context, a research methodology was required which would meet several criteria. Firstly, it needed to facilitate the design and implementation of a new educational intervention. Secondly, it had to enable the evaluation of whether the intervention worked and identify which elements of its design were effective or ineffective. Thirdly, it had to be a method applicable in the complex real-world clinical contexts where General surgery trainees interact with their supervisors, peers, and patients. Fourthly and significantly, it needed to be a methodology that could offer fresh insights and guidance for others attempting similar initiatives. This was especially crucial in the South African context, where WBA was being considered to address the issue of clinical competence assessment during training and prior to certification for independent practice. The lessons learned from this process could greatly facilitate implementation by other General surgery teams, as well as in other medical specialities in South Africa. Finally, this methodology needed to emphasise grounding the work in education theory for two reasons. First, it would enhance its applicability in other settings, and second, it would enhance my understanding of education theory as a relative newcomer to the field.

Therefore, a design-based research (DBR) approach was selected as the most appropriate methodology for the thesis (Design-Based Research Collective 2003). In addition to being suitable for meeting the study objectives, this methodology also provided a helpful framework for a PhD thesis (Herrington et al. 2007; Goff and Getenet 2017; Abdallah and Wegerif 2014). Not only is it flexible, but it also offers a clear structure and a logical process to follow for a thesis involving the design and implementation of an educational intervention.

2.2 History of Design-Based Research

The origin of DBR can be attributed to Brown and Collins, who described it in the early 1990s (Brown 1992; Collins 1992). Ten years later, the Design-Based Research Collective strengthened the case for its utility in conducting educational research (Design-Based Research Collective 2003). The primary rationale for DBR as a methodology is that it can aid in bridging the gap between educational research and educational practice. Previous education research had tended to focus on one facet, neglecting the other. On the one hand, some interventional studies sought to demonstrate gains in a new educational strategy over traditional methods, without being based on education theory or investigating how or why such interventions worked (Dolmans and Tigelaar 2012). On the other hand, some educational research was heavily theory-grounded, without impactful demonstrations of real-world applicability (Abdallah and Wegerif 2014). Design-based research bridges this gap by facilitating the design and implementation of a new intervention while, at the same time, contributing towards the testing and refinement of theory (Abdallah and Wegerif 2014; Plomp 2007).

2.3 Overview of Design-Based Research

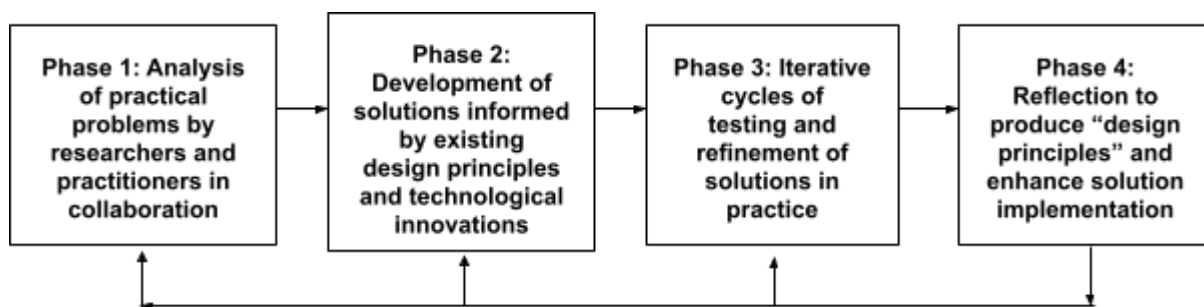
Key to the DBR-facilitated interventions is the understanding that context matters. While previous studies attempted to examine learning processes as isolated variables, DBR allows researchers to systematically adjust aspects of the design, serving as a type of experiment in naturalistic contexts (Plomp 2007; Barab and Squire 2004). Thus, DBR has been defined as "a systematic but flexible methodology aimed at improving educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (Wang and Hannafin 2005). In a sense, DBR can be considered a collection of approaches in naturalistic settings, advancing theory but also impacting on practice (Barab and Squire 2004). It has also been described as a 'methodological toolkit' or even as a 'meta-methodology' to provide evidence-based claims from real-world learning contexts for meaningful and impactful educational research (Barab and Squire 2004; Abdallah and Wegerif 2014). In terms of epistemology, it is neither purely positivistic nor interpretive in orientation but includes elements of both, allowing for pragmatic approaches driven by specific research questions and objectives.

2.4 Characteristics and phases

The key characteristics of DBR are as follows: first, it takes place in continuous cycles of design, implementation and redesign (Design-Based Research Collective 2003). Second, it occurs in real-world learning settings. Third, it is aimed at testing and refining theories but also improving and advancing educational practice (Barab and Squire 2004). Fourth, it includes multiple study designs, particularly mixed-methods approaches. Fifth, the designers, researchers, and practitioners frequently interact during the entire process to share ideas and understandings (Dolmans and Tigelaar 2012).

The study process itself can be described or divided into a number of phases (Fig 2.1). Reeves described four phases: first, the analysis of practical problems by researchers and practitioners in collaboration, second, the development of solutions informed by existing design principles and technological innovations, third, iterative cycles of testing and refinement of solutions in practice and fourth, reflection to produce design principles and enhance solution implementation (Reeves 2006). Abdallah and Wegerif suggested a refined three-phase approach: first, a preliminary phase to identify and formulate the problem of the study, second, the prototyping phase for iterative design and implementation cycles and third, the assessment or reflective phase to conclude with the solutions or intervention specifications and allowing for recommendations to improve it. In this final phase, a design framework is described through a comprehensive assessment of the cycles of intervention (Abdallah and Wegerif 2014). Both of these approaches have been described as suitable for use in PhD theses (Herrington et al. 2007).

Figure 2.1: Phases of DBR (Reeves 2006)



2.5 Key differences to related methodologies

There are several other methodologies that could have been employed to address the objectives of this type of study. Some of these may appear similar to DBR, but there are key differences. Experimental research design involves pre and post-testing to produce distinctly representable results, with an emphasis on controlling variables. However, in an educational context, experimental control is difficult as variables cannot be clearly isolated in realistic learning settings (Abdallah and Wegerif 2014). Clearly, a purely positivist methodology would not have sufficed. On the contrary, a pure interpretivist paradigm may have provided an in-depth analytical account and models for practice. However, it would not have suited, as it does not interfere directly or change educational reality by testing and refining theory in context (Collins, Joseph, and Bielaczyc 2004). Action research is more closely related to DBR in its attempt to connect theory to practice. However, there are two key differences: first, DBR aims to refine theory embedded in the designed intervention, making the intervention not the end product but a vehicle for theory refinement or development (Bielaczyc and Collins 2007). Second, with DBR, the researchers are key in initiating the research process and designing the intervention, while in action research, the research process is often initiated by practitioners who feel a particular problem needs to be solved (Wang and Hannafin 2005). Formative evaluation is another methodology that is similar to DBR, involving the creation of a design that works in complex social settings. However, it does not entail theory generation or refinement as a goal (Dolmans and Tigelaar 2012).

2.6 Outputs of Design-Based Research

The outputs of DBR studies include the following: first, design principles, which are evidence-based heuristics informing future development and implementation decisions (Van den Akker 1999). These principles contain both substantive and procedural knowledge, allowing readers to decide which insights are relevant to their settings, aided by a comprehensive and accurate description of procedures, results, and context (Plomp 2007). Although the exact findings of a study are highly context-specific, the description of design principles allows for greater generalizability (Herrington et al. 2007). The second output is more practical, i.e., the intervention. In DBR, this product is a major output of the research and may include anything from a software package, strategies for faculty development, teaching and learning materials or products (Herrington et al. 2007; Plomp 2007). These interventions can be used in practice and are real solutions to the problems identified. The third output is professional development of participants. As collaboration is an integral part of

DBR, involvement in the research enhances the professional development of all stakeholders involved (Herrington et al. 2007; Plomp 2007). Collaboration is not only a key component of the intervention to ensure practicality and relevance but also creates ownership and commitment from stakeholders, who often include both teachers and learners (Dolmans and Tigelaar 2012).

It is important to clarify the emphasis placed on a DBR study's goal in refining or producing theory. Some DBR studies focus more on testing or proving theory and are termed validation studies (Dolmans and Tigelaar 2012; Plomp 2007). The aim of these studies is specifically to elaborate and validate theories. The primary quality focus of the design is therefore on theoretical quality, with the scientific output primarily being domain-specific instruction theories and methodological emphasis being on small-scale testing in research settings (Van den Akker, Nieveen, and Mckenney 2006b). Design-Based Research studies that focus more on the utilisation of theories are called development studies. The primary aim of these is to solve educational problems, with the design focused on the practicality of the intervention. The scientific output, rather than being specific instruction theories, is broadly applicable design principles, and the methodological emphasis includes evaluation in various user settings (Van den Akker, Nieveen, and Mckenney 2006b). Such development studies start with the formulation of design guidelines based on a review of the literature, including relevant theory (Dolmans and Tigelaar 2012).

Initially it may be confusing, as a DBR approach appears to demand a new and distinct education theory as an output. However, while a generalised theory is certainly a helpful output, it is not necessarily required. In essence, DBR captures and makes explicit the implicit decisions of a design process, transforming them into guidelines for addressing similar educational problems. Each cycle of intervention includes systematic reflection on elements of the design drawn from the literature and is thus theory-inspired (Plomp 2007). Reeves as well as Wademan used the concept of design principles when referring to the theoretical yields of DBR. In this way, the design principles themselves may constitute a design theory or intervention theory, to refer to the knowledge generated from the research in a specific context (Reeves 2006).

2.7 Disadvantages of Design-Based Research

There are multiple advantages to a DBR approach, as mentioned previously. However, design-based research is not without its challenges and pitfalls. The first is that, although it

presents interesting insights into a particular innovation within one specific context, this may have limited value in other contexts and, therefore, limited generalisability (Dolmans and Tigelaar 2012). This limitation can, to a degree, be overcome by grounding the design on theory and using theory to explain findings. In addition, a rich description of the study's context is crucial so that readers can understand how or whether the findings can be applied to their own context. Finally, by generating design principles, others are provided with a detailed description of how to implement an intervention, rather than just what the intervention was or what was achieved (Dolmans and Tigelaar 2012).

Another limitation is that the position of the researcher may bias the findings, as the researcher identifies the problem, designs the solution, and then evaluates its success. The researcher may, therefore, be less critical of an intervention design, convinced that it works (Dolmans and Tigelaar 2012; Plomp 2007). In addition, learners or teachers may find it difficult to criticise the design. These limitations may be overcome by triangulation through using mixed methods approaches, as well as allowing for a stakeholder team to drive key decision-making processes rather than just being informed of the process (Dolmans and Tigelaar 2012; Plomp 2007; Raqib 2019). Reflexivity is also crucial, with the researcher disclosing their background, pre-existing assumptions, and expectations (Bunniss and Kelly 2010).

Design-based research is also risky and complex, being grounded in messy real-world settings. The educational environment may change substantially, or participants may lose interest or motivation, withdrawing from the process altogether (Dolmans and Tigelaar 2012). The intervention may also fail to improve practice entirely. In addition, conflict may arise when stakeholders have their own ideas on how the intervention should be designed and implemented. Overcoming these issues requires strong organisational and communicative capabilities from the researcher (Plomp 2007). Finally, DBR can be time-consuming, requiring rigorous analysis of the problem, design of the solution, and then cycles of testing and refinement, which can take a number of years (Dolmans and Tigelaar 2012).

2.8 High Quality Design-Based Research

The researcher may employ several strategies to enhance the quality of their use of DBR (Plomp 2007; Van den Akker, Nieveen, and Mckenney 2006a). The first is to have an explicit conceptual framework based on a variety of sources, including a review of the literature, interviews with experts, and reviewing other similar interventions. The second is to ensure a

congruent study design by applying a strong chain of reasoning with every cycle of testing and refinement. The third is systematic documentation, analysis, and reflection of context, all design decisions, and results. The fourth is to triangulate data sources and collection methods to enhance the reliability and internal validity of the study's findings. As mentioned previously, triangulation may also assist in overcoming potential bias introduced by the researcher and ensure trustworthiness of the conclusions. The fifth is to pay attention to the validity and reliability of data collected. The sixth is to take data interpretations back to participants and get input from practitioners and other researchers to increase the validity of the findings.

2.9 Outline of thesis in Design-Based Research context

Although a narrative description of the thesis was presented in Chapter 1, the table below describes the thesis specifically in the context of DBR. This provides important context for how the components fit together to meet the end goals of the thesis.

Table 2.1: Thesis according to design-based research phases

Phase of DBR	1	2	3	4
Phase description	Analysis of practical problems by researchers and practitioners in collaboration	Development of solutions informed by existing design principles and technological innovations	Iterative cycles of testing and refinement of solutions in practice	Reflection to produce “design principles” and enhance solution implementation
Thesis plan for phase	Semi structured interviews to determine the perspectives of General surgery trainees and supervisors regarding the assessment of clinical competence,	Formulation of guiding design principles based on: 1) Review of education theory relevant to WBA 2) Participant perceptions (from phase 1) 3) Literature review of WBA in General	Implementation of solution in three consecutive surgery rotations (of 3 months duration each) at UCT. Refinement of solution based on consultation with key stakeholder	Refinement of guiding principles from phase 2, through reviewing lessons learnt in cycles of implementation (phase 3), in order to produce a final set of

	how this has been achieved previously, and how it should be performed in the future at UCT.	surgery 4) Expert meetings 5) Scoping review of EPAs in General surgery 6) National survey to inform key activities for local assessment strategy	committee and informed by participant surveys at the end of each cycle.	design principles.
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2.10 Reflexivity statement

Before delving into a description of the collection, analysis, and interpretation of data, I find it prudent to outline my background assumptions and the stance I took towards the data. Prior to this work, my involvement in studies had predominantly been quantitative in nature and I had initially regarded qualitative studies as vague, messy, and unattractive to engage with in research. However, as I began exploring the realm of health professions education research, I soon recognized the importance of these types of studies in explaining the complex social phenomenon of learning, teaching, and assessment. For this thesis, in line with the prevalent approach in medical education studies, I adopted a constructivist ontology and interpretivist epistemology (Raqib 2019). Yet, for some aspects of the project, I embraced a more pragmatic paradigm, where a specific objective or problem determined the lens for that part of the study (Mackenzie 2006). Even when quantitative approaches were employed, the overall context of the thesis remained interpretivist, viewing reality as socially constructed, dynamic, and knowledge as subjective and contextualised. Consistent with this epistemology, the broad aim of the thesis centred around describing and understanding WBA and how it functions in this context. In that way, my perspective leaned more towards that of a participant interpreter than a disinterested scientist seeking to explain or predict findings in a positivist way (Raqib 2019). Being aware of these pre-existing assumptions, I made an effort to maintain the trustworthiness of my interpretations. Strategies included maintaining reflexivity, triangulating data sources and methods, and constant communication with supervisors as well as participants (Dolmans and Tigelaar 2012).

Considering the above, it is essential to disclose my pre-existing assumptions and expectations going into the study. Based on the literature I had read, I deemed it important that WBA should be introduced and believed that it could be successful. Consequently, my

expectation was that it would succeed. However, I did not have a clear idea of which factors would make that outcome more or less likely. At the outset of this thesis, I had recently assumed the role of convener or assistant director of a postgraduate training program. In this capacity, I was evidently motivated to implement initiatives that would enhance learning for trainees. Although my role included clinical work, a significant portion of my time could be devoted to planning, implementing, and monitoring educational initiatives such as WBA. This is important to disclose as it meant that I had the time and capacity to drive this initiative and investigate it in a scholarly manner simultaneously.

2.11 Ethical considerations and approval

Ethics approval was obtained from the UCT Health Research Ethics Committee (HREC 246/2022) for both the thesis and individual sub-studies contributing to the chapters. Additionally, approval was granted from UCT for the inclusion of UCT staff and students in the research.

2.11.1 Privacy and Confidentiality

Interview recordings and survey results were securely stored on a password-protected computer and backed up to a secure digital storage platform. The computer was kept in a locked room, accessible only to the student. Response data was de-identified once data collection was complete. After transcription of interviews, recordings were permanently deleted from all devices. Consent forms informed participants of their right to request the deletion of their data at any point in the study. Access to WBA data was restricted to supervisors directly involved in training for the rotation, and to the research team.

2.11.2 Informed Consent Process

Consent and willingness to participate in the study were obtained before administering questionnaires or conducting interviews. Participants were informed of their right to disengage themselves and their stored responses at any time during the study.

Every trainee and supervisor received proper information about the WBA program and this study before its implementation on October 1, 2022. This was part of a faculty development and trainee education process. A notification at the top of each questionnaire and form indicated that completion implied agreement to allow the report to be recorded as part of the study. The stakeholder team was also consented for their participation.

2.11.3 Risks and Benefits

It was not anticipated that any of the interviews or surveys would cause psychological distress, as the content was not sensitive or personal. The anonymity of survey and interview respondents was strictly maintained to ensure no risk to their professional careers. For the implementation phase, the strategy was designed to minimise disruption in clinical workflow and service delivery. Data on trainee competence was stored confidentially and only accessible to the research team and supervisors directly involved in that trainee's training for a given rotation.

Workplace-Based Assessment is becoming the standard for determining the clinical competence of medical trainees worldwide, with many descriptions of benefits to trainees in terms of feedback and learning. By improving training for competence, trainees may be better prepared for the “real world” after certification. The results of the study will also assist the UCT Division of General surgery in confirming and ensuring the clinical competence of trainees at graduation. Additionally, it may assist General surgery programs at other institutions, as well as other disciplines at UCT, in implementing WBA.

Chapter 3. Theoretical underpinnings

It is essential for any health professions education research to be grounded in education theory. Similarly, it is just as important for significant academic work, such as a PhD, to be theory-based (Wellington 2013). As a relative newcomer, with no prior formal training in health professions education, it was crucial for me to develop a solid understanding of the theories underpinning assessment in this field. Therefore, having provided an overview of DBR and the rationale for its use in this thesis, I will now discuss key theoretical concepts related to the study, as well as the theoretical lenses applied during design, implementation and reflection on the success of the intervention.

3.1 Learning theories

The primary aim of any training program or educational initiative is to ensure that learning occurs. Assessment plays a dual role in achieving this goal. Firstly, it confirms that learning has taken place, guiding decisions related to the progression, remediation, or certification of individual students (Schuwirth and van der Vleuten 2011). Secondly, assessment serves as a means to facilitate learning itself. Consequently, teaching, learning, and assessment are intricately interconnected (James 2006). Therefore, gaining an understanding of assessment and its underlying theories necessitates a foundational comprehension of learning and learning theories.

Various theories exist to describe how adults learn, derived from both psychological theories and practical observations (Taylor and Hamdy 2013). No single theory can comprehensively explain the dynamics of a medical trainee's learning process. The existence of multiple learning theories is not a drawback (Dong et al. 2021). Different types of learning demand different theories in distinct contexts. Effectively utilising learning theories involves comprehending them and applying them judiciously to specific learning scenarios. Each student possesses unique experiences, limitations, and preferences, and the role of the medical educator is to furnish the resources and a supportive environment to optimise each student's learning process (Taylor and Hamdy 2013).

Learning theories can be categorised in various ways (Taylor and Hamdy 2013). One simplified approach groups them into three families: behaviourist theories, cognitive and constructivist theories, and social-cultural and situated theories.

3.1.1 Behaviourist theories

In the 1600s, the prevailing perspective on learning considered that all knowledge originated from experience. Moving to the early 1900s, Thorndike introduced the Law of Effect, asserting that learning occurred when it had a positive impact on the individual. He also formulated the Law of Exercise, suggesting that repetition strengthened learning (Thorndike 1911).

The 1950s witnessed the emergence of behaviourist learning theories, with Skinner describing learning as a stimulus-response process (Skinner 1954). According to these theories, the external environment plays a pivotal role in learning, occurring as a conditioned response to external stimuli, which may involve rewards or punishments. Behaviourist theories also proposed that complex processes could be broken down, and learning achieved by practising, reinforcing, and subsequently building on each element. Behaviourism dominated theoretical perspectives in the 60s and 70s and continues to influence education practices (James 2006).

From a behaviourist standpoint, learning involves accumulating skills and memorising facts within a specific domain. These theories suggest that the learning environment is most effective when teaching students in homogeneous groups based on skill level or individually according to their progress rate, aligned with a fixed skill acquisition hierarchy (James 2006). In practical terms, curriculum planning is facilitated by introducing basic skills before complex ones, accompanied by positive feedback and correction of mistakes to establish stimulus-response connections.

3.1.2 Cognitive constructivist theories

In the 1970s, a shift in perspectives occurred under the influence of theorists like Chomsky and Bruner, who recognized that behaviourist theories fell short in explaining the acquisition of higher-order skills, such as language learning (Chomsky 1975), (Bruner 1966). Unlike behaviourist theories, which lacked a concept of 'mind' or intelligence as essential components for learning, cognitive and constructivist theories of learning necessitate the active engagement of learners and focus on the 'mind' as a brain function. These theories delve into how learners construct meaning and comprehend their environment through mental models, which outline the organisation of concepts and principles in mental schema.

Cognitivist and constructivist theories underscore understanding and problem-solving as the context for learning (Dong et al. 2021). Moreover, prior learning and knowledge are considered crucial elements of a student's capacity to acquire new content. The distinction between novices and experts lies in how experts can organise concepts and knowledge into mental schemas that are practical and easily retrievable (James 2006). The teaching implications involve guiding novices toward an expert-level understanding of concepts and processing strategies, demonstrating how these can be applied to problem-solving.

3.1.3 Sociocultural and situated theories

The sociocultural and situated family of learning theories represents a relatively recent development (Taylor and Hamdy 2013). This perspective acknowledges that social relationships are essential for learning and proposes that learning occurs through the interaction between an individual and their social environment.

Vygotsky, an early proponent of these approaches, presented numerous ideas on how learning communities support individual learning (Vygotsky 1978). These theories suggest that learning involves active participation, and the knowledge acquired is shared within a social group. Vygotsky's influential work, "Mind in Society," contends that thinking occurs through actions that alter the external situation, particularly the social context, and, reciprocally, the situation shapes an individual's thinking through continuous interaction (Vygotsky 1978). Other key theorists in this field include Bandura, Lave, and Wenger, with the latter two describing learning as a cognitive apprenticeship within a community of practice (Lave and Wenger 1991), (Wenger 1999). Within this context, the development of professional identities is crucial, involving the learner being shaped by a community of practice. Knowledge is intimately linked to the context, making it challenging to assess whether an individual has acquired learning in a setting divorced from practice (James 2006).

Implications for teaching suggest the need to create environments where learners are encouraged to think and act by engaging in authentic societal tasks (James 2006). Furthermore, engagement with these tasks should occur in what Vygotsky terms the "zone of proximal development" (Vygotsky 1978). Authentic activities are those a learner can accomplish with an 'expert other' who provides assistance by scaffolding their learning, gradually removing the scaffold as the learner becomes capable of handling the task independently. Thus, teachers and students collaborate to solve problems, jointly developing skills and understanding (James 2006).

3.1.4 Implications of learning theories

Connecting adult learning theories with clinical practice at an institutional level can present challenges. The relevance and helpfulness of specific theories or components thereof may vary depending on the context (Taylor and Hamdy 2013). The overarching objective or goal of a program significantly influences the entire curriculum and, consequently, the learning theories necessary to achieve this goal. The application of any theory and related teaching strategies may necessitate substantial changes in institutional culture, as well as faculty and learner development. Moreover, a shift in teaching practices may require a corresponding shift in thinking around assessment, ensuring that constructive alignment (Biggs 1996) across all curriculum elements is maintained (Taylor and Hamdy 2013; James 2006).

Competency based medical education, an offshoot of outcomes based education, is becoming an increasingly popular approach to education in the health professions. It revolves around multiple domains of competence, some of which involve 'intrinsic roles' related to affect or attitudes rather than knowledge and skills. Examples include communication, collaboration, and ethical and professional practice. Therefore, the application of learning theories and related teaching practices must align with the goal of students becoming competent in these domains (Taylor and Hamdy 2013). Since these roles are predominantly learned and expressed through social interaction, greater emphasis on sociocultural and situated learning theories may be needed when designing competency-based teaching and learning strategies.

3.2 Assessment theory/frameworks

Assessment practices in medical education have evolved in tandem with significant shifts in learning theory (Schuwirth and van der Vleuten 2020). Unlike having a single unifying theory, medical education assessment draws on various aspects of theories from other scientific fields, including higher education, general education, cognitive psychology, psychometric theories, and judgement theories in psychology (Lambert W. T. Schuwirth and van der Vleuten 2011). These broader theories have laid the foundation for more specific theoretical frameworks of assessment tailored to medical education, with a predominant focus on measuring the development of expertise in medical trainees (Lambert W. T. Schuwirth and van der Vleuten 2011).

3.2.1 Frameworks for assessing expertise development

Pangaro and ten Cate delineated three distinct types of assessment frameworks within the realm of medical education (Pangaro and Ten Cate 2013). The initial category comprises analytic frameworks, which compartmentalise competence into domains. These domains trace their roots to the Outcomes-Based Education movement, as described by Harden et al. (Harden et al. 1999). These frameworks operate on the assumption that the discrete elements or domains of competence collectively constitute a competent practitioner, and each element can be discreetly measured. A seminal instance of such a framework is the knowledge, skills, attitudes (KSA) framework, synonymous with the cognitive, psychomotor, and affective domains articulated by Bloom (Bloom et al. 1956). More contemporary examples encompass the CanMeds roles and the Accreditation Council for Graduate Medical Education (ACGME) competencies. (Accreditation Council on Graduate Medical Education (ACGME) 1999), (Frank 2005). While these frameworks comprehensively cover all facets of practice, they suffer from detailed descriptions of sub-competencies and associated competencies to precisely define the broader domains. Another limitation lies in their complexity, making them less accessible to clinicians, with a challenging connection to clinical activities, particularly in the context of assessment practices (Pangaro and Ten Cate 2013).

'Synthetic' frameworks amalgamate practice domains with the necessary knowledge, skills, and attitudes into tasks. Examples include entrustable professional activities (EPAs) and the reporter-interpreter-manager-educator, or RIME framework (Ten Cate 2005), (Pangaro 1999). These frameworks assume that complex social tasks necessitate the simultaneous application of multiple domains of competence by the learner. While they offer a strong connection with workplace activities, ensuring a high degree of authenticity, they may fall short in identifying specific aspects requiring attention for trainee improvement and progression (Pangaro and Ten Cate 2013).

The third category encompasses developmental frameworks, primarily focused on measuring and guiding progression. Unlike analytic frameworks, developmental frameworks highlight stages or milestones instead of static competence outcome domains. Examples include the Dreyfus and Dreyfus framework and Miller's pyramid, which delineated the journey from novice to expert practitioner (Dreyfus, Dreyfus, and Zadeh 1987), (Miller 1990). Rooted in socio-cultural learning theory, these frameworks align with concepts like Communities of Practice, where novice learners gradually transition from peripheral participants to active community members (Lave and Wenger 1991). While developmental

frameworks offer the advantage of application across multiple training years and personalised assessment and progress tracking, their disadvantage lies in somewhat generic stages, necessitating the description of discrete elements like milestones, rendering them complex and challenging to implement in practice (Pangaro and Ten Cate 2013).

Despite the categorical labelling of each framework, significant overlap exists between them, with many possessing features of another. For instance, EPAs include the assessment of specific knowledge, skills, and attitudes, with judgments also grounded in competency domains (Ten Cate and Taylor 2021). Similar to learning theories, the choice of expertise-related frameworks hinges on the timing and purpose of assessment. Analytic frameworks may be more suitable for assessing readiness for independent practice, while developmental frameworks may be preferable for measuring and guiding growth throughout a program (Pangaro and Ten Cate 2013).

3.2.2 Psychometric theories

Irrespective of the assessment program's purpose, it generally involves collecting observations or data to draw conclusions about the learner. This process necessitates both reliability and validity, concepts for which psychometric theories have been developed.

The initial validity theories were predominantly grounded in criterion or predictive validity (Lambert W. T. Schuwirth and van der Vleuten 2011). Cronbach emphasised the significance of construct validity, with contemporary interpretations suggesting that construct validity holds the utmost importance (Cronbach and Meehl 1955; Hill et al. 2022). Consequently, most modern validity frameworks centre around construct validity, acknowledging that no single test or evidence can singularly certify an assessment's validity. Instead, validation is built on a case of arguments (Lambert W. T. Schuwirth and van der Vleuten 2011).

Designers of an assessment process must articulate validity evidence, demonstrating the assessment's validity for a specific purpose in a given context at a particular time (Hill et al. 2022). Messick and Kane's validity frameworks are among the most well known in medical education. Messick's framework delineates five sources of validity: content, response processes, internal structure, relations to other variables, and consequences of testing (Messick 1995). Kane's framework enables the measurement of assessment validity through a sequence of steps where validity evidence is amassed and evaluated at each step (Kane 2001).

Three primary reliability theories have been described, including classical test theory, generalizability theory, and item response theory (Lambert W. T. Schuwirth and van der Vleuten 2011). While the intricacies of these theories exceed the scope of this chapter, their significance in medical education is noteworthy. Psychometric theories, encompassing reliability, gained prominence during an era when assessment in education was predominantly perceived as a measurement-related endeavour (Schuwirth and van der Vleuten 2020). In the 1960s, dissatisfaction with assessment practices led to a shift towards more standardised, structured, and less subjective assessments in medical education. In these times, assessments were often deemed subjective, biased, and unreliable.

Early assessment developments were rooted in test psychology, with the prevailing notion that competence should be quantitatively captured as a score, framing assessment design as a psychometric measurement issue (Schuwirth and van der Vleuten 2020). In the late 1980s, Swanson and Norcini's work challenged the perception that subjectivity was the main source of unreliability, attributing it instead to poor sampling (Swanson and Norcini 1989). Furthermore, the concept of objectivity was questioned in the early '90s, challenging the foundation of measurement-type assessments grounded in psychometric theories. It became evident that even seemingly objective assessments, such as single-best answers, involve human judgement in blueprinting syllabi, setting standards, selecting items, and wording of items (Van der Vleuten, Norman, and De Graaff 1991). Regardless of its basis in psychometric theory or not, reliability remains a crucial aspect of any assessment design.

3.2.3 Assessment for learning

A relatively newer approach to assessment is the concept of assessment for learning, advocating for the primacy of learning. While not constituting a specific theory, it represents a shift in perspective on assessment (Lambert W. T. Schuwirth and van der Vleuten 2011). This approach has led to the formulation of new theories or extensions of existing ones, as exemplified by Cilliers et al., which incorporates motivational theory and delineates the factors within an assessment program that influence learning, their mechanisms, and the ensuing consequences (Cilliers et al. 2012).

Though the term formative assessment is sometimes used interchangeably, it may not necessarily embody the same concept. Initial descriptions of formative assessment differentiated it from summative assessment based solely on the timing of the test. The term may also refer to a strategy involving frequent ad hoc tests conducted over time, culminating

in a final assessment of learning. However, these assessments do not inherently contribute to the learning process (Gardner 2012). Regardless, the term formative assessment is frequently used to describe assessment for learning and is similarly used in this thesis.

The principles of assessment for learning were outlined by the Assessment Reform Group in 2002 (Assessment Reform Group 2002). This approach necessitates effective planning, emphasising an understanding of how students learn. Central to classroom practice, it becomes a crucial professional skill for educators. It adopts a sensitive and constructive approach, fostering motivation, promoting a clear understanding of goals and criteria, providing insights into improvement, and contributing to the development of self-assessment skills. Furthermore, it recognizes and acknowledges all educational achievements.

Assessment for learning can be applied to various learning approaches or theories (James 2006). In behaviourist approaches, addressing poor performance may involve practising incorrect items or breaking them down into more basic components. In cognitive or constructivist theories, assessment for learning becomes essential for eliciting students' mental models, scaffolding their understanding of knowledge, and providing opportunities to apply strategies and concepts in new situations. In sociocultural and situated theories, assessment for learning is linked to authentic real-world activities, focusing on how well learners exercise agency, utilise resources or tools, and solve problems in context. In this perspective, assessment programs need to cultivate learning identities and facilitate the development of students' self-assessment practices. Central to assessment for learning in this context is direct observation by 'expert others', followed by the provision of quality feedback. This process enables learners to critically reflect on their performance and compare their self-assessment with an expert's evaluation of their capabilities (James 2006).

3.3 Shifts in assessment practice

In the 1990s, a significant shift in assessment thinking took place, influenced by two key factors. Firstly, there was a growing recognition of the limitations that the 'assessment as measurement' approach imposed on learning. Secondly, it became evident that 'assessment as measurement' was insufficient in capturing certain aspects of learner competence, such as independence, thoughtfulness, and critical thinking, which were often compromised by measurement-centric practices (Schuwirth and van der Vleuten 2020).

As mentioned earlier, the emphasis on objectivity and standardisation in assessment, while important for reliability, was found to be less critical than ensuring adequate sampling. This realisation allowed assessments to return to authentic contexts, facilitating a broader inclusion of factors such as professionalism, critical thinking, and reflection in the assessment process (Norcini et al. 1995). This shift marked a departure from the strict measurement-based practices that hindered the assessment of crucial dimensions of learner competence.

3.3.1 Authentic assessment

In 1990, Wiggins introduced the concept of authentic assessment, defining it as a method that directly examines student performance on intellectually significant tasks. This marked a departure from traditional assessments relying on indirect measures with efficient but simplistic tools to infer performance. While traditional formats like single-best-answer tests can indicate academic proficiency, they often mislead learners and teachers about the mastery required. Authentic assessments demand students to demonstrate performance with acquired knowledge, assessing application rather than mere recall or reasoning. They involve real-world challenges, preparing students for the complexities of professional life (Wiggins 1990).

Since Wiggins' initial description, authentic assessment has evolved, with contemporary perspectives emphasising several key characteristics. First, it stresses the importance of posing challenging assessments. Second, it insists on outcomes manifesting as performance or products. Third, it highlights the need for designs that facilitate knowledge transfer. Fourth, it incorporates metacognition as a vital component. Fifth, it recognizes the importance of ensuring accuracy in assessment performance. Sixth, it acknowledges the impact of the assessment environment and tools on task delivery. Seventh, it emphasises the value of incorporating opportunities for discussion and feedback. Lastly, it values the collaborative aspect of assessment (Ashford-Rowe, Herrington, and Brown 2014).

Concerns about authentic assessment include associated costs in terms of both money and human resources. While sampling can mitigate these concerns, the significant gains to student learning and teacher professional development counterbalance the drawbacks. Authentic assessment of real-world tasks may also have greater validity, aligning more closely with the construct they aim to measure. Improving the accuracy of human judgement

required for assessing these tasks may be achieved through faculty development (Wiggins 1990).

MacArthur extends the concept of authentic assessment beyond the evaluation of real-world tasks (McArthur 2023). Connecting authentic assessment with situated learning, part of social-cultural learning theories (Herrington J & Herrington 1998), she argues that it should enable students to find their place in society and receive recognition for their contributions. Authentic assessment, therefore, involves not merely joining an existing world or community of practice but transforming that world and community (McArthur 2023). The practical implication is that the design of an authentic assessment program should ensure the social value of the tasks being assessed, acting as a vehicle for transformation by grounding practice in societal ideals within a specific context.

3.3.2 Workplace-based assessment

The initial concepts of authentic assessments, particularly in medical education, were rooted in the use of portfolios. However, the evolution of medical education underscored the significance of practitioners' actions in real-life clinical settings. This shift necessitated assessments that could document increasing levels of competence in authentic clinical environments, leading to the development of WBA (Norcini 2005).

Initially, the primary goal of WBA was to ensure competent, independent practice at the end of training. However, its ability to measure performance in context also provided a valuable avenue for feedback to enhance performance in clinical settings (Burch 2019).

Consequently, WBA has become a crucial educational tool in medical education (Norcini and Burch 2007).

Despite its apparent merits, WBA faces challenges regarding validity and reliability (Pangaro and Ten Cate 2013). The role of the assessor is pivotal for validity, as factors such as the application of assessment criteria, cognitive biases, cognitive load restrictions, and assessor fallibility may compromise the validity of WBAs (Schuwirth and van der Vleuten 2020).

Traditional reliability requirements are also challenging to meet in the workplace, with issues like leniency bias, the halo effect, and low inter-rater reliability, especially with poorly trained assessors (Pangaro and Ten Cate 2013).

Earlier WBA instruments attempted to distil performance into numerical outcomes or an overall numeric score. However, recognizing the complexity of competence, it became evident that such phenomena could not be adequately summarised by a single number (Schuwirth and van der Vleuten 2020). This realisation contributed to the development of EPAs and the use of entrustment-supervision scales, which more closely mirror the judgments made by supervisors daily (Ten Cate 2005). Thus, EPAs significantly enhanced the psychometric properties of workplace assessment.

However, psychometric challenges in WBA persist due to fundamental differences in the paradigms of learning and assessment. Efforts have been made to optimise psychometric robustness, including multiple sampling by assessors in various settings to improve reliability, rater training, and the use of entrustment-supervision scales to enhance validity (Burch 2019). However, there are increasing calls to reconsider WBA practices beyond the psychometric paradigm, prompting a reconsideration of the value of human judgement in assessment (Schuwirth and van der Vleuten 2020), (Hodges 2013).

Performance assessment in WBA involves a complex decision-making process which is influenced by contextual factors. Some argue for a shift in perspective towards constructivist, social-psychological approaches to assessing performance (Govaerts et al. 2007). This type of assessment relies on narrative descriptions by experts of learners' competence, introducing qualitative evaluations. The trustworthiness of these narratives aligns with quantitative concepts of validity and reliability, described as credibility and dependability (Guba and Lincoln 1989). There is ongoing research into ensuring the quality of narratives for assessment, especially in the context of high-stakes decision-making (Ginsburg et al. 2017), (Cook et al. 2016)

3.3.3 Programmatic assessment

One of the recent paradigm shifts in assessment thinking is the consideration of assessment as a comprehensive system or program rather than relying solely on individual judgments. This shift emerged partly from the recognition that competence, learning, and assessment are intricate and interconnected phenomena (Schuwirth and van der Vleuten 2020). Programmatic assessment embodies a whole systems approach, aiming to integrate and holistically approach assessment across the educational continuum. While progression and certification decisions are still imperative, they are grounded in the triangulation of information collected longitudinally from various sources, facilitating meaningful feedback

and adjusting learning activities along the way (Cees P. M. van der Vleuten and Schuwirth 2005). Importantly, programmatic assessment necessitates transparent thinking and a clear rationale behind high-stakes decision-making (Schuwirth and van der Vleuten 2020).

3.4 Workplace-based assessment: the sociocultural lens

Sociocultural learning theories provide valuable perspectives for observing, planning, and analysing workplace learning. These theories are particularly critical as they acknowledge the significance of social relations in shaping the context for learning. Furthermore, they recognize the importance of cultural and historical factors in influencing current practices (Gandamihardja and Nestel 2019). While briefly mentioned earlier, these theories will now be discussed in more detail, serving as the guiding lens for this thesis.

3.4.1 Situated Learning and Communities of Practice

Situated learning, as outlined by Lave and Wenger in 1991, posits that expertise develops through active participation in community activities, where learning occurs through immersion in a specific environment with a group sharing a common goal (Lave and Wenger 1991). Wenger further elaborated on this idea in 1998, introducing the Community of Practice theory, which he defined as "groups of people who share a concern or passion for something they do and learn how to do it better through regular interaction" (Wenger 1999).

A community of practice is characterised by three key elements: domain, community, and practice (Wenger-Trayner and Wenger-Trayner 2015). Membership in such a community implies a commitment to a shared domain, establishing a common competence that differentiates members from others. In the context of surgical training, the "domain" can be described as the safe and effective delivery of surgical care, contributing to the evolution of surgical practices, and the development of surgical trainees. The "community" involves members engaging in pursuits related to the domain, fostering relationships that facilitate learning. Lastly, "practice" refers to how the community defines its activities, products, and tools. Over time, sustained interaction within the community results in a shared repertoire of resources, including experiences, methods, tools, and problem-solving approaches. In a surgical context, this encompasses surgical knowledge, judgement, techniques, instruments, theatre etiquette, surgical language, practice documentation, surgical journals, and websites by surgical accreditation and regulatory bodies (Gandamihardja and Nestel 2019). Trainees may be part of multiple communities during their training, such as trainee-only communities

or subgroups preparing for exams, described as landscapes of practice, emphasising how individuals navigate multiple communities of practice in a given environment (Wenger-Trayner and Wenger-Trayner 2015).

Participation in community activities and interactions with supervisors not only teach trainees how to practise surgery but also instruct them on how to behave within the surgical community of practice (Gandamihardja and Nestel 2019). Observing supervisors, who are full members, helps trainees understand the requirements for transitioning from peripheral participants to full membership (Lave and Wenger 1991). The recognition of trainee development goes beyond the demonstration of knowledge and skills; it also involves the ability to work in and lead a team, engage professionally with peers and patients, and communicate effectively with patients and families (Dimitriadis, Iyer, and Evgeniou 2014). In the early stages of community participation, greater supervision and assistance are provided to ensure patient safety. However, as trainees progress in their abilities, supervisors may grant increased autonomy based on their role in the community.

3.4.2 Assessment of Situated Learning

In situated learning, evaluation is a continuous and dynamic process that assesses learner progress, teaching strategies, and the learning environment. The primary aim is to not only measure learner progress but also modify and adapt instructional strategies for the development of greater expertise. Evaluation, when coupled with learning, recognizes knowledge as situated, developed and applied within a specific context, activity, and culture (Mclellan 1993).

Early evaluation methods, such as portfolios of learning experiences, sought to integrate learning and assessment (Collins 1990). Portfolios function as progress records, showcasing students' learning through their engagement in community activities and exploration of the domain. While portfolios enable students to select and revise their work for inclusion and presentation, assessing them poses challenges. It necessitates a comprehensive review on the part of the assessor and involves intimate and subjective discussions with students (Mclellan 1993). Additionally, the gap between activity, assessment, and immediate feedback has led to an increased adoption of WBA of situated learning in health professions education.

3.4.3 Workplace-based assessment through a Sociocultural Lens

Some argue that programmatic assessment and competency-based medical education currently assume cognitive, constructivist learning views (Castanelli 2023). However, from a sociocultural perspective, trainees are not isolated; their thinking and activity arise from community engagement (Vygotsky, Rieber, and Hall 1997). Workplace-based assessment not only assesses learners but also provides opportunities for trainees to contribute to community activities, resulting in changes in themselves and their environment (Billett 2016). As trainees receive assessment reports granting increased autonomy, they gain greater degrees of membership and contribute increasingly to community development. Workplace activities are closely correlated with the local context, including historical and cultural aspects. Through WBA, supervisors assess not only knowledge and skills but also compare trainees to an expected local standard for other facets such as work ethic, professionalism, communication, teamwork, and leadership.

From a sociocultural lens, WBA appears to be a good fit for the assessment of surgical trainees, especially considering how it can stimulate learning in the workplace (Castanelli 2023). However, it has limitations and critiques. Supervisors and trainees may remain sceptical about traditional criteria of validity and reliability (Pangaro and Ten Cate 2013). Practical costs in terms of human resources, digital platforms, time, and energy may be substantial (Wiggins 1990). Workplace-based assessment relies on fair judgments by assessors and granting appropriate autonomy as trainees progress. The medicolegal and social context of the workplace in some settings may limit autonomy provision for trainees to demonstrate greater independence in performing authentic tasks (Ten Cate, Schwartz, and Chen 2020). Additionally, some students and surgical trainees have reported experiences of exclusion and intimidation (Gandamihardja and Nestel 2019). Their legitimacy to participate in the community's activities depends on those within the community, and when this does not occur, their participation and opportunities for assessment thereof may be limited.

Another significant issue with WBA, from a situated learning perspective, is its reported difficulty in translating to assessment for learning. Contributing to this challenge is the confusion between formative and summative assessment that occurs in clinical practice (Harrison et al. 2017). Supervisors find it challenging to judge trainee performance while acting as a coach (Meeuwissen, Stalmeijer, and Govaerts 2019). Trainees, on the other hand, may focus on staging and performance rather than using the opportunity for specific feedback and improved performance (LaDonna et al. 2017). Applying a sociocultural lens

may better understand the contextual and relational elements of assessment for learning through WBA, providing opportunities for improvement (Castanelli 2023).

There is a relative paucity of published literature on implementing social and cultural learning theories in health professions education programs (Mukhalalati et al. 2022). In addition, very little has been written on the application of sociocultural and situated learning in surgery, and nothing specific could be found in published journals specifically addressing assessment (O'brien and Battista 2020).

3.4.4 Conclusion: Learning and assessment lenses for the thesis

A sociocultural lens was employed in planning, conducting, and reporting the results of this thesis. This lens serves to connect desired theoretical understandings that underpin WBA's role in assessing clinical competence and its function in assessment for learning (Castanelli 2023). Specifically, a sociocultural lens was used to comprehend the impact of WBA on learning during surgical training and provide opportunities for improvements in current practice.

Furthermore, an approach based on a synthetic framework for assessment was applied, recognizing its robust connection with workplace activities, considering them as complex social tasks. While not purely synthetic, the assessment framework incorporated elements of developmental frameworks that describe how a trainee becomes progressively more included in a community of practice as expertise develops. As Pangaro stated, frameworks, when applied, are frequently hybrid in nature (Pangaro and Ten Cate 2013).

3.5 Change theory

Implementation of a new assessment strategy, especially WBA which requires significant resources, represents a major change to a system. Thus, the theoretical background for this thesis would be incomplete without discussing change theory. George Bernard Shaw's assertion that "progress is impossible without change" underscores the inevitability of change in our ongoing efforts to innovate and improve healthcare and medical education. However, a significant challenge arises as almost two-thirds of change projects reportedly fail (Higgs and Rowland 2005). The reasons for such failures often stem from inadequate planning, poorly motivated staff, insufficient communication, or excessively frequent changes (Nelson-Brantley and Ford 2017).

3.5.1 Rationale

Practices derived from change theories can significantly enhance the likelihood of success and, consequently, improvements in educational practice. Change theory can be conceptualised as "a framework of ideas supported by evidence that explains aspects of change beyond a single project" (Reinholz and Andrews 2020). These theories aim to both explain and facilitate the process of change in individual and collective behaviours, considering various contextual and personal factors. As a result, change theories can assist medical educators in designing and implementing effective strategies for innovation and improvement in educational practice (Main 2023).

Innovations not grounded in change research and theory face two major limitations. First, they are less likely to be successful as they fail to leverage the existing body of knowledge developed by scholars in the field. Second, such initiatives are less likely to contribute to generalizable knowledge if they do not build upon what is already known in the field (Reinholz and Andrews 2020). Numerous change theories have been described, each with unique strengths and weaknesses. Despite their differences, there is significant overlap among them, and different aspects can be applied depending on the specific contexts required.

3.5.2 Lewin and Kotter models

One of the earliest change management models was proposed by Kurt Lewin (Lewin 1947). This relatively straightforward model portrays change as a three-step process: unfreezing, followed by a transition, and finally, freezing. The unfreezing phase involves dismantling entrenched viewpoints and overcoming defence mechanisms to overcome the current inertia. In the second stage, the change takes place, often leading to confusion and uncertainty. In the refreezing phase, old ways of thinking are replaced, and people revert to a comfort zone, feeling at ease with the new status quo. A drawback of Lewin's model is the absence of step-by-step instructions.

In 1995, John Kotter presented his eight-step model, specifically tailored for organisational change (Kotter 2009). The eight steps are as follows:

1. Create a sense of urgency
2. Build a guiding coalition

3. Form a strategic vision and initiatives
4. Enlist a volunteer army
5. Enable action by removing barriers
6. Generate short-term wins
7. Sustain acceleration
8. Institute change

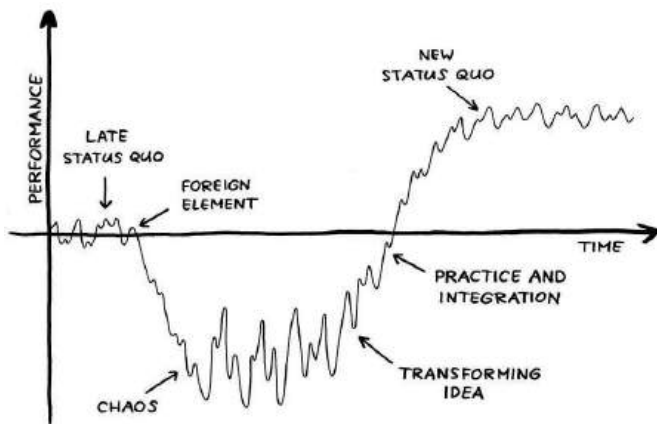
Kotter's model is known for its practicality and provides a sequence of steps to follow. However, a weakness of the model is its limited emphasis on personal change as well as on gathering feedback from participants. Despite this limitation, Kotter's eight-step change model is widely discussed and applied in healthcare and medical education (Harrison et al. 2021; Karimi, Sohrabi, and Aalaa 2022).

3.5.3 Bridges/Satir models

Two models that emphasise the personal aspect of change are the Bridges Transition Model and the Satir Change Model. The Bridges Transition Model focuses on how change impacts individuals (Bridges and Mitchell 2000). In the first stage, individuals must let go of familiar ways of doing things, often encountering resistance. The second stage involves moving into the neutral zone, a transitional phase between the old and new ways, where individuals can explore the new status quo. The final stage, the new beginning, signifies when individuals become more accustomed to the new way of doing things. This model takes a more personal approach, fostering collaboration between participants and change drivers to facilitate the transition from old to new.

The Satir model, based on the five stages of grief, highlights the initial resistance to new changes, leading to a chaos phase (Satir 1991). During this phase, maximum support from change leaders is crucial to minimise the duration and intensity of the chaos phase and its impact on performance. Following this, the integration phase sees improved productivity as participants recognize the positive impact of the new change. Ultimately, the integration phase transitions into the new status quo, where productivity stabilises at a high level as the changes become accepted and integrated into daily routines.

Figure 3.1: Satir change model



Virginia Satir Change Curve © Jurgen Appelo

(<https://www.flickr.com/photos/jurgenappelo/5201852636>). CC-BY 2.0

While the Bridges and Satir models offer insights into the change process and acknowledge potential resistance, they may not provide specific guidance for managing individual team members. Rogers' Diffusion of Innovation theory categorises team members into groups based on their acceptance of change (Rogers 2010). These categories include innovators, early adopters, early majority, late majority, and laggards. Identifying team members' categories can help change agents focus their efforts more effectively. Targeting early adopters initially, for example, can turn them into vital change champions who can influence the early and late majority. Even those openly resisting change need to be identified and approached with tailored strategies, considering their potential influence on others.

Numerous other change models and theories have been used in healthcare and medical education that will not be discussed in detail. Notably, these include the Plan-Do-Study-Act cycle as well as the Awareness, Desire, Knowledge, Ability and Reinforcement (ADKAR) change model (Main 2023).

3.5.4 Conclusion

Introducing a new assessment strategy, particularly one like WBA involving various stakeholders in the clinical setting, represented a significant change. In many contexts, the adoption of WBA signals a shift towards competency-based medical education, encompassing broader paradigm shifts. A comprehensive understanding of change theory becomes crucial for effective planning, implementation, and refinement of such a transformative assessment strategy.

For this thesis, the planning and implementation of change was guided by Kotter's model to provide practical direction. Additionally, the Satir model and Rogers' categories were used to offer a more nuanced perspective on how the change process impacts both the group and individuals on a personal level. This multifaceted approach aimed to enhance the understanding and management of the complex dynamics involved in the adoption of WBA in this context.

Chapter 4. Defining the problem in collaboration with practitioners

The work described in this chapter is based on the following publication: Nel D, McNamee L, Wright M, Alseidi AA, Cairncross L, Jonas E, Burch V. *Competency Assessment of General Surgery Trainees: A Perspective From the Global South, in a CBME-Naive Context*. Journal of Surgical Education. 2023 Oct 1;80(10):1462-71.

4.1 Rationale

The first phase of the thesis, based on the Design-Based Research (DBR) methodology, requires an exploration of the problem in collaboration with practitioners (see Chapter 2, Fig 2.1). In South Africa and at UCT, postgraduate training and assessment remains largely based on the traditional apprenticeship model. Although there has been a drive to incorporate competence assessment of trainees, almost two decades of implementation have revealed mixed opinions regarding the utility of WBA and CBME (Caverzagie et al. 2017; G. Kotter 2009; Hawkins et al. 2015; Upadhyaya et al. 2021; Massie and Ali 2016). What starts off as an ideal approach in theory may not necessarily translate into a strategy that is perceived to be acceptable and feasible by tired, busy surgical trainees and supervisors.

Before proceeding with local implementation of CBME-related assessment practices (WBA and PA), which were designed and largely evaluated in the Global North, we sought to determine whether these would be perceived to be both necessary and acceptable to the trainees and supervisors in a resource-constrained setting, with significantly lower doctor-to-patient ratios than in the Global North (O'Flynn et al. 2016). In addition, recognition of a shared mental model (McComb and Simpson 2014) of clinical competence and its assessment among trainees and supervisors, would provide a clearer understanding of the local sociocultural context. This understanding would facilitate the design and implementation of any new assessment strategy within this 'community of practice' (Wenger 1999).

4.2 Methods

4.2.1 Study design

We undertook a qualitative study, conducting semi-structured interviews with groups of professionals within General Surgery. The interview questions were designed to determine what supervisors (consultant surgeons) and trainees (i.e. registrars/residents) understood regarding the concept of 'clinical competence', the importance of measuring it, if and how they felt it had been measured in our program before, and finally, how they felt it could best be assessed going forward. Thematic analysis was used to analyse the data. The study was performed within the interpretivist paradigm to emphasise the contexts that influenced individual assessment experiences, enabling a depth of understanding that was constructed through interactions between us as the researchers, the participants and the data (Braun and Clarke 2006).

4.2.2 Setting and Participants

Purposive sampling was used to select participants to maximise variation in terms of age, gender, local/international background and years of training/service. Five participants were selected from each of the following four groups: senior supervisors, recently qualified/junior supervisors, local trainees and international trainees (20 in total). Senior supervisors were defined as being in full time service in the Division for at least 3 years. Recently qualified junior supervisors include surgeons who had completed their training and fellowship certification examinations in the previous three years. Trainees needed to have completed at least three years of their training in the Division and not yet undertaken the final fellowship certification examinations, to be eligible for inclusion. Eligible participants were contacted telephonically and asked if they were willing to participate in the study. Informed consent was obtained and documented prior to commencement of an interview. Institutional review board approval, as well as university approval for research involving staff or students was obtained.

4.2.3 Data Collection

Each participant was interviewed in person or using an online meeting platform if an in-person meeting was not possible. An initial set of non-directive questions was used. Probing questions were used to guide the interview process, with deviations or further questions allowed based on the judgement of the interviewer. A suitable set of questions could not be found in the literature, so we (DN and co-supervisor VB) designed the

questions based on the primary and secondary objectives of the study. The questions were reviewed by LC and EJ (co-supervisor and supervisor) and piloted on two trainees and two supervisors to assess whether they were clear and elicited the information required. The initial set of questions as well as follow-up questions are shown below. All interviews were conducted by the primary researcher (DN).

Initial questions:

1. What does the term 'competence' mean to you, in the context of training/being trained as a General surgeon?
2. What competencies would you consider essential for a General surgeon practising in South Africa?
3. Are there other competencies which you think are essential for a General surgeon practising outside of South Africa, that are not essential for practising in South Africa?
4. What do you think of the methods which have been used to assess the competencies expected of general surgical trainees at UCT to date?
5. How important do you think it is to develop and implement trustworthy methods of in-training assessment of competence for surgical trainees at UCT?
6. Describe the methods used to assess the competencies of General surgery trainees that you have participated in at UCT, and explain their strengths and weaknesses?
7. How well do you think each of the methods you described assessed the various competencies required of a qualified General surgeon - do you consider them trustworthy, sustainable and feasible?
8. How have these methods of assessment of competence impacted/influenced your approach to learning/studying whilst serving as a trainees) in the general surgical training program at UCT? - *trainees only*
9. Do you think that there are better ways of in-training assessment of the competencies required of a General surgeon?

Probing questions for each of the above questions:

- a) Can you expand on your answer?
- b) Can you tell me more?
- c) Is there anything else you would like to add?

The spoken version of the interview was recorded using simple audio recording software on a mobile phone or Zoom (San Jose, California, USA: Zoom Video Communications Inc)

audio file, if conducted online. The primary researcher made notes on non-verbal cues of the participants during the interview, as these were not video recorded. Transcription of recordings was performed using Otter.ai (Mountain View, California, USA: Otter.ai Inc). Transcripts were then de-identified, stored and analysed using NVivo qualitative data analysis software (QSR International Pty Ltd. Version 12 Pro, 2022). Interview transcriptions were compared to the audio files and corrected by a member of the research team for this part of the thesis (MW).

4.2.4 Data Analysis

Reflexive thematic analysis (RTA) was used with a predominantly inductive approach, such that data was open-coded and participants' meanings were emphasised. However, a degree of deductive analysis was still used to ensure that the coding contributed to producing meaningful themes to answer the research question and objectives. The analysis was performed as per the six phases of RTA described by Braun and Clarke: familiarising oneself with the data, generating codes, constructing themes, reviewing potential themes, defining and naming themes, and producing the report (Braun and Clarke 2006).

Initial coding was performed by the primary researcher (DN) and MW, and then reviewed by LM, an experienced qualitative researcher who acted as Educational Advisor to this part of the project. In addition to being assistant program director, DN was part of a national steering committee tasked with postgraduate WBA implementation in South Africa, and thus made a conscious effort to critique, appraise, and evaluate how my subjectivity and professional context influenced the entire research processes, taking care to avoid introducing preconceived conclusions during the analytic process (Olmos-Vega et al. 2022). A number of additional strategies were used to ensure trustworthiness of the data, including reflexive journaling, thorough documentation of the analytic process, consultation with MW and LM upon completion of each phase of the analysis, and finally, input from participants on the codes and themes developed.

4.3 Results

4.3.1 Participant Characteristics

Twenty individuals participated: five senior supervisors, five junior supervisors, five local trainees and five international trainees (Table 4.1). All participants were faculty or trainees in the Division of General Surgery at UCT and had spent at least 3 years in the Division.

Table 4.1: Description of participants

Participants	Median age (range)	Male (n=14)	Female (n=6)	Code
Senior supervisors	47 (42-58)	4	1	SS
Junior supervisors	36 (34-42)	3	2	JS
Local trainees	33 (32-35)	4	1	LT
International trainees	34 (31-38)	3	2	IT

4.3.2 Theme development

Initial coding of the entire dataset produced 118 preliminary codes, refined to 55 unique codes through four iterations. Nine candidate themes were then developed and refined to five final themes, which underwent multiple naming changes and re-allocation of relevant codes. Underlying codes were also reworded during this final process, as greater understanding of concepts developed through repeated interactions with the dataset and discussion between the researchers.

4.3.3 Theme 1: Assessment of competence is essential

Both supervisors and trainees felt that assessing competence during training was vital. As one junior supervisor stated:

“I think it's more important than the actual [national college exit examination]. I think it's essential. It's the only way to know if someone is ready to be a surgeon” (JS2).

A few reasons were given why participants felt it was so important. First, and most alarming, was a perception that previous assessment methods had allowed the certification of trainees who could not function safely and independently as specialist surgeons:

“So I feel like there are people going through the same training program, but some people in the end were able to function as a surgeon and work safely as a General surgeon, and then there are some people that also graduate the same program that are not” (JS2).

The second reason, related to the aforementioned, was that current practices of primarily assessing theoretical knowledge, results in trainees giving up clinical learning experiences, especially performing procedures, to seek instruction focused on book knowledge:

“But for me, the focus has always been for the exam and if you ask the trainees, they would also say ‘prepare me for the exam’”(SS1).

The third reason was that a lack of explicit competence assessment leaves trainees unsure of their clinical ability and progress. As one trainee said:

“I think I’ve never had an explicit thing [where a supervisor said], you’ve done this, and this was done well, and this is where you need to improve” (LT4).

Therefore, in the perceived absence of explicit competency assessment feedback, trainees seem to infer competence from the level of autonomy provided. If a supervisor allows a trainee to run a theatre list, perform an operation, run an outpatient clinic, or do a ward round on their own, trainees felt that they were probably deemed competent to do that independently, even though it's not explicitly stated:

“I think a lot of the time, it’s very informal. You kind of get a feeling of your competency from the way seniors allow you to do things”(LT5).

The final reason was that the training program carries the responsibility to ensure its graduates are ready for independent practice:

“Just because you’ve got book knowledge on a topic doesn’t mean you can actually do the clinical work and you’ve got clinical acumen... we know we’ve got a big responsibility towards the trainees, but also the general public” (JS2).

4.3.4 Theme 2: Competence includes multiple domains of practice

The second theme was that competence, as a construct, included multiple different domains or roles. The most frequently mentioned were those competencies relating to the central, integrating role of 'medical expert'/'healthcare practitioner' e.g. possessing and applying theoretical knowledge, ability to assess patients and make diagnoses, clinical reasoning, making safe decisions, and instituting operative, perioperative and non-operative management:

“You need to be able to manage the patient as a whole - not just the operation, but the perioperative side of things” (IT3).

A number of competencies relating to the 'intrinsic roles' were also identified as important for surgical trainees to acquire: professionalism, communicating with patients and colleagues, working as part of a team, leadership, managing resources, teaching junior staff, performing basic research, recognizing your own limitations, and the ability to adapt to different contexts:

“You should be able to perform basic level of research and analyse research as well and...deal with the interpersonal aspects of your job... you must be able to have a skillset to communicate with patients and colleagues”(JS2).

In addition to describing which competencies a surgeon needed, participants repeatedly set the benchmark for competence at *safe* practice, not necessarily mastery or excellence. As two participants succinctly stated:

“To me, competence is safety”(SC5)

and,

“You want to train people who will finish and be a safe surgeon”(LT3).

Participants explained this as being able to handle clinical situations safely, not harm the patient and seek more expert help when needed:

“I think that’s also knowing your limits and within what scope you can work and when to take it to a colleague or another specialist”(JS3).

4.3.5 Theme 3: A surgeon must be able to operate

Despite the wide range of competencies that were mentioned that a General surgeon needed, there was one that came through so strongly that it became a theme in itself: a surgeon must be able to perform General surgery procedures safely and independently. As one supervisor emphatically stated:

“The essence of a surgeon is surgery! That’s our core business... you should be able to identify the patient in need of an operation, and you must be able to do them well, and look after them well. To me, that’s the essence of it”(SS4).

The ability to perform procedures was mentioned by every participant, emphasised repeatedly by many, and usually mentioned first when asked: “Which competencies do you feel are important for a General surgeon to possess?” As one trainee stated:

“It’s a surgical hands-on speciality. You have to be technically competent”(LT4).

A reason given for the emphasis on technical capability, was that participants felt that performing procedures sets surgery apart from other specialties:

“The decision-making around managing your patients is not only limited to what you’re doing in theatre, but I think that’s what separates us from physicians” (JS1).

4.3.6 Theme 4: Previously used methods were inadequate to assess competence

When questioned about which methods of in-training assessment of competence interviewees had participated in, all but one mentioned an End of Block Assessment (EoBA). This assessment occurred at the end of a three-month rotation and was described as consisting of a 15-30 minute unstructured oral examination, where clinical knowledge and reasoning was assessed. Some trainees reported occasionally being asked to describe how to perform an operation during this examination. A small number of trainees and supervisors mentioned participating in a single procedural assessment as part of the EoBA, where a trainee was observed performing an operation. Supervisors recalled having to write a simple narrative description of the trainee’s performance, which was included in the EoBA report form and sent to the Head of Department:

“We also went through a phase where we wanted to have a supervised marked operation by a trainee towards the end of their block, or part of an operation, that would be a formal assessment of their surgical skills... it went through a phase and then people stopped doing it” (SS3).

Exploration of participants' perceptions regarding the ability of these previously used assessment methods to assess the competencies required of a General surgeon, revealed that all participants felt they were inadequate to do so. Several reasons were given for this, including that the EoBA was unstructured, lacked oversight, had no real consequences, did not provide feedback to trainees, was unreliable and subjective, and took place sporadically. As one recently certified supervisor stated:

“My entire [five years of training] time, I have had two formal assessments, one, which I thought was very random and very poorly done” (JS4).

Apart from its limited value in assessing competence, a major disadvantage was that the EoBA did not allow for any remediation during the block:

“One needs to identify those people early and give them extra support, and not right at the end when you see the wheels are coming off - that's a problem” (SS2).

In addition, the EoBA was described by some as a 'snapshot', a single point of assessment in time that was limited in its ability to cover the depth of topics related to the specialty participated in by the trainee for that three-month rotation:

“So I think in terms of doing an end of block assessment and trying to get an understanding, I think the amount of knowledge that you can assess is a little bit thin” (LT1).

Despite the perception that the EoBA was not adequate to assess competence, participants felt it still had value. First, it helped prepare trainees for the national exit examination, which has a similar format. Second, it did encourage some trainees to put in extra hours of studying in the last week or two before the assessment, which they felt aided them in consolidating some of the knowledge gained during the rotation:

“Towards the end, when you knew it was coming, you sort of did a bit of extra work, crammed a bit in the last two weeks”(LT1).

The other method mentioned to measure competence was using a logbook of procedures performed, with two senior supervisors expressing that one could infer some degree of competence from the number of cases performed. However, the trainees felt differently:

“When you go for your final exam, it's a verbal and written exam; there's almost no way to say, 'Hey, this guy can cut'... It might appear in your logbook that you've done this, this and this and, I suppose if you are incredibly terrible, someone will pick it up at some point”(LT4),

And

“I could pretty much put in there that I've done like six laparotomies and I don't think my application would get rejected. I don't think anybody looks at [the logbook]- it's a waste of time”(IT4).

4.3.7 Theme 5: Frequent assessment with feedback is desired

When asked to suggest better ways of in-training assessment of competence, both trainee and supervisor participants felt that frequent, continuous assessments are needed:

“I do think that one has to change to kind of a continuous assessment throughout the block. How exactly you're going to do that I'm not certain, but it seems slightly more fair and representative of someone's performance”(SS1).

Many also felt that such a strategy of assessment would be preferable to a single point in-training or exit examinations:

“I think continuous assessment, and in-block assessment from people who are seeing you every day, has more substance to it and is closer to your real performance than having one exam” (JS4).

Participants felt that regular assessments would also allow for the early identification of gaps in clinical ability, allowing them to be addressed timeously. In addition to frequent assessment, participants felt that timeous provision of constructive feedback would be critical to enable these assessments to have a formative impact:

“I think what's missed is more the feedback to the individual to say, 'You're doing well, you're not doing well'... So there's a lot of informal assessments going on, but the feedback is definitely lacking”(JS3).

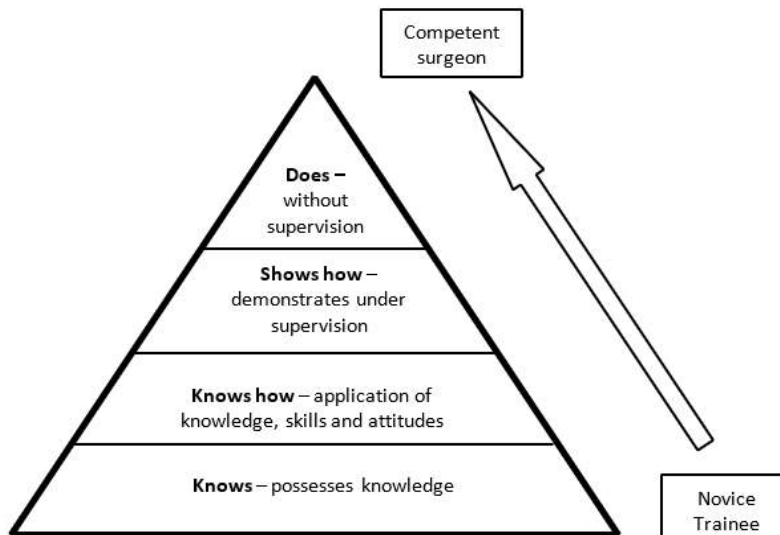
4.4 Discussion

This study evaluated the perceptions of UCT General surgery supervisors and trainees regarding the meaning of competence and assessment thereof. Key findings were that a shared mental model (McComb and Simpson 2014) already existed in terms of the definition of a competent surgeon, the importance of assessing competence, and that previously used assessment methods were inadequate.

There have been various definitions of a 'competent surgeon' and, therefore, differences in how trainees are certified as having achieved this upon completion of residency (Bhatti and Cummings 2007). A holistic definition of competence, which combines the key elements of knowledge, skills and attitudes of a surgeon, has been put forward as: "the demonstrated ability to safely care for patients thoughtfully and knowledgeably whilst maintaining acceptable standards of professional behaviour" (Hall, Crebbin, and Ellison 2004). The participants of this study, despite having had no previous exposure to CBME, considered competence to include the various domains/roles already described by local and international competency frameworks, which form the foundation for CBME curricula (Jason R. Frank, Snell, and Sherbino 2015; Health Professions Council of South Africa 2014). What was striking, however, was the significant emphasis placed on the ability to perform surgical procedures, which was unanimously considered the most important competency a surgeon needs. Of course, participants still considered other competencies to be important, and clearly they are (Zegers et al. 2011), but designing an assessment strategy that does not focus on procedural ability may quickly be perceived as a box-ticking exercise (Pereira and Dean 2013).

The other important finding was that the benchmark for competence was clearly perceived as the ability to be 'safe' when functioning as an independent surgeon, which correlates with the transition to competence as described by Miller (Miller 1990). Thus, in the context of the participant responses in this particular study, a competent General surgeon can be defined as: "An individual who possesses the full range of required competencies to safely act as an independent surgeon, especially when performing procedures".

Figure 4.1: Miller's pyramid of clinical competence



After establishing *what* participants defined as a competent surgeon, the next question was: *why* does competence need to be assessed? Both trainees and supervisors felt that the assessment of in-training competence was important for both formative and summative purposes. The formative aspect was described by the perception that a lack of explicit competence assessment and subsequent feedback leaves trainees unsure of their ability, deficiencies and progress towards becoming a surgeon. This can be considered in the context of situated learning theory, in particular 'Communities of Practice' as described by Wenger (Wenger 1999). There is no dedicated year of surgical internship in South Africa, thus, when a new doctor joins the program, they are automatically given the title of 'surgical trainee' and become a 'legitimate peripheral participant' of the university's General surgery community (Lave and Wenger 1991). Although some felt that they were being informally assessed by their supervisors and given autonomy accordingly, not getting explicit feedback from individuals who are already full members and judging entry into the General surgery community, was perceived as limiting their progress towards 'having what it takes'. As learning and assessment are inextricably linked (James 2006), the understanding that participants consider learning to become a surgeon takes place within this community of practice, suggests that assessment by the members of this community would also be perceived as having a high degree of authenticity (Wiggins 1990). Despite the formative emphasis, a summative value for competence assessment was also described. This was expressed in the worrying perception that current summative assessment methods had allowed for the graduation of trainees who were considered by their peers to be unsafe to practise independently, compromising the responsibility of the training institution and certifying body.

After establishing the *what* and *why*, the final question in this study was *how* should competence be assessed going forward? There was a clear perception that previously used methods to assess competence, primarily an EoBA (a type of In-Training Evaluation Report), were inadequate (Hatala et al. 2017). The reasons why these were not considered adequate can be used to improve the EoBA's implementation. Thus, it can still contribute meaningfully as a type of longitudinal measure of workplace competence if: it is overseen by the program director or department chair, has visible consequences which are acted on, quality narrative feedback is provided to trainees, it has more structure, is performed by multiple supervisors together (to enhance reliability) and takes place consistently (Hatala et al. 2017). However, such changes do not address the concerns regarding its validity of assessing workplace competence and limited formative value. Most participants indicated that continuous assessment through direct workplace observation from supervisors, who are full members of the university's General surgery community of practice, would address these concerns. The finding of an existing shared mental model where trainees and supervisors recognize the importance of learning and assessment within their community of practice, suggests that in this CBME-naive population, WBA may be welcomed by trainees and supervisors alike.

As mentioned previously, WBA has had a mixed reception from the international surgical fraternity (Massie and Ali 2016). As is shown in Table 4.2, the findings of our study suggest that the acceptability and successful implementation of a WBA strategy for General surgery may be enhanced by application of the following design principles: 1) an emphasis on assessing procedures, 2) careful integration of summative and formative purposes 3) facilitation of quality, timeous feedback to trainees after direct observations (Rose, Waibel, and Schenarts 2011). The latter would require extensive faculty development, particularly in our context with no prior exposure to WBA/CBME and where a lack of quality feedback was already raised as a limitation of previous assessment practices.

In terms of summative/formative use of WBA, previous studies have raised the concern that attaching significant summative value to direct observations introduces a range of issues that limit their formative utility (Shalhoub, Marshall, and Ippolito 2017). This in turn may limit acceptability, especially to trainees, and hamper attempts at implementation. Therefore, this study supports the recommendation that WBA ought to be introduced as a component of a program of assessment, with individual observations being low stakes to maximise formative value, and summative decisions being made in a separate setting, for example through a 'Competence Committee' meeting, where the summation of multiple observations is reinterpreted to make high stakes decisions (Bok et al. 2013; Harlen 2012).

Table 4.2: Summary of themes and recommended design principles for competency assessment of General surgery trainees

Themes	Recommended design principles
1. Assessment of competence is essential	Careful integration of summative and formative purposes
2. Competence includes multiple domains of practice	–
3. A surgeon must be able to operate	Emphasis on assessing procedures
4. Previously used methods were inadequate to assess competence	–
5. Frequent assessment with feedback is desired	Facilitation of quality, timely feedback to trainees after direct observations

4. 4.1 Limitations

This study reflects participants' perceptions in a specific context and may therefore not be generalizable to other settings, particularly outside of General surgery. In addition, we acknowledge that other parts of the Global South are actively looking at the implementation of CBME/WBA. Therefore, we do not claim to offer a unique perspective that represents the Global South, but merely a perspective from our own context where CBME has not yet been implemented. Although CBME and WBA have not been formally introduced in South Africa, UCT frequently hosts elective students and academic visitors from countries that have established these in their curricula. Thus, participants may have had some exposure to visitors' experiences of CBME and WBA, which in turn may have influenced their own opinions and responses in this study. Finally, although we did not consider our own subjectivity as negatively affecting the study findings (and actually consider it to be beneficial within our chosen paradigm), I found it challenging to truly question the assumption that WBA ought to be considered necessary, considering my role in the national WBA Steering Committee. Extensive further discussion between authors and participants aided in considering if the findings could be interpreted any differently to ensure that the conclusions drawn were a trustworthy representation of the data (Olmos-Vega et al. 2022).

4.5 Conclusion

Trainees and supervisors in this CBME-naive community of practice perceived continuous in-training assessment of clinical competence to be important and necessary.

Thoughtful integration of the formative and summative use of direct observation in the workplace, an emphasis on procedural ability and the provision of timeous, high-quality feedback, may act as guiding principles to enhance the implementation of an in-training assessment of competence strategy. Thus, this chapter not only describes the analysis of the 'educational problem' by researchers and practitioners, but also provides guiding principles for design of the 'solution' to the problem - a WBA strategy for General surgery training at UCT. The following chapter reviews the use of EPAs in surgical training, which further aided in providing guiding design principles.

Chapter 5. Scoping review of Entrustable Professional Activities in postgraduate General surgery training

The work described in this chapter is based on the following publication: Nel D, Jonas E, Burch V, Cairncross L, Nel A, Alseidi A, George B, Ten Cate O. *Entrustable Professional Activities in Postgraduate General Surgery Training: A Scoping Review*. Ann Surg. 2024 Jun 17 (Epub ahead of print)

5.1 Rationale

From the literature review and expert interviews (Chapter 1), it became clear that WBA should not be seen in isolation, but rather as part of a system or program of assessment. Programmatic assessment is one of the core components of CBME, an approach which aims to ensure that graduates attain the minimum standards for unsupervised practice in their field (Frank et al. 2010). With CBME, well-defined abilities to be achieved by graduates in a specific context are initially identified. This is followed by defining the required competencies, after which a program of assessment is implemented to measure learners' progress towards achieving these (Frank et al. 2010). These competencies may include medical knowledge and technical skills, but also 'intrinsic' competencies like communication, collaboration, professionalism, leadership and advocacy. Although competencies can be defined, their practical teaching and assessment, especially the 'intrinsic' competencies, can be complicated, as they may be perceived as detached from the specific clinical environment in which they apply (Ten Cate and Taylor 2021). For example, a supervisor may have difficulty deconstructing their observation of a trainee performing a cholecystectomy into the competencies of surgical expertise, communication with the patient and theatre time, and collaboration with the scrub nurse and assistant.

Entrustable Professional Activities (EPAs) were introduced to facilitate the connection between learners' competencies (characteristics or abilities) and the professional activities entrusted to them on graduation/qualification (Ten Cate and Scheele 2007). By describing the competencies, skills, knowledge and higher order abilities required to perform a specific professional activity, a postgraduate clinical specialty can be deconstructed into units of practice that can be supervised, taught, assessed, monitored, and certified. Defining the units of practice that make up a specialty also facilitates redesign and realignment of

curricula, to provide trainees with the required content and learning experiences required to competently carry out these defined core professional activities (Ten Cate and Taylor 2021).

It was clear from the initial literature review and expert interviews that EPAs were rapidly becoming the favoured framework for implementation of WBA in training programs. A useful starting point to define EPAs for a local WBA strategy would be to review what others have done elsewhere. Although several reviews on the use of WBA in General surgery have been published, none have focused solely on EPA-based strategies (Massie and Ali 2016; Torsney, Cocker, and Slessor 2015; Aryal, Hamed, and Currow 2021; Oh et al. 2020; Fahim et al. 2018; Ryan et al. 2022; Mayne, Wilson, and Kennedy 2020; Hackney et al. 2023). The use of EPAs has been described in the broader context of graduate medical education, but included few studies from surgical disciplines (O'Dowd et al. 2019; Liu et al. 2021; Shorey et al. 2019). As specialties differ in how best to use EPAs for assessment to establish competence, specialty-specific reviews are important (Hatala et al. 2019). The aim of this chapter was to describe context or country specific differences in EPA selection, highlight common barriers and facilitators to their implementation, and explore areas for future research. Reviewing how others have used EPAs in surgery training programs would also contribute to the generation and refinement of guiding design principles for the local solution.

5.2 Methods

This scoping review was based on the original approach described by Arksey and O'Malley complimented by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols extension for scoping reviews (PRISMA-ScR) (Arksey and O'Malley 2005; Tricco et al. 2018). The review process consisted of five stages: 1) Identifying the research questions, 2) Identifying relevant studies, 3) Study selection, 4) Charting the data and 5) Collating, summarising and reporting results. The protocol was published previously and the study was registered on the Open Science Framework (Nel et al. 2023; Nel 2023a). A waiver of ethics approval was obtained from the University of Cape Town Health Research Ethics Committee.

The primary research question was how EPAs have been selected and implemented in postgraduate General surgery training. Secondary objectives were to describe facilitators and barriers to implementation of EPAs for training or assessment, and to identify aspects for further study. A systematic search was designed with the help of a faculty librarian with special competence in literature search strategies. The following databases were searched

for published literature: Pubmed (Medline), Ebscohost (including CINAHL and Africa-Wide, PsycINFO and ERIC), Scopus, and Scielo (via Web of Science). In addition, an extensive grey literature search was performed, including published literature and grey literature databases, theses/dissertations, conference abstracts, regulatory body reports/guidelines, Internet search engines, targeted websites, consultation with experts, and snowballing of surgical educator contacts.

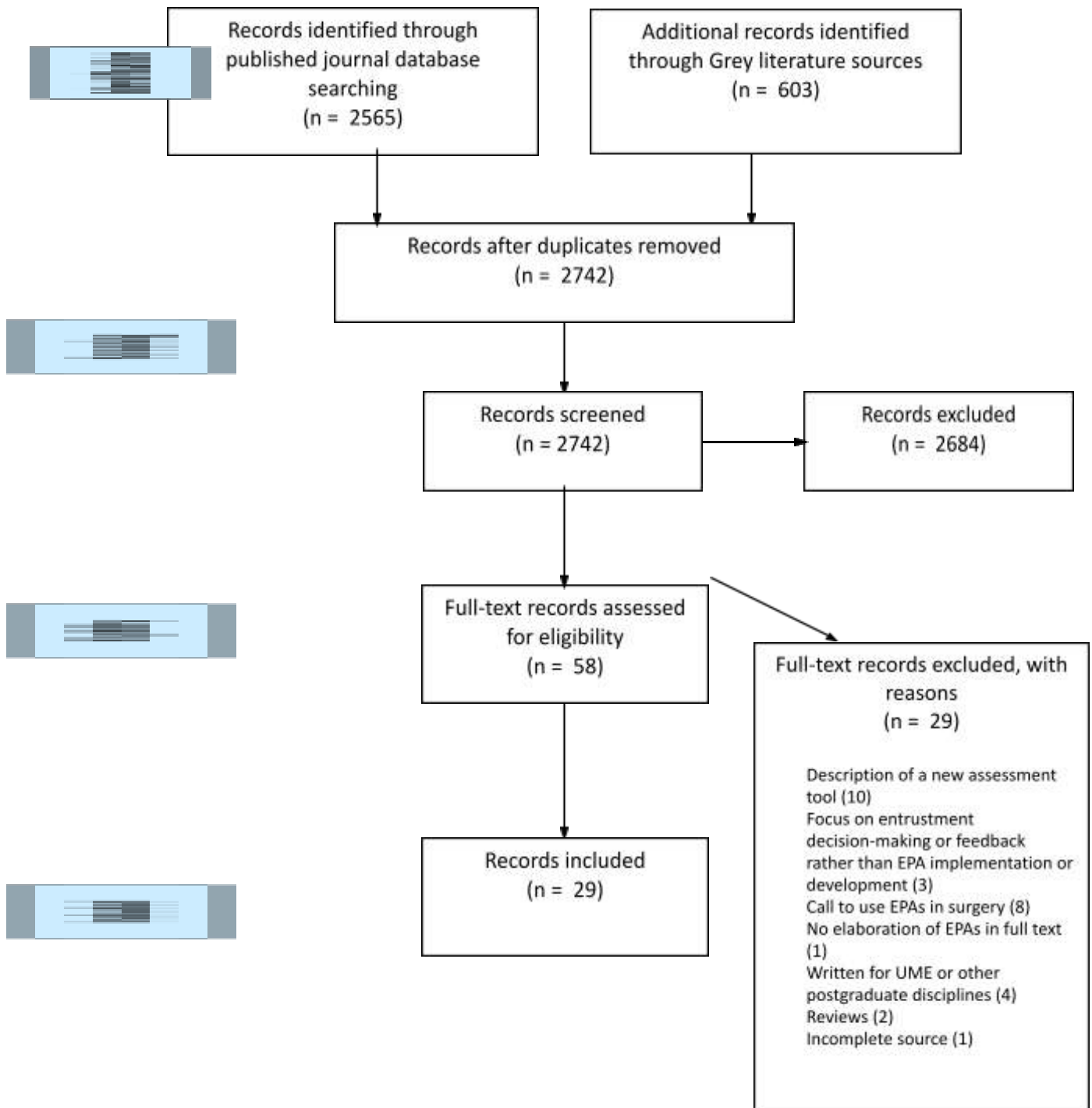
The search string included two main tiers of terms, related to "Entrustable Professional Activities" and "Surgery" (Appendix B1). Articles/sources were eligible for inclusion if they described the use of EPAs for curriculum design, teaching strategies, and/or assessment of competence in postgraduate General surgery training. Only sources that were identifiable in English and created/published after January 2005 were considered, as the EPA concept was first described in 2005. Sources that focused on non-General surgery specialties, undergraduate training, internship, or subspecialty/fellowship training were excluded. In contexts where General surgery training included one or two years of mandatory subspecialist/fellowship training prior to graduation, the EPAs related to the initial, non-subspecialist phases of training were included.

Two independent reviewers (DN and AN) screened article titles and abstracts; a third independent reviewer (EJ) reviewed and resolved discrepancies. Grey literature abstracts and document summaries were similarly screened. Assessment of full texts for inclusion in the review was then performed in the same manner. When required, Google translate was used for non-English grey literature. The search process was completed in August 2023. Extraction and charting were performed by DN and checked for accuracy against the source data by EJ prior to interpretation. An attempt was made to retrieve key missing data by contacting authors. For sources specifically describing EPA selection and use in assessment, the accuracy of the extracted information was confirmed by the authors or a local representative(s) in that setting. As per scoping review methodology guidelines, formal quality appraisal and risk of bias of included sources was not performed.

5.3 Results

Following the screening and full text review process, 29 published and grey literature sources were included in the review (Fig. 5.1). The full list of included sources with details on authorship and source characteristics is available (Appendix B2).

Fig 5.1: PRISMA flowchart



Assessed sources were divided into two distinct groups for charting. The first were primarily, but not exclusively, grey literature which described the lists of EPAs chosen in different institutions/countries, including number selected, tools used for assessment, sequencing of EPAs through training, and evidence of summative decision making through a Competence

Committee. The second group of published articles described findings related to EPA implementation.

5.3.1 EPAs selected in different settings

EPA use in postgraduate General surgery training was identified in 11 unique contexts (Table 5.1), including the USA (American Board of Surgery 2021), Canada (Canadian Association of General Surgery 2022), Brazil (Delbone 2022), Colombia (Domínguez-Torres et al. 2021), Netherlands (Het Concilium Chirurgicum 2021), UK (Joint Committee on Surgical Training 2023), Ethiopia (Amare, Siebeck, Sendekie, et al. 2022), South Africa (Division of General Surgery, University of Cape Town 2022), India (Department of General Surgery, Sri Balaji Vidyapeeth University, n.d.), Australia (Australian Board in General Surgery 2017) and Singapore (Singapore Residency Advisory Committee for General Surgery 2023). Most of the identified EPAs were selected as part of a national process, except for India, Brazil, and South Africa, where they were from single institutions. Unlike Ethiopia and Colombia, where a Delphi process was used, EPAs were primarily selected and described by an expert panel or working group. The actual EPA titles for each of the 11 contexts, with links to the online source, were collated (Appendix B3).

In terms of surgical procedures, some made a clear distinction between non-procedural and procedural groups of EPAs, e.g. naming the latter 'Procedure Based Activities' or 'Key procedures' (Australian Board in General Surgery 2017; Het Concilium Chirurgicum 2021), while some were standalone EPAs (Amare, Siebeck, Sendekie, et al. 2022), and others nested or simply included in the specifications of broad procedural or disease-specific EPAs, e.g. 'Performing elective surgical procedures', and 'Gallbladder disease' (Canadian Association of General Surgery 2022; Delbone 2022; Domínguez-Torres et al. 2021; American Board of Surgery 2021; Joint Committee on Surgical Training 2023; Department of General Surgery, Sri Balaji Vidyapeeth University, n.d.; Singapore Residency Advisory Committee for General Surgery 2023; Division of General Surgery, University of Cape Town 2022). Progression in entrustment was described by sequencing EPAs through training, either by separation into different sets of EPAs for phases of training, or by setting expected entrustment levels required per EPA throughout the full training duration. Summative decision-making via a CC was described in seven of the 11 countries.

Table 5.1: EPA selection and description in different settings

Country	Number of EPAs	WBA Tools	Sequenced	CC
USA	18 (14 include separately assessed preop, intraop and postop phases)	Entrustment-supervision (ES) scale with narrative feedback	Described individually for each EPA	Yes
Canada	32 (5 foundations, 22 core, 5 transition to practice)	ES scale with narrative feedback, narrative observation	Divided into EPAs for foundations, core and transition phases	Yes
Brazil	16	Direct observation, case-based evaluations, written tests	Per phases of training (1-3)	Yes
Colombia	4 (with 117 procedures nested under a broad EPA)	Not reported (NR)	NR	NR
Netherlands	17 (with 30 "key procedures" for first 4, pre-specialization years)	OSATS, CBD, CAT, MSF	Entrustment readiness expected per EPA in year 1 vs years 2-4	Yes
UK	5 (surgery-specific EPAs termed "CIPs")	MCR with ES scale	Per phases of training (1-3)	Yes
Ethiopia	29	NR	NR	NR
South Africa	11	ES scale with narrative feedback	Described individually for each EPA	Yes
India	26	Mini-CEX, MSF, ES scale	Per year of training 1-5	NR
Australia	33 (16 non-procedural EPAs, 17 PBAs - "EPA subtype")	ES scale	Divided into EPAs/PBAs for years 1-3, years 4-5	NR
Singapore (draft)	6 (with 13 specific procedures under 2 broad EPAs)	Mini-CEX, MSF, EBD	Described individually for each EPA	NR

CAT - clinically appraised topic; CBD - case based discussion; CC - competence committee; CEX - clinical evaluation exercise; CIP - Capabilities in practice; EBD - entrustment based discussion; ES - entrustment-supervision; MCR - multi-consultant report; MSF - multi-source feedback; NR - Not reported; OSATS - objective structured assessment of technical skills; PBA - Procedure Based Activity

5.3.2 Discrepancies and similarities in EPAs

The selected EPAs differed greatly, with 53 unique procedural and 27 non-procedural EPAs identified across all contexts (Appendix B4). Eight EPAs were represented in at least nine out of eleven (80%) countries, as shown in Table 5.2.

Table 5.2: EPAs with greater than 80% overlap between different countries

	EPA title	Included as standalone EPA	Included in specifications of broader EPA	Number of countries
1	Managing ward rounds and the care of inpatients	Canada, Colombia, Netherlands, UK, Ethiopia, SA, Australia, Singapore	USA, Brazil, India	11
2	Managing patients in an outpatient clinic/service	Canada, Colombia, Netherlands, UK, SA, India, Australia, Singapore	USA, Brazil	10
3	Managing appendicitis/performing appendicectomies	USA, Brazil, Netherlands, Ethiopia, SA, India, Australia	Canada, Colombia, UK, Singapore	11
4	Managing abdominal wall defects/performing hernia repairs	USA, Canada, Brazil, Netherlands, Ethiopia, SA, India, Australia	Colombia, UK, Singapore	11
5	Managing the acute abdomen/performing laparotomies	USA, Canada, Brazil, Netherlands, Ethiopia, SA, India, Australia	Colombia, UK, Singapore	11
6	Managing benign and malignant colonic lesions/performing colectomies +/- anastomoses/stomas	USA, Netherlands, Ethiopia, SA, Australia	Canada, Colombia, UK, Singapore	10
7	Managing gallbladder disease/performing cholecystectomies	USA, Brazil, Netherlands, Ethiopia, SA, Australia	Canada, Colombia, UK, Singapore	10
8	Managing benign and malignant breast lesions/performing mastectomies or lumpectomies +/- SLNBs or ALNDs	USA, Netherlands, Ethiopia, SA, India, Australia	Canada, Colombia, Singapore	9

SA – South Africa; SLNB – sentinel lymph node biopsy; ALND – axillary node dissection

5.3.3 Key findings of EPA implementation

Table 5.3 includes articles that describe findings of EPA implementation, with all originating from either the USA (n=14), Australia (n=3), or Ethiopia (n=2). The use of an EPA framework for assessment was supported by articles confirming its validity, mainly inferred from the correlation between EPA ratings and concurrent milestone reviews (Albright et al. 2020; Brazelle et al. 2022). However, some raised concerns regarding participant perceptions of reliability, especially in the context of summative use for high-stakes decision making (Gupta et al. 2020; Moore, Young, and Hong 2017; Padilla et al. 2022).

The use of EPAs in continuous workplace assessment was reported to be helpful in measuring and improving trainee self-assessment ability (Amare et al. 2023; Stahl, Jung, et

al. 2020). The assessment of EPAs also allowed programs to monitor whether graduates were adequately prepared to carry out the core tasks in the specific context. Other benefits included improved feedback provision to trainees, and continuous information for program leadership on trainee progress towards competence (Albright et al. 2020; C. I. Anderson et al. 2018; Stahl, Collins, et al. 2020; Stahl, Jung, et al. 2020; Stahl and Minter 2020). In addition, EPA use may have increased the autonomy given to trainees, improving their operative exposure (Wagner et al. 2018).

Table 5.3: Key findings of EPA implementation

Country	Aim	Method	Main finding	Reference
USA	Measure correlation between EPA assessments and milestone evaluations for single EPA ("Gallbladder")	Retrospective cohort	EPA assessments correlate with semi-annual milestone evaluations, but with benefit of real-time evaluation and continuous feedback	(Albright et al. 2020)
Ethiopia	Evaluate EPA ratings from supervisor and trainee perspectives	Survey	Residents were not considered ready for unsupervised performance of all EPAs and overrated their own ability	(Amare, Siebeck, Yigzaw, et al. 2022)
Ethiopia	Describe faculty and trainee perceptions of graduates' ability to independently execute EPAs	Survey	Trainees overrate their abilities, with concerns of all trainees' ability to independently execute EPAs	(Amare et al. 2023)
USA	Improve teaching and learning practices by introducing modern system of WBA	Multicentre prospective cohort	Strategic implementation of EPAs and BID model resulted in improved feedback & self-assessment	(C. I. Anderson et al. 2018)
USA	Describe the development and initial pilot process of EPA implementation	Commentary	The challenge of defining the scope of General surgery resulted in selection of 5 EPAs for pilot	(Brasel et al. 2019)
USA	Provide validity evidence for EPAs as an assessment framework	Cross sectional	EPA scores correlate with year of training, case difficulty and milestone evaluations	(Brazelle et al. 2022)
Australia	Evaluate the safety of laparoscopic cholecystectomy as an EPA	Retrospective audit	Trainees do not have higher complication rates for lap chole when used as an EPA	(K. T. Cheung et al. 2022)
USA	Evaluate perceptions of trainees towards EPAs	Survey	Trainees have concerns regarding the reliability of EPA assessments for summative intent	(Gupta et al. 2020)
USA	Assess perceived levels of EPA entrustment in year 5 residents	Survey	The majority of final year residents reported self-perceived entrustment of EPAs by faculty	(Kearse et al. 2021)
USA	Describe the process of initial	Commentary	Collection of EPA data was feasible	(Lindeman et al.

	EPA selection and implementation in a multicentre pilot		at the majority of participating programs	2021)
Australia	Describe the initial development and implementation of EPAs in a colorectal unit	Letter	There were perceived benefits and problems at an early stage of EPA implementation	(Moore, Young, and Hong 2017)
USA	Determine differences in EPA assessments between male and female trainees	Cohort	Faculty assessments showed no difference in EPA levels between male and female residents	(Padilla et al. 2022)
USA	Report on 7 months of EPA implementation at a single institution	Conference Abstract	EPA implementation is feasible and can be generalised across other departments	(Stahl et al. 2019)
USA	Describe strategy to implement pilot EPAs into a training program	Cohort	EPAs were successfully integrated into an assessment framework	(Stahl, Collins, et al. 2020)
USA	Compare resident self-assessment versus faculty assessment of EPAs	Retrospective review of prospective database	Resident EPA self-assessments correlate with faculty assessments	(Stahl, Jung, et al. 2020)
USA	Describe the evolution of surgical training and assessment in the USA	Narrative review	Definition and micro-assessment of EPAs are a promising step toward a competency-based approach	(Stahl and Minter 2020)
Australia	Describe the potential applications of EPAs in training and certification	Narrative review (book chapter)	EPAs can provide the basis for meaningful in-training assessment	(Tobin 2019)
USA	Describe EPAs and identify perceived differences in capability, autonomy, and expectations between faculty and residents	Survey	EPAs are practical for developing competency-based curricula and may improve resident operative experience	(Wagner et al. 2018)

BID - briefing, intraoperative teaching and debriefing

5.3.4 Facilitators and barriers

Several studies described practical aspects of EPA implementation in postgraduate General surgery training programs. The key barriers and facilitators to EPA integration, described by these and other included studies, are shown in Table 5.4.

Table 5.4: Facilitators and barriers for EPA integration into postgraduate General surgery training

Facilitators	• Focus on surgical procedures, especially common procedures that trainees can safely
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	<p>perform (C. I. Anderson et al. 2018; Brasel et al. 2019; Tobin 2019; Wagner et al. 2018)</p> <ul style="list-style-type: none"> • Planning a phased introduction e.g. piloting with a smaller number of EPAs (Brasel et al. 2019; Lindeman et al. 2021) • Thorough description of selected EPAs and distribution to faculty and trainees (Amare et al. 2023) • Continuous, multimodal trainee and faculty development to ensure buy-in and widespread understanding (shared mental model) (Amare et al. 2023; C. I. Anderson et al. 2018; Lindeman et al. 2021; Stahl et al. 2019; Stahl, Collins, et al. 2020; Stahl and Minter 2020; Tobin 2019) • Minimising workflow disruption by making individual assessments as simple and quick as possible, and integrating into daily routines (Moore, Young, and Hong 2017; Stahl, Collins, et al. 2020) • Promoting self-assessment by trainees (Amare et al. 2023; Stahl, Jung, et al. 2020) • Bidirectional initiation of EPA assessments (Stahl, Collins, et al. 2020) • Allowing EPA performance to impact autonomy provided (Wagner et al. 2018) • Incorporating a change management strategy to strategically increase buy-in from trainees and supervisors (Stahl, Collins, et al. 2020) • Web based/mobile platform that facilitates timely feedback, reminds supervisors and stores data for summative decision making (C. I. Anderson et al. 2018; Brazelle et al. 2022; Lindeman et al. 2021; Stahl, Collins, et al. 2020; Stahl et al. 2019) • Effective local leadership to guide the implementation process (C. I. Anderson et al. 2018; Stahl, Collins, et al. 2020) • Departmental leadership buy-in for support, including resources needed for implementation (Lindeman et al. 2021; Stahl, Collins, et al. 2020) • Reduction in other assessment methods to prevent assessment fatigue (Stahl and Minter 2020) • Incorporating a system of monitoring, re-evaluation and improvement in design and implementation (C. I. Anderson et al. 2018; Stahl et al. 2019)
<p>Barriers</p>	<ul style="list-style-type: none"> • Including activities for assessment that are not frequently supervised in routine practice (Albright et al. 2020) • The breadth of General surgery (Brasel et al. 2019) • Lack of transparency in assessment criteria (Amare, Siebeck, Yigzaw, et al. 2022) • Concern regarding reliability of supervisor assessment and associated summative implications (Amare, Siebeck, Yigzaw, et al. 2022; Gupta et al. 2020; Moore, Young, and Hong 2017) • Lack of knowledge and understanding (Gupta et al. 2020) • Increased workload for supervisors (Moore, Young, and Hong 2017) • Discordant assessment of trainees' own ability vs faculty ratings (Padilla et al. 2022) • Institutional policies limiting trainee autonomy (Kearse et al. 2021) • Inconsistent usage/engagement by both trainees and faculty (Stahl, Collins, et al. 2020) • Faculty not submitting assessment reports (Stahl, Collins, et al. 2020) • Faculty not providing formative feedback (Amare, Siebeck, Yigzaw, et al. 2022)

5.4 Discussion

This study provides an overview of the current use of EPAs in postgraduate General surgery training. A scoping methodology was chosen due to the broad question, heterogeneity of sources and opportunity to identify gaps in the literature.

5.4.1 Contextual differences and similarities

The selection and sequencing of EPAs demonstrate the various ways postgraduate General surgery training is structured and the scope of a General surgeon's practice in different contexts. In many European countries, for example the Netherlands, the initial years of 'general' training is followed by a mandatory sub-specialization period before graduation (Het Concilium Chirurgicum 2021). Even in the USA where subspecialty training isn't mandatory, 80% of General surgery graduates pursue subspecialty training (Mattar et al. 2013). This contrasts with a Global South context, for example Ethiopia, where specialist and subspecialist training is less prevalent. The difference in scope of practice is demonstrated by some of the standalone Ethiopian EPAs included e.g., 'Diagnosis and management of a patient with Benign Prostatic Hyperplasia' (Amare, Siebeck, Sendekie, et al. 2022). In high-income countries (HICs), this task would more typically be carried out by specialist urologists.

As EPAs reflect the core of the profession i.e., the minimum required task proficiency of each graduate, variation in the activities entrusted to a General surgeon according to context is expected. While these differences may have implications for the transferability of certification between countries, their existence is understandable and justifiable. The definition of EPAs by experts in a particular setting allows curricula to be aligned to train surgeons who are fit for purpose in that specific context (Mulder et al. 2010). For some countries, particularly from the Global South, this presents an opportunity to transform and decolonize curricula through the process of EPA selection and implementation (Yanful et al. 2023).

Despite the wide use of EPAs identified, eight were common to at least 80% of countries. This suggests that there are core tasks performed by General surgeons across the globe. These tasks, defined as EPAs, come closest to providing a global definition of a General surgeon: a healthcare practitioner who provides inpatient, outpatient, and operative care for patients with appendicitis, abdominal wall defects, an acute abdomen, colonic lesions, gallbladder disease, and breast lesions. Countries or institutions that have not yet defined

EPAs for postgraduate General surgery training may consider using these eight as a starting point, with context-specific modification as appropriate.

5.4.2 Selecting procedural EPAs

Caring for surgical in- and outpatients were included in nearly all EPA lists in some format and there were overall fewer unique non-procedural EPAs (Appendix B4). However, committing to a set of procedural EPAs within a specific context appears to be less straightforward, as is evident by the large number of unique procedural EPAs identified in the review. Including a procedure as a standalone or nested EPA (small unit of professional practice meeting the EPA definition, being also part of a larger EPA to be entrusted later in training), especially in a national context, means agreeing to it being a core task required of all trainees. As institutions vary in educational resources and procedural volumes for trainees, this may be more difficult to achieve for some programs. In addition to the difficulty of ensuring adequate exposure to EPAs, programs would also need reasonable numbers of assessments to ensure adequate sampling and allow for reliable entrustment decision-making. A long list of required procedural EPAs may result in a high assessment burden, limiting the acceptability and feasibility of WBA based on EPAs (Aryal et al. 2020).

Therefore, most EPA lists described in this review included a sample of core/index procedures that could be assessed reliably to infer broader procedural competence (Appendix B3). This strategy ensures that procedural EPAs are both frequently performed and supervised in practice, which may facilitate implementation (Williams et al. 2021). However, despite the empiric rationale for selecting a more limited set of “index” procedures, omitting certain procedures may have negative policy or political consequences. One potential strategy to overcome this issue would be to include the option of ‘elective EPAs’ in addition to a nationally agreed upon set of required EPAs. These can be used selectively in training settings that do offer adequate exposure to such procedures (Ten Cate et al. 2015).

It is also important to note that the EPAs in these sources were generated primarily through expert meetings or working groups, but also through more formal consensus methods like Delphi, which provide the opportunity for broader input. Thus, in addition to healthcare context, the method of identifying and selecting EPAs may also have contributed to the wide range of procedural EPAs.

5.4.3 Validity

Concerns have been raised, especially from trainees, regarding the validity of EPA-based assessments for summative decision making (Gupta et al. 2020; Moore, Young, and Hong 2017). As can be seen from the list of included sources, EPAs for postgraduate General surgery training have only been widely implemented over the last 5 years (Appendix B2). In this time, some have specifically attempted to provide validity evidence by demonstrating the correlation between EPA ratings and year of training, case difficulty and semi-annual milestone evaluations (Albright et al. 2020; Brasel et al. 2019). However, modern approaches to validity in health professions education look beyond isolated parameters, to compile a validity argument based on a number of sources. Messick's unified theory of validity includes the following five elements when considering a validity argument: content, response process, internal structure, relations to other variables, and consequences (Messick 1995).

The use of EPA-based assessments can be considered as part of a large, complex system for making judgments of trainee performance and progression. Therefore, their use is subject to the same expectations for validity as any assessment process, requiring an analysis of the validity of the supporting data. This is challenging to do for EPAs in General surgery globally, as there is significant heterogeneity in the EPAs themselves, the tools used to assess them, and the methods of summative decision-making using individual data points. However, broad comments can be made regarding current validity evidence for their use, based on the sources included in this review.

In terms of content validity, EPAs are by definition more representative of the construct of interest, being the work performed by General surgeons in a specific context (Brasel et al. 2019; Lindeman et al. 2021; Stahl, Collins, et al. 2020). In addition, the use of entrustment-supervision scales in EPA-based assessments, rather than arbitrary numerical scores, make intuitive sense to surgeons when judging trainee performance (Stahl and Minter 2020). However, this is based on opinion and not empiric evidence from within surgery. Although EPAs in General surgery were most frequently defined and elaborated by expert groups with health professions education expertise available, the use of the EQual rubric (D. R. Taylor et al. 2017) to critically review the EPA descriptions and language used was not evident in any of the sources .

In terms of response process, it is clear that for EPA assessments to be valid, a shared mental model must be achieved through rigorous faculty and trainee development

(Lindeman et al. 2021; Stahl, Collins, et al. 2020). When this is done, trainees' perceptions of their performance seem to align with faculty assessments (Stahl, Jung, et al. 2020). Conversely, a lack of understanding of assessment criteria may account for discordant assessment ratings, especially when utilising assessors who are not surgeons themselves (Amare et al. 2023). Evidence for web-based development resources, including guidebooks, webinars, and videos were available in many of the contexts where EPAs are currently implemented in postgraduate General surgery training (American Board of Surgery 2021; Canadian Association of General Surgery 2022; Delbone 2022; Het Concilium Chirurgicum 2021; Joint Committee on Surgical Training 2023; Australian Board in General Surgery 2017).

In terms of internal structure, it is difficult to provide a broad comment. Although components such as inter-rater reliability have been investigated for some of the tools used to assess EPAs in surgery, a detailed discussion of these is beyond this text (Albright et al. 2020). No research has yet been done in surgery on assessing the reliability of summative decision-making events using EPAs, e.g. CC meetings.

In terms of relations with other variables, EPA-based assessments in surgery have been shown to correlate well with semi-annual milestone evaluations in the USA (Albright et al. 2020; Brazelle et al. 2022). In addition, EPA-based assessments have been shown to correlate with case difficulty and task complexity, as well as year of training and gains in clinical experience within training years (Brazelle et al. 2022; Stahl, Jung, et al. 2020). Although this evidence is from a single context only, it does add meaningfully to the validity argument for EPA use in surgery. There is currently no information on the impact of EPA-based assessments on patient outcomes in surgery.

Finally, in terms of consequences, EPAs appear to have a positive impact on learners' formative progress by providing more frequent and quality opportunities for feedback, allowing trainees to continuously improve their performance (Albright et al. 2020; C. I. Anderson et al. 2018; Tobin 2019). In addition, EPAs may provide a graduated autonomy framework and improve trainees operative performance, especially in settings where this may be restricted due to medico-legal requirements (Wagner et al. 2018). EPAs may also lead to curricular redesign and have been described to catalyse a shift towards competence-based education in surgery (Brasel et al. 2019; Moore, Young, and Hong 2017).

Although there is some evidence to make a validity argument for the use of EPAs, little empirical evidence is available from within surgery, especially from outside the USA.

However, many other current assessments such as global end of rotation evaluations, ungrounded CC conversations, and summative attestations of competence by program director or head of department signature, all have the same, if not more, validity concerns. EPAs, while not convincingly validated in surgery as yet, do offer an opportunity for improvement over these assessments that are global, temporally remote from observed performance, and based on theoretical competency frameworks of limited practical relevance to faculty.

5.4.4 Reliability and assessment quotas

Reliability of WBA is achieved through multiple assessments by multiple raters over time. The actual number of assessments required to demonstrate consistency is challenging to define and has been described to range from three to sixty, depending on the context, assessment tool and type of activity (Beard et al. 2011; Williams, Kim, and Dunnington 2016; Williams et al. 2019). In addition, reliability can also be influenced by faculty development, as supervisors are in essence the assessment instrument (Schuwirth and van der Vleuten 2011). Thus, training may lead to a decrease in variation from assessor to assessor and enhanced reliability of EPA assessments.

In recent years there has been a shift in thinking towards programs of assessment, with appreciation of the value of 'intersubjective' decision-making by a collective (Hodges 2013). Thus, a key part of high-stakes decision making based on EPAs, is reinterpretation of individual assessments by a group i.e. a CC. Thus, the number of assessments required per EPA may not necessarily be specified as a universal absolute number, but will depend on how many data points/'pixels' a CC in a given context requires to form an opinion regarding a trainee's ability to perform a task independently. For practical purposes, this may still require a threshold number to be decided upon in a particular context.

5.4.5 Areas for further study

Although the use of EPAs in postgraduate General surgery training is increasing, there remain several areas where further study is required. Almost all published and grey literature sources describe EPAs in the context of assessment. The impact of introducing EPAs into other aspects of curricula, particularly how content and learning experiences may need to be redesigned to align with EPA-defined assessment targets, warrants reporting. There are also obvious logistical issues around implementation, such as how to assess the broad scope of General surgery practice in a feasible manner. Related to this is the dilemma of selecting the

most appropriate procedures, either as standalone EPAs or nested within broader EPAs. As mentioned previously, the prevailing strategy is to select a set of core, frequently performed procedures that each need to be assessed a number of times to make trustworthy entrustment decisions. However, the omission of more specialised procedures may exclude useful information on trainee ability and may also influence the desire of trainees to engage in procedures that are 'not on the list'. Innovative solutions to this dilemma are required. In addition to EPA selection, choosing the most appropriate WBA tools from the wide range available is an additional challenge, with a lack of comparative studies to assess which has the greatest utility in General surgery.

Introducing EPAs into a single or national training curriculum is a major change management exercise. It would be beneficial to describe the most effective change models/frameworks to apply, best practices for faculty and trainee development, and the most effective methods to access intrinsic motivation and effect personal change in a surgical context. As was mentioned previously, there is limited validity evidence available and more studies from varied contexts, utilising modern approaches to validity, could increase trainee and faculty trust in this framework, enhancing its acceptability and implementation. Finally, most papers describing experiences with EPA implementation are from HICs. Studies from lower resourced countries may identify unique challenges and require innovative solutions to common but unique problems.

5.4.6 Limitations

Although the search was intended to be exhaustive, it may have missed non-English programs where EPAs are named differently (De Andrade et al. 2022). The review focused on EPAs, currently one of the most widely embraced and popular frameworks for competency assessment in postgraduate medical training. It is, however, not the only framework used for assessment and curricular design in graduate medical education and General surgery (Pangaro and Ten Cate 2013). The findings may therefore be less applicable to settings where EPAs are not used, and where interest in CBME is lacking.

5.5 Conclusion

This scoping review was prompted by insights from the initial literature review and expert interviews, which suggested that the EPA framework is a valuable approach to use for WBA. A review of relevant education theory in Chapter 3 also supported this view, arguing for the practical value of a synthetic assessment framework such as EPAs. This review provided a

wealth of useful information for planning the WBA 'solution' for the Division of General Surgery at UCT. The EPAs that others had defined offered a good starting point to inform the EPAs that could be used locally. Additionally, the way these EPAs have been structured across years of training, methods used for summative decision-making, and WBA tools used, all provided valuable information for planning a local version. The key findings of EPA implementation described, including the facilitators and barriers identified, significantly contributed to the development of guiding design principles for the 'solution'. These are described, along with the guiding design principles from other sources, in Chapter 7.

Chapter 6. Procedures most frequently performed by South African-trained General surgeons

The work described in this chapter is based on the following publication: Nel D, Burch V, Beley K, Ebrahim Z, Brand M, Montwedi D, Cairncross L, Jonas E. *Procedures most frequently performed by South African-trained General surgeons - implications for training and assessment*. South African Journal of Surgery. 2024 Sep 1;62(3):242-8.

6.1 Rationale

An important aspect of designing the 'solution' to the educational 'problem', i.e. WBA of clinical competence in surgical trainees, is to determine the targets or activities for assessment. Previous chapters (one, three and five) have highlighted the utility of defining these as EPAs - essential tasks that professionals are entrusted to perform independently after certification.

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, may be challenging. In South Africa (SA), this is due to the different training exposures across centres, which are influenced by differing hospital resources, as well as divergent opinions on the scope of procedures a General surgeon should be able to perform, versus what should be performed by subspecialists. In addition, all postgraduate training in SA 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 (Dell and Kahn 2018). As WBA in South Africa will be a university driven process, the list of EPAs that are decided upon may be skewed toward specialist academic hospitals and may not be entirely appropriate to the private sector, where most General surgeons practice.

Determining the most frequent procedures SA-trained General surgeons are performing after certification, may assist in defining the choice of most appropriate General surgery procedural EPAs for WBA at South African universities. This knowledge may also be a helpful consideration for the planning of General surgery postgraduate training programs in SA (Ten Cate et al. 2015). Including other training centres beyond UCT ensures that the

results of this study are applicable nationally, when WBA is implemented across all SA training institutions as envisioned.

6.2 Methods

6.2.1 Study design and participants

This study was a cross-sectional observational study using a self-administered questionnaire. General surgeons who passed the final certification examination and were admitted as Fellows of the College of Surgeons (FCS) of the CMSA from 2017-2022 and were in full-time clinical practice in either private or government settings or 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 skew the data away from what the job requires of a newly admitted General surgeon. Being admitted as a Fellow of the College of Surgeons is analogous to becoming a member of the Royal College of Surgeons in the United Kingdom or obtaining board certification as a General surgeon in the United States. Participants were excluded if they were subspecialists, in the process of sub-specializing, or were not in full time clinical practice. 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 (Adams et al. 2021). Attempts were made to contact all eligible potential participants. 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.

6.2.2 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 (Appendix C). Simple procedures such as abscess drainage or soft tissue biopsy/excision were not included in the list, as these are not specific to General surgery and are frequently performed by General practitioners in SA. 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 in the top 10 most frequently performed procedures. There is currently no

information on the ideal number of index procedures to include in a workplace-based assessment 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. Ethics approval was obtained from the Human Research Ethics Committee of the University of Cape Town (UCT HREC 477/2022).

6.2.3 Data collection

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, was obtained from the survey. 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 the procedures, if any, they felt underprepared to safely perform without supervision on completion of training, i.e. at the time of commencing independent surgical practice.

6.2.4 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.

6.3 Results

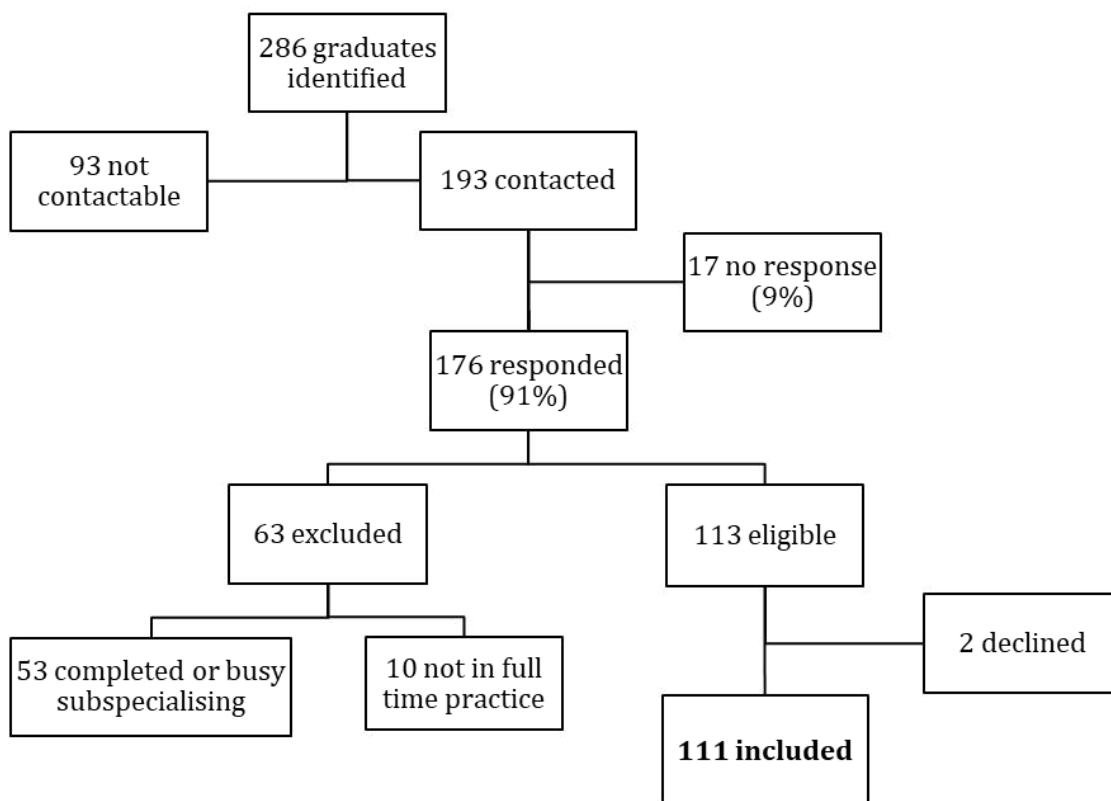
6.3.1 Study participation

Of 286 General surgeons admitted as fellows of the College of Surgeons 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 (Fig 6.1).

6.3.2 Participant characteristics

Of the 111 included participants, eighty-one (73%) were male, 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 enrolls 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 practising in SA.

Figure 6.1: Flowchart of participant recruitment



6.3.3 Most frequently performed procedures

The 10 procedures most frequently performed by General surgeons who recently trained at South African institutions are shown in Table 6.1.

Table 6.1: Top 10 most frequently performed procedures by General surgeons who recently completed training at South African institutions

Number	Procedure	Percentage surgeons who included procedure in their list of top 10 most frequently performed procedures
1	Hernia repair	95%
2	Appendectomy	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

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 6.2. The differences between government, combination of government and private practice, and private practice only were analysed statistically.

Table 6.2: Procedures most frequently performed by recently qualified surgeons practising in government vs. private in South Africa

Procedure	Government only (n = 47)	Government & private (n = 20)	Private only (n = 20)	p-value
Hernia repair	43 (91%)	19 (95%)	20 (95%)	0.99
Appendectomy	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

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

6.3.4 Preparedness to perform frequent procedures

Fifty-seven study participants (51%) 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 6.3). 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 6.1).

Table 6.3: 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 certification
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%

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 6.4. Although the numbers were too small to allow for statistical comparison, the onset of the COVID-19 pandemic may have had an impact in 2020.

Table 6.4: 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 one or more of the most frequently performed procedures
2017	12	4 (33%)
2018	13	5 (38%)
2019	14	6 (43%)
2020	19	15 (79%)
2021	37	17 (46%)
2022	16	7 (44%)

In terms of surgeons practising 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 the table below.

Table 6.5: 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 one or more of the most frequently performed procedures
Full Time Government only	47	20 (43%)
Combination Government and Private	20	10 (50%)
Full Time Private only	21	12 (57%)

6. 4 Discussion

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

6.4.1 Most frequently performed procedures

The 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 categorization 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 some similarities to this study (Cortez et al. 2023; Schroeder et al. 2020). Hernia repair, laparoscopic cholecystectomy, appendicectomy, gastroscopy, colonoscopy and mastectomy/lumpectomy featured as the most frequently performed procedures. However, 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 training (Mattar et al. 2013). 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 (Mayosi and Benatar 2014). These findings demonstrate the importance of ensuring that EPAs are relevant for the local context, and that simply copying lists of procedural EPAs from other settings would be inappropriate.

6.4.2 Differences in practice types within SA

A statistically greater proportion of surgeons in the government sector listed emergency laparotomy as one of their most frequently performed 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 (Moodley, Aldous, and Clarke 2014). 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 (Cortez et al. 2023; Schroeder et al. 2020).

6.4.3 Implications for procedural training

In SA, 76% of the population have no private health insurance and rely on public healthcare services (Statistics South Africa 2017; Pretorius 2017). 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 practising 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 as a fellow of 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 (Mattar et al. 2013; Coleman et al. 2013; Fitzgerald et al. 2013). 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 procedures in their practice (Table 6.4).

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 (Nayar et al. 2020) 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 described in the literature and improving the training for this procedure should be considered a priority (Ko and Dominitz 2010).

6.4.4 Implications for assessment

As WBA is implemented in postgraduate training programs in SA, the findings of this study provide insights which can inform the selection of procedural EPAs (Nel, Burch, et al. 2022). As outcomes define decisions regarding both training and assessment in the competency-based medical education era, lists of procedures most frequently performed should inform the choice of core procedural EPAs for WBA (Frank et al. 2010). 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 three to sixty, depending on the context, assessment tool and type of procedure (Williams, Kim, and Dunnington 2016; Beard et al. 2011; Williams et al. 2019). Although controversial, some have argued that there should be at least three to five observations to allow for reliable summative decision making (Williams, Kim, and Dunnington 2016).

In a study by Kruger and colleagues, the logbooks of General surgery trainees applying for the final CMSA General surgery fellowship examination were reviewed to assess the mean number of procedures performed and the level of supervision provided (Kruger and Veller 2014). 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 appendectomy (n=6). All of these most frequently-supervised procedures appear on the list of 10 most frequently performed in practice, suggesting that they represent an appropriate and practically feasible 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 after hours 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, Netherlands, Australia and UK, but is unique to the South African training context (American Board of Surgery 2021; Australian Board in General Surgery 2017; Het Concilium Chirurgicum 2021; Joint Committee on Surgical Training 2023).

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 (Pereira and Dean 2013; Beamish et al. 2020). 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 that are frequently supervised in their training context, as institution-specific 'elective' EPAs (Ten Cate et al. 2015).

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' (D. Nel, Jonas, et al. 2024). On the other hand, long lists of procedures create a burdensome system which is neither feasible nor sustainable (Beamish et al. 2020). More work is needed to find innovative solutions to this dilemma.

6.4.5 Limitations

In many countries, certified surgeons are required to keep accurate logbooks of procedures performed for recertification and auditing purposes. This 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 study participants may have skewed the data in favour of General surgeons remaining in practice in SA. Thus, the results of this study must be applied with caution to recently qualified General surgeons who go on to practise in other countries where the scope of practice may be different. It is also important to note that the data regarding the 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 more recent review of General surgery trainee logbooks is warranted to determine if procedural exposure and supervision patterns have changed significantly in the last decade. A potential example could be that trainees are getting to do fewer colonoscopies under supervision, due to the increasing emphasis on subspecialist fellow training in some centres. Finally, the number of study participants was small and the study period included the COVID-19 pandemic, which undoubtedly impacted training and may have contributed to the lack of preparedness reported by participants (Patel et al. 2021). Ideally, the findings of this study should be verified in post-pandemic conditions recruiting a larger number of participants.

6.5 Conclusion

The findings of this study document self-reporting of procedures most frequently performed by General surgeons who recently completed training in SA. If core General surgery procedures are to be chosen as EPAs as part of a competency assessment 'solution' at a SA training institution, the following procedures may be considered on the basis of this study: hernia repair, appendicectomy, laparotomy, laparoscopic cholecystectomy, gastroscopy, colonoscopy, mastectomy, and intestinal anastomosis/stoma formation. This list includes procedures that are both frequently performed by SA surgeons in real-world practice, as well as procedures supervised frequently enough during training to facilitate a feasible program of WBA for General surgery training in SA.

Chapter 7. Proposed solution and guiding principles

7.1 Introduction

The initial phase of a design-based research thesis delineates the problem to be addressed by the study (Herrington et al. 2007). In essence, a national initiative exists to implement WBA for postgraduate specialist training programs in South Africa (Nel, Burch, et al. 2022). While WBA has been implemented in General surgery in other contexts, challenges related to feasibility and negative perceptions have surfaced and seem to be widespread (Mughal et al. 2023). The South African training and healthcare contexts are unique, suggesting that the generic application of existing WBA strategies may not be suitable for this setting. Additionally, issues surrounding WBA in other settings call for a more intentional approach to enhance the design and implementation of WBA for surgical training.

In Chapter 4, a qualitative study examining the perceptions of trainees and supervisors regarding clinical competence and its assessment was outlined. Both parties deemed it vital to evaluate clinical competence before final certification, and the domains of clinical competence that required assessment seemed to align with descriptions in other settings. Participants expressed dissatisfaction with prior clinical competence assessments and a desire for a new assessment system, incorporating frequent workplace observations with feedback to enhance learning and confirm achievement of competence. These findings suggested that trainees and supervisors in the Division of General Surgery at UCT may be prepared for the implementation of a new WBA strategy. Designing this strategy could draw inspiration from designs in other contexts but would need adaptation to suit our local context, as outlined in previous chapters.

Various methods were employed to gather information supporting the formation of guiding principles for the proposed assessment strategy, essentially a 'solution' to the presented educational 'problem'. These sources included informal consultations with field experts, a literature review on WBA with a specific focus on General surgery, an overview of the relevant education theory, a qualitative study exploring perceptions of competence and assessment, and finally, a scoping review of EPA use in General surgery. The first part of this chapter will elaborate on the guiding principles derived from each of these sources. Part one of this chapter concludes by presenting a final set of consolidated guiding principles.

Part two of this chapter provides a detailed description of the planned assessment strategy, i.e., the solution. This description also explains how the guiding principles informed the elements incorporated into the solution's design. Additionally, it briefly outlines how the solution would be enacted and refined through cycles of implementation, as is consistent with a Design-based research (DBR) methodology (Herrington et al. 2007). A more comprehensive description of the cycles of implementation and refinement is provided in Chapter 9.

7.2 Development of guiding principles

7.2.1 Expert meetings

Informal meetings with six international experts with experience either in WBA on a national scale or specifically within General surgery yielded significant insights with regards to WBA implementation. Initially, the meetings were focused more on understanding key concepts and clarifying misconceptions. However, through this process, the experts were able to share many of the lessons they had learnt in the design and implementation of WBA in their context.

The details of the expert discussions were summarised in Chapter 1. The discussions were studied to extract principles that could be utilised to design a new WBA strategy for our context. The distilled principles are described in Table 7.1.

Table 7.1: Guiding design principles distilled from informal expert interviews

Design principle	Description
Maintain a formative focus	Emphasise the importance of learning rather than testing
Minimise the assessment burden	Avoid high mandatory assessment quotas
Faculty development is essential	Ensure understanding of concepts related to WBA and CBME, as well as assessment tool use by supervisors, in order to improve validity
Start off slowly	Pilot with a handful of workplace activities for assessment
Be positive during implementation	Lead with enthusiasm and positivity to counteract the resistance and potential negativity to change

Implement WBA as part of a CBME strategy	WBA needs to be implemented along with other elements of programmatic assessment and CBME e.g. a competency committee for high stakes decisions, using assessment for learning, competency focused instruction, and using a competencies framework
Use EPAs as a framework	An EPA framework enables assessment of competencies through locally relevant tasks
Get leadership support	Use a clearly thought through and documented strategy to get commitment from department and university leadership
Get buy-in from participants	Includes motivating participants but also creating awareness of negative consequences for non-participation by individuals and teams
Re-evaluate the strategy periodically	Get feedback, especially from trainees, and adapt the strategy to improve it
Use a digital platform to capture and aggregate data	Not only for individual assessments, but also to aggregate data for individual trainees to track their progress and CC's to make decisions
Keep WBA tools simple	Use simple assessment tools that include entrustment-supervision scales and promote feedback provision
Have a change management strategy	Utilise a change framework to implement a big change like a new assessment strategy

7.2.2 Workplace-based assessment literature review

A literature review on WBA (Chapter 1), specifically on how it has been used in General surgery, also yielded valuable insights for the design of an optimal WBA strategy. In Table 7.2, principles that may be applied to a WBA strategy specifically within the context of General surgery are detailed. Many of these lessons originate from articles published by authors from the UK (Aryal, Hamed, and Currow 2021), one of the earliest widespread adopters of WBA in General surgery. However, there have been recent articles from other settings, particularly North America, where WBA based on EPAs is becoming part of national training programs. Although there is repetition in the design principle titles, the descriptions differ, as slightly different angles on each principle were described by different sources.

Table 7.2: Guiding design principles from literature review on WBA in General surgery

Design principle	Description
Use EPAs as a framework	EPAs provide a useful framework for WBA by integrating multiple competencies with the professional tasks required of trainees

Promote feedback to trainees	Provide significant formative value through the provision of continuous, ideally face-to-face feedback
Use a digital platform to capture and aggregate data	Fully digital, preferably mobile-friendly, platform to facilitate assessments and ensure that these are entered accurately
Focus on surgical procedures	Consistently reported by trainees and trainers as the most useful component of WBA in surgery
Avoid a high assessment burden	Keep required quotas low, otherwise may lead to dissatisfaction for both trainees and trainers and potential gaming and abuse of the system
Faculty development is essential	To achieve better supervisor engagement and equip with skills to assess reliably and give feedback
Trainee development is essential	To understand key concepts especially the low stakes nature of individual assessments/observations, with transparency around how these are to be used for high stakes decision making
WBA must complement existing assessments	WBA does not replace other methods of assessment, but complements them by providing meaningful in-training evaluations of clinical competence
Maintain a formative focus	Ensure individual assessments are understood as low stakes events and are accompanied by quality, timely feedback from supervisors
Implement WBA as part of a CBME strategy	Include other CBME elements, especially a competence committee to reinterpret the low stakes observations to make higher stakes decisions
Minimise WBAs disruption of the clinical workflow	Ensure assessments are quick and simple to complete for busy trainees and supervisors
Get buy-in from participants	Ensure sustained engagement from leadership, supervisors and trainees

7.2.3 Education theory

Chapter 3 presented a comprehensive review of education theory relevant to WBA, as well as its inclusion and implementation in training programs. The motivation for this is not just to guide thinking and interpretation of the results but also to allow for theory to guide the design of real-world solutions, which is beneficial for two reasons. First, to ensure that the solution is more likely to be successful as it leans on years of thinking and understanding around learning, assessment, and change management. Second, to make the output of the study generalizable to other contexts. As described in Chapter 2, these are important considerations in the development of a design-based research study or thesis. The full text

from Chapter 3 was reviewed to extract the following principles for the design of a WBA strategy.

Table 7.3: Guiding design principles from review of relevant education theory

Design principle	Description
Select appropriate EPAs	Activities that fall within trainees' zone of proximal development, but also tasks that are relevant to the role expected by society in that context
Promote feedback to trainees	From direct supervisors who are full members of the surgery community of practice, which means the feedback is not only most meaningful but also shapes professional identity
Promote trainee self-assessment	Enable comparison of self-assessment to full members' assessment to gauge growth and identity formation in the community of practice
Use EPAs as a framework	Represent a synthetic assessment framework to amalgamate competence domains with the necessary knowledge, skills, and attitudes required to execute complex social tasks
Optimise formative value of WBA activities	Includes seeking an understanding of how students learn through engaging in authentic workplace activities, and how assessment of these tasks influences learning
Faculty development is essential	Ensure understanding of concepts and tools to enhance accuracy, but also of cognitive biases (e.g. leniency, halo) that may impair trustworthiness of individual and collective assessment decisions
Keep WBA tools simple	Minimise assessment complexity and cognitive load required for each assessment to enhance validity
Use entrustment-supervision scales in WBA tools	To enhance validity of assessments, as entrustment is a concept that faculty use routinely to make ad-hoc entrustment decisions in clinical practice
Get trainee feedback on WBA implementation	To enhance the collaborative aspect of authentic assessment, in recognition that trainees are not only shaped by their engagement, but also shape their environment and supervisors by it
Beware psychometrics when setting assessment requirements	Be wary of being overly influenced by psychometric thinking in design of an assessment system, specifically in setting minimum assessment quotas
Embrace collective subjectivity for decision making	Specifically for high-stakes decision making like progress to next phase of training or readiness for certification, again not being overly influenced by psychometric demands

Incorporate narrative descriptions in WBA tools	Emphasise the importance of qualitative assessment and value of human judgement rather than just aggregation of numerical data
Implement WBA as part of programmatic assessment	With WBA as a component of a system of assessment, contributing data to high-stakes decision making
Include multiple assessors from different cadres of supervisors	Including from other disciplines, fellows and senior trainees - recognizing trainees may belong to multiple communities of practice during training duration
Enable WBA to facilitate increased autonomy to trainees	Assessment reports describing the ability to act with greater autonomy should translate to this actually happening in the clinical space, allowing trainees to move from legitimate peripheral participants to full members
Have a change management strategy	Insights from change management theories and models: anticipate a chaos phase after initial introduction; recognize importance of personal factors in change process; involve a core stakeholder team to drive the process; develop champions (through identifying and developing early adopters); constant communication to address barriers and celebrate successes; sustain the momentum

7.2.4 Perceptions study

The next set of design principles were extracted from interviews with supervisors and trainees within the UCT Division of General Surgery. The design principles were elicited from the five major themes that were derived from the data. These five themes yielded three design principles, which are described in Table 7.4.

Table 7.4: Guiding design principles derived from qualitative study on supervisor and trainee perceptions regarding assessment of clinical competence

Design principle	Description
Integrate summative and formative purposes	Ensure individual assessments are learning oriented to improve performance but that these also allow for higher stakes decision-making for trainees that are
Focus on surgical procedures	Most assessments should be around procedures and ensuring that trainees can
Promote feedback to trainees	Facilitation of quality, timely feedback to trainees after direct observations

7.2.5 Scoping review

As previously mentioned, many articles on WBA in General surgery originated from the UK, where the EPA framework is not explicitly utilised. Despite similarities to ‘capabilities and practice’, there seems to be a separation in thinking in the UK surgical programs between WBA and EPA assessments. The EPA framework is evidently becoming the most popular for workplace-based assessment globally, with several countries describing and implementing EPAs for assessment purposes. However, there is a lack of alignment of this trend and a focused exploration of factors aiding their integration into assessment programs for General surgery. Consequently, in addition to an initial broad literature review focusing on WBA, a scoping review was also conducted. This study explored facilitators and barriers to EPA implementation in General surgery training programs. These findings were scrutinised to derive design principles for the development of a WBA strategy (Table 7.5).

Table 7.5: Guiding design principles derived from scoping review on the use of EPAs in General surgery training programs

Design principle	Description
Focus on surgical procedures	Focus on surgical procedures, especially common procedures that trainees can safely perform
Plan for phased introduction of WBA	Start gradually, e.g. piloting with a smaller number of EPAs
Faculty and trainee development is essential	Continuous, multimodal trainee and faculty development to ensure buy-in and widespread understanding, including: details on each EPA, assessment tools and processes, summative decision making, importance of timely feedback
Minimise WBAs disruption of the clinical workflow	By making individual assessments as simple and quick as possible, and integrating into daily routines
Promote trainee self-assessment	Promote development of self-assessment practices by trainees
Have a change management strategy	Incorporate a change management strategy to increase buy-in from trainees and supervisors
Use a digital platform to capture and aggregate data	Provide a web-based/mobile platform that facilitates timely feedback, reminds supervisors and stores data for summative decision making
Get buy-in from departmental leadership	Get departmental leadership buy-in for support, including resources needed for implementation

Minimise the assessment burden	Reduction in other evaluation methods to prevent assessment fatigue
Re-evaluate the strategy periodically	Incorporate a system of monitoring, re-evaluation and improvement in the design and implementation

7.2.6 Collation of Guiding principles

All the individual principles that were distilled from the five described sources were reviewed and collated to create one list of guiding principles (Table 7.6). Although there is some overlap, the principles primarily contributed either substantive knowledge or procedural knowledge. Substantive knowledge refers to the essential characteristics of the strategy and how it should be constructed; in other words, more of a description of the 'product.' Procedural knowledge refers more to the activities of the 'process' of implementing the product (Plomp 2007). The collated set of principles was utilised to guide the design of the solution, i.e., the WBA strategy for implementation during the third phase of the design-based research process.

Table 7.6: Collated design principles to guide initial design and implementation of a local WBA strategy

No.	Design principle	Description
#1	Use EPAs as a framework	EPAs provide a useful synthetic assessment framework for WBA as they integrate competencies with the knowledge, skills and attitudes required to perform locally relevant professional tasks.
#2	Focus on surgical procedures	There should be emphasis on assessing common surgical procedures that trainees can safely perform on their own during training (falling in the zone of proximal development), and that are relevant to the role expected of them by society in a particular context.
#3	Minimise the assessment burden	Avoid high mandatory assessment quotas based on psychometric thinking, and consider adjusting other assessment requirements if needed, as WBA use is increased.
#4	Minimise WBAs disruption of the clinical workflow	By making individual assessments as simple and quick as possible to complete, to minimise cognitive load and enhance validity. Includes using simple tools that include entrustment-supervision scales with narrative feedback.
#5	Promote feedback to trainees	Provide mechanisms that encourage timely, ideally face-to-face, feedback after an activity is assessed.

#6	Promote trainee self-assessment	Provide mechanisms for trainees to compare their own EPA competence ratings to supervisor ratings
#7	Use a digital platform to capture and aggregate data	Fully digital, preferably mobile-friendly, platform to facilitate assessments as well as aggregate data for trainees to track their progress and for summative decision making by the competence committee.
#8	Get buy-in from departmental leadership	Get support from the university leadership as well as head/chair of the clinical department for WBA by having a clearly thought through and documented strategy. Includes getting approval of dedicated departmental resources to support implementation.
#9	Trainee development is essential	Continuous multimodal trainee development on concepts of WBA, CBME and EPAs, as well as how EPAs will be assessed, and how assessment data will be used to make high stakes decisions.
#10	Faculty development is essential	Ensure understanding of concepts and tools to enhance accuracy, but also of cognitive biases (ego leniency, halo) that may impair trustworthiness of individual and collective assessment decisions. Emphasis on the importance of providing feedback.
#11	Clear articulation of summative and formative purposes of WBA	Ensuring that assessments have, and are perceived to have, significant educational value, but at the same time provide useful data points for summative decision making.
#12	Implement WBA as part of a CBME strategy	WBA needs to be implemented along with other (although not necessarily all) elements of programmatic assessment and CBME e.g. use of a competency committee for high stakes decisions, using a competency framework, and a shift to competency focused instruction. Other assessment methods may continue to play a part in a training program's system of assessment.
#13	Start off slowly	Consider a pilot to assess feasibility of WBA implementation and provide a lived experience for later, more complete implementation.
#14	Have a change management strategy	Be intentional about change management and use it to strategically implement various aspects of WBA. Involves a core stakeholder team to drive the process, developing champions (through identifying and developing early adopters), and sustaining the change with constant, positive communication to correct misconceptions, report on progress and counteract resistance and negativity.
#15	Re-evaluate the strategy periodically	Plan to periodically assess user experiences/perceptions (especially trainees), engagement and design mechanisms for agile modification of the strategy.

One clear limitation of the guiding principle development process was that all the experts initially interviewed (Table 7.1) were from HICs. At this early stage of the study I had little

insight into the presence of WBA and CBME in LMICs, and unfortunately did not request any of the interviewees to refer me to experts in these settings. In hindsight, this would have been a helpful exercise, allowing a lower resourced perspective to be expressed in the initial set of guiding principles. Limitations to the development of guiding principles from the other sources are described in the relevant chapters.

7.3 Description of the solution

The design of the solution, or WBA strategy for General surgery at UCT, can be described in three parts. The first is the planning/preparation component, which describes primarily substantive components of the design, such as the stakeholder team, list of EPAs to be used, assessment tools and digital platform. The second is the implementation component, which includes primarily procedural features like faculty and trainee development. Finally, the evaluation phase relates to iterative cycles of testing and refinement based on participant feedback, which is fully described in Chapter 8.

7.3.1 Design/preparation

Stakeholder team (ST)

The best place to start with the description of the solution is to describe the ST. It was important to select a core group of individuals for both the planning or preparation phase, as well as the implementation or refinement phases. The rationale for utilising a ST is based on the guiding principles (GPs) of securing leadership support (GP#8), faculty and trainee development (GP#9, GP#10), and the use of a change management strategy (GP#14). In addition, from a design-based research perspective, getting input from practitioners in practice is an important component for gaining an understanding of the problem that the solution is trying to address. It, therefore, makes sense that this understanding is enhanced by including practitioners or representatives in the decision-making process for the design and implementation of the solution.

In terms of selecting members of the ST, the head of the department or division of surgery was a key role player to include, as per the guiding principle of securing leadership buy-in (GP#8). It was critical to have this individual's support for dedicated time and other resources that would be necessary for the implementation phase. The head of the department, who is also responsible for the clinical service, and therefore any assessment strategy that takes

place in that context and may have an impact on the service, needs to have prior input and approval. The next set of individuals were the trainees, and for this ST, three trainees were selected. Two of these trainees were South African graduates, and one was an international medical graduate. It was very important to get the trainees' voice, especially regarding feasibility and acceptability of the WBA strategy. This was also an opportunity to develop champions within the trainee group. The next group of individuals for the stakeholder team were the supervisors, of which three were selected. Specifically, these were senior clinical supervisors who would be some of the individuals responsible for completing assessments in the workplace. And again, their input on acceptability and feasibility was very important. The final team member that was included was a health professions education expert. This individual was a clinician-educator with extensive experience in WBA. The role of this person was to guide the ST to ensure that the solution was sound from a health professions education perspective. In addition, this team member also helped educate the members of the ST on basic education principles relevant to WBA.

The participation of the ST was designed in such a way that it would be feasible for them to engage in the process. In other words, their involvement was not too onerous or burdensome for very busy individuals. And second, it was to maximise the input that they could give as the end-users of the strategy as to what would work well and what would not. These individuals were also selected because they were considered potential 'early adopters' of the strategy, and therefore, could be shaped into champions. The initial role of the ST was to aid in the selection of EPAs, as well as selection of tools for the assessment of EPAs in the workplace. As implementation commenced, their role was envisioned to shift more towards feedback, as well as advising on the proposed refinements of the strategy. In addition, as has been mentioned, their roles were also expected to shift towards champions and advocates among their peers during the implementation phase.

The development strategy for the ST started with an initial meeting. At this meeting, they were given a 45-minute introduction to WBA, as well as related concepts, including CBME, programmatic assessment, and EPAs. After the initial introduction, a brainstorming session followed to select EPAs. In addition to EPA selection, they had to provide comments on the assessment tools that were proposed. And finally, they were advised on their role going forward, which included three-monthly meetings after the end of each cycle of intervention.

The ST fulfilled a core function of ensuring that the WBA strategy was feasible for the local setting. However, we also felt it was important to think broadly from the start. Therefore, in

addition to the ST, an external advisory panel was recruited to the study. This panel included key individuals from outside the Division of General Surgery at UCT, who were able to provide important feedback on how the local strategy was unfolding. In addition, this group of individuals was carefully selected as a strategy to gain approval from other parts of the country for the WBA design and implementation being pioneered at UCT.

The following were selected as part of the external panel. First, the president of the Colleges of Medicine of South Africa who at the time was playing an active role in advocating for WBA implementation across all postgraduate specialist training in South Africa. Second, the president of the College of Surgeons of South Africa who was also an HoD of Surgery at another institution. The third person was an international expert, and the creator of the EPA concept. It was thought that his input and guidance on the selection and description of EPAs would be extremely helpful. Fourth, the external advisory panel included an HoD of Surgery from another province, who would be able to give feedback on how the strategy could be implemented in other settings in South Africa. This was important to ensure that our local strategy could be generalizable and useful to other centres, should WBA be implemented for surgical training on a national scale. The final individual was another HoD, again at another institution, who was also the chair of the Examination Committee for the College of Surgeons of South Africa.

What follows is a description of the other components of the solution, including the design, implementation, and evaluation phases, and how these were informed by the aforementioned guiding principles.

EPA selection

Guiding principle #1 emphasises the use of an EPA framework, a principle reinforced during expert meetings and the literature review. Thus, the initial step involved generating a set of EPAs that would be assessed in the workplace, with a focus on procedures as per GP#2. It was essential to achieve a careful balance in the number of EPAs chosen to minimise the assessment burden (GP#3), and to start off slowly (GP#13). Valuable insights from the scoping review on EPA use in General surgery contributed not only to the guiding principles but also options for potential EPAs based on implementation in other contexts. This exercise additionally generated ideas for potential assessment tools, which will be discussed later.

The scoping review revealed that some contexts emphasised a few broad EPAs, e.g. the UK approach, while others preferred extensive lists of specific or granular EPAs, e.g. Canada.

Combining these approaches seemed logical, aiming for fewer broader EPAs, with a focus on procedures. During the initial ST meeting to generate EPAs for initial implementation, the survey results regarding the most frequently performed procedures (as described in Chapter 6) was pending. Consequently, the initial EPAs were described, anticipating guidance from the forthcoming study results, for potential refinements in the intervention cycles.

Formulating EPAs during the first ST meeting involved asking the ST what they thought the key activities of a General surgeon were, that we could feasibly assess in the workplace. This inquiry was preceded by a discussion about EPAs generated in other contexts, thereby enriching the ST's decision-making with insights from work done elsewhere. The team was reminded of the necessity to consider local feasibility in the process of developing EPAs, using ideas and guidance from other contexts.

In the initial meeting, consensus emerged on the need for EPAs assessing trainee competence in managing an outpatient clinic, inpatients, an acute admissions intake, and performing surgical procedures — core domains of a General surgeon's practice. The discussion then predominantly focused on determining the core/index procedures to be included. The dialogue began with presenting a list of procedural EPAs deemed feasible by the study team, followed by a brainstorming session to identify additional procedural EPAs. The team eventually reached an agreement on the first set of procedural EPAs to be included. It was emphasised that this process would evolve, allowing for adjustments after the initial cycle of implementation.

In addition to the three broad EPAs mentioned earlier — managing inpatients, managing an acute intake, and managing outpatients — the selected procedural EPAs included hernia repair, laparoscopic cholecystectomy, appendicectomy, gastroscopy, mastectomy, lower limb amputation, and laparotomy. Suggestions for procedures not included in the initial selection included stoma formation, bowel anastomosis, colonoscopy, colon mobilisation, thyroid exposure, groin exposure, laparoscopic port insertion, and perianal fistula procedures.

EPA description

Following the selection of EPAs, the next step involved the comprehensive description of each chosen EPA. This step was important to ensure participants' understanding of the specifications, inclusions, exclusions, and the assessment method for each EPA. Moreover, it was imperative for trainees to grasp the specific knowledge and skills under assessment, enabling them to demonstrate these in their performance of the task. In shaping the

descriptions of EPAs to demonstrate competent practice, guidance was sought from how others had described these, along with guidance from the literature (Ten Cate and Taylor 2021). Consequently, the EPAs were articulated in alignment with international guidelines. These detailed descriptions of each EPA were then disseminated as a document to both the stakeholder team and the advisory panel.

The initial feedback from the advisory panel, particularly from Professor Ten Cate, proved highly valuable. This feedback enabled us to craft EPAs that aligned with best practices and were intelligible to users beyond our local division. The advisory panel was also informed of the proceedings of the first ST meeting, including the decisions made regarding the implementation plan. This provided them with the context to offer feedback not only on the EPAs but also on the forthcoming plan for implementation of WBA activities based on these EPAs.

The thorough descriptions of EPAs aligned with the guiding principles of supervisor and trainee development (GP#9 and GP#10). Furthermore, the descriptions underscored how EPA-based WBA would be used for ultimately making summative decisions (GP#11). Hence, they delineated a clear demarcation between low-stakes individual EPA observations, primarily formative in nature, and their subsequent cumulative utilisation at a later stage for high-stakes decision-making or summative purposes.

EPA assessment quotas

After deciding which EPAs to use and clearly describing them, the next decision was how many WBAs or observations would be required during a typical three-month surgical rotation. The guiding principles here were to start off slowly (GP#13) and also to minimise the assessment burden on practitioners (GP#3).

From the literature, including a scoping review on the use of EPAs in General surgery training, it was apparent that there was a wide range of what educators perceived enough assessments to be. Although it is tempting to try and implement a comprehensive strategy, we were cautioned by the literature as well as by the experts to start very gradually. Starting at a slow pace would enable us to build later, but the important factor was maintaining feasibility from the start. Implementing a strategy that participants perceived as not feasible from the start, would likely be a recipe for long-term failure. Thus, after discussion with the stakeholder team, it was decided that trainees would be required to get at least two observations for any of the listed EPAs in the first three-month rotation. The expectation was

that this would increase based on feedback from the trainees and an increased understanding by all participants of how to perform these WBA observations.

Assessment tools

After deciding on the EPAs, the next step of the design process was to select the tools to be used to assess the individual EPAs in the workplace. The guiding principles here were to ensure a procedural focus (GP#2) while minimising the assessment burden (GP#3) and workflow disruption (GP#4). The latter was the key principle to make these WBA observations feasible in day-to-day clinical practice.

Following this guiding principle, it was important to include tools with entrustment-supervision scales and narrative feedback (GP#5). Starting with the procedural EPAs, we favoured the Ottawa Surgical Competency Operating Room Evaluation (O-SCORE) due to its inclusion of entrustment-supervision scales and the meaningful feedback provided to the trainee with each question item's response (Gofton et al. 2012). Additionally, it included space for narrative feedback at the end of the form to guide the trainee in their goal of improving their practice. The O-SCORE had also been validated in a surgical context, providing good evidence for its use. We then gravitated towards the Ottawa Clinic Assessment Tool (O-CAT), as it was a similar tool designed for use in an outpatient setting (Rekman, Hamstra, et al. 2016). Since we couldn't find an equivalent tool for inpatient assessment, we adapted the O-CAT for this purpose. These tools were presented to the ST, and they were satisfied with the rationale and choice of tools. Again, it was emphasised to the ST that the tools were subject to change as we progressed through cycles of implementation and refinement.

In terms of assessors, we chose to include not only our own supervisors, but also supervisors overseeing our trainees in other departments. This included the intensive care unit as well as the paediatric surgery team, which does not fall under the Division of General Surgery at UCT. We believed that their feedback would be valuable and provide an interdisciplinary perspective on our trainees' competence.

Digital platform

Once we formulated the list of EPAs and the WBA tools to be used, we needed to package these for day-to-day use. According to our guiding principles, we elected to use a digital platform (GP#7) and chose not to rely on a paper-based system. This digital platform had to be mobile-friendly and easy to use, in order to minimise assessment burden (GP#3) and

workflow disruption (GP#4). Additionally, this platform had to facilitate feedback to trainees on their assessments/observations in the workplace (GP#5), as well as promote trainee self-assessment (GP#6).

At the time of implementation, there was no suitable, affordable, commercially available solution in South Africa. Therefore, we used an in-house platform based on the Google suite of applications. Google was chosen because it is freely available and easy to use. Assessments were created using Google Forms, and the data stored on Google Sheets in a Google Drive. This ensured low data requirements, which was important for our setting where Wi-Fi isn't always available at all hospitals.

The first part of the WBA observation process was the trainee request for an observation. Initially, we explored models of phone swapping so that the whole form could be completed on the trainee's phone at the bedside or after an operative case, but this was considered to be impractical. Therefore, we created a process whereby the trainee would send an observation request to a supervisor immediately after an activity had taken place. Trainees had a link shared with them which they could click on, opening a Google Form. This form included basic details about themselves such as their name, year of study, and rotation. Additionally, it required details on the activity that was observed, including the date it took place. In order to develop their own self-assessment capacity, the request form also had a question where they rated their own perceived entrustment level for the activity (i.e. EPA), which they could then compare against the entrustment rating received from the supervisor. Finally, they had to select a supervisor to whom they sent the observation request. Once they submitted the request, an email and SMS were sent to the supervisor to notify them that the trainee had requested an observation for an EPA-related activity. The request message included a hyperlink that the supervisor could click to open the report form for the assessment. In addition to an initial email and SMS, supervisors were also sent a reminder email at 24 hours in case they missed the first set of notifications.

In terms of the observation report process, once a supervisor clicked on the sent link to complete a WBA observation, a Google Form would open, requesting demographic and descriptive information about the context of the observation. The questions that followed were tailored to the type of activity and mirrored the O-SCORE, OCAT, or inpatient equivalent tool. Upon submission of the completed form, the system sent a PDF report to the trainee, the supervisor, the head of unit, and the program convener. This report was automatically stored in the trainee's portfolio on the designated Google Drive from where the

system operated. The Google form was set up to encourage feedback by directly asking the supervisor if they had given face-to-face feedback. Additionally, upon submission of the completed form, a confirmation message would pop up to ask if feedback had been given. The confirmation email with the attached PDF, sent to the trainee and other members of the team, would again prompt the supervisor and remind them to give in-person feedback.

The final component of the digital platform was the creation of a dashboard to aggregate and display assessment data. This was done through Google's Looker Studio software, which reads data directly from Google Sheets. The dashboard included information on how many WBA observations each trainee had completed, including the number of inpatient, outpatient, and procedural observations. To protect trainees' confidentiality, the dashboard did not include any entrustment ratings or narrative feedback. The dashboard was primarily used by trainees to keep track of how many WBA observations they had undertaken. Similarly, the dashboard assisted supervisors to ensure that the trainees were completing the required observations while in their unit. The dashboard also provided oversight for the study team as well as the stakeholder team to monitor buy-in and uptake across the program.

Programmatic assessment

The final component of the preparation/design phase was to integrate WBA observations into a broader programmatic assessment strategy in the General surgery training program (GP#12). This aspect was not explicitly discussed during the ST planning meeting, except to explain the role of a Competency Committee (CC) and that individual observations would be reinterpreted for summative decision-making at a later point in time (GP#11). However, as a study team (student and supervisors), we were actively working on the strategy behind the scenes and had made the following decisions. Firstly, the CC would be composed of members of the departmental Postgraduate Education Committee. This committee, already operational, made decisions about the rotations trainees were allocated to, making discussion on trainee progress a natural evolution of their responsibilities. Regarding the process of the CC, we drew inspiration from the Canadian Competence By Design description of how they manage these meetings and simplified it to work for a large division with multiple trainees (Royal College of Physicians and Surgeons of Canada 2018).

Secondly, we recognized the importance of our traditional end-of-block assessments, as they provided valuable longitudinal information, especially related to professional behaviours and competencies. However, we made changes to these assessments based on feedback

from the qualitative study described in Chapter 4. So, we redesigned our end-of-block assessments, making them more formative and retained them as a part of our programmatic assessment strategy.

Our thinking in terms of programmatic assessment was guided by the principle of implementing WBA with other aspects of CBME (GP#12). We therefore also included a core competency framework in the description of our EPAs, as recommended by the guidelines (Ten Cate and Taylor 2021). However, at this point we had not given much thought to the development of competency-focused instruction or other elements of CBME beyond the concept of programmatic assessment (Van Melle et al. 2019).

7.3.2 Implementation

Faculty development

In the previous section, the design of the WBA strategy was discussed, highlighting the critical role of the ST in decision-making. The next part of the solution was implementation of the strategy. Initially, engaging with supervisors was crucial, requiring extensive faculty development efforts (GP#10). The aim of faculty development was twofold: to promote buy-in, and to ensure supervisors had a robust understanding of relevant concepts and assessment tools. The latter was particularly important as proper use of assessment tools would bolster their perceived validity (Pangaro and Ten Cate 2013).

Emphasising the significance of providing feedback was essential (GP#5) because this feedback not only shapes trainees' progress but also fosters buy-in from both supervisors and trainees, by realising the educational value of WBA. It was also vital to convey to supervisors the distinction between individual, low-stakes observations and high-stakes summative decision-making by the CC. From the outset, the term "assessment" was replaced with "observation" to underscore the formative, low-stakes nature of individual events.

Faculty development primarily occurred during monthly supervisor meetings, chaired by the Head of the Division of General surgery. Given that postgraduate training was a regular agenda item at these meetings, integrating faculty development on WBA was seamless. Faculty development efforts commenced two months before the initial study implementation date.

At the initial information session with supervisors, several introductory elements were addressed. First, supervisors were informed about the national movement towards implementing WBA in all postgraduate medical training programs in SA. This clarification was crucial to underline the importance and urgency of implementing WBA locally. They were also briefed on the rationale behind the implementation of WBA. Third, key concepts such as WBA and EPAs were explained, along with the role of WBA in programmatic assessment and how high-stakes decision-making is conducted by a CC. Finally, supervisors were informed that local implementation would be part of a research study, and participation was voluntary.

The second faculty development session took place a month later, and was shaped by feedback from the research candidate's supervisors who were in the audience for the first session. In summary, the feedback suggested shifting the focus towards practical logistics and avoiding excessive education theory, as the recipients found it difficult to grasp. Therefore, the next session primarily focused on the practical aspects of how the new assessment strategy would operate, answering the question, "What do I need to do?"

The session began with a brief recap of the purpose of WBA and then supervisors were informed about the selected EPAs, including their specifications and limitations. The expected level of entrustment for each EPA was described for each year of training, providing supervisors with an understanding of trainees' expected progression through the program. The minimum number of WBA observations per EPAs for the first three months of implementation was also outlined. Supervisors were informed that ideally, trainees would initiate observations, and notifications would then be sent to their mobile phone and email inboxes. The importance of face-to-face feedback was reiterated. Subsequently, the three WBA tools were described, followed by a live demonstration of a supervisor completing an observation. This was performed by sending a dummy request to one of the audience members (a pre-planned event) who then went up to the computer at the lectern and completed the observation so that their peers could see on the screen how simple and quick it was to do. This was a really important moment, as the supervisors instantly realised that completing an observation report would take them a very short time and add little to their already heavy administrative workload.

Trainee development

Trainee development followed a similar strategy. It was crucial to emphasise to trainees, as it was for supervisors, the formative value of workplace observations. Again, the term

"observations" was explicitly used from the outset to stress the low-stakes nature of these activities (GP#11). Trainee development was initiated two months prior to implementation, also with an in-person group meeting. This meeting was scheduled during one of the monthly 'trainee days' (protected afternoon time for training-related talks).

The first engagement with trainees again described the old way of training specialists and the need for a new method to ensure clinical competence. Trainees were introduced to the concepts of CBME and competency frameworks. Additionally, they were given information on programmatic assessment and the role of WBA (GP#12). The rationale for WBA was reemphasized, followed by an explanation of the EPA concept and how it related to WBA.

As trainees were going to receive feedback on their performance using entrustment-supervision scales, these were discussed in detail. It was emphasised that these narrative scales were going to be utilised instead of numeric rating scales and that there were no numeric values attached to the entrustment descriptors. In other words, there was no pass mark or score that would mean they had failed an observation. The role of the portfolio was also discussed, including WBAs, and the contents beyond it, including the end of block assessment. The clear distinction between the formative and summative purposes was reemphasized, again by describing the role of the CC (GP#11).

The second meeting, as for the supervisors, focused primarily on practical aspects and logistics. It was emphasised to trainees that they were responsible for initiating observations and for undertaking the minimum required observations per rotation. The different observation tools were demonstrated, and trainees were shown an example of an email they would receive with the observation report attached as a PDF document. A live demonstration of sending an observation request was also done. At this meeting, a leaflet/brochure was handed out with a summary of the EPAs, what they included, and the different types of observations (e.g., outpatient, inpatient, and procedural). In addition, a set of videos were created and put on YouTube with the links distributed to the trainees. These videos covered key concepts related to WBA and CBME, as well as how to request an observation. The trainees were also sent a single page PDF that included links to the training videos, a link to request an observation, a link to the dashboard so they could track their progress, and finally, a link to the EPA description document. This PDF was stored on a Google Drive with a publicly available link. This link was posted on the trainees' WhatsApp group description so that it could be easily found. Supervisors had a similar PDF document with the link posted on the supervisor WhatsApp group.

Change management

The final component of the implementation phase of the WBA strategy was related to the use of change management. This principle (GP#14) was identified as crucial for the early phases of implementation, and was guided by Kotter's eight steps for leading change (Kotter 2009):

Figure 7.1: Kotter's cycle of change (Kotter 2021)



1. Create a sense of urgency - achieved through faculty and trainee development sessions described previously. The rationale for WBA was clearly described for both groups, emphasising the urgent need for its implementation to ensure competent surgeons and to optimise learning opportunities in the clinical environment. In addition, it was emphasised that this local initiative was part of a national implementation plan.
2. Build a guiding coalition - accomplished through the formation of the stakeholder team. This team included key local workforce role players.
3. Form a strategic vision - through information sessions explaining WBA, CBME, programmatic assessment (PA) and EPAs. Describing the rationale for WBA envisioning a future program with workplace-based observations as an integral part of enhancing learning, were also part of shaping the vision.

4. Enlist a volunteer army - through identifying potential early adopters in each of the 15 units within the Division. These individuals were communicated with regularly via email and a WhatsApp group to serve as local change agents and champions of the project.
5. Remove barriers to enable action and change. This included addressing aspects in the design such as using a smartphone digital platform and making observations simple and quick to complete. Strategies were planned to handle potential active resistance to change, recognizing individual differences and seeking input from local leadership.
6. Celebrate short-term wins - included providing regular feedback on the number of observations completed. A progress chart was created to track completion to motivate participants and demonstrate uptake. Another short-term win involved generating awards or certificates for those showing the greatest buy-in initially, leveraging competitiveness among trainees and supervisors.
7. Sustain acceleration - by constantly communicating the vision and progress to all participants.
8. Institutionalise change - aimed to integrate the new WBA strategy into the existing program. While planning for the last four steps of Kotter's cycle was challenging as implementation had not occurred, it was important to adopt the right mindset and tools to address change once implementation began.

7.3.3 Evaluation

The final component of the WBA strategy was the evaluation phase, with cycles of implementation, reflection, and refinement based on feedback from participants (GP#15). These intervention cycles facilitated review of the initial guiding principles so that a final set of design principles for implementing a local WBA strategy could be formulated. This process is further elaborated on in Chapter 8.

7.4 Limitations

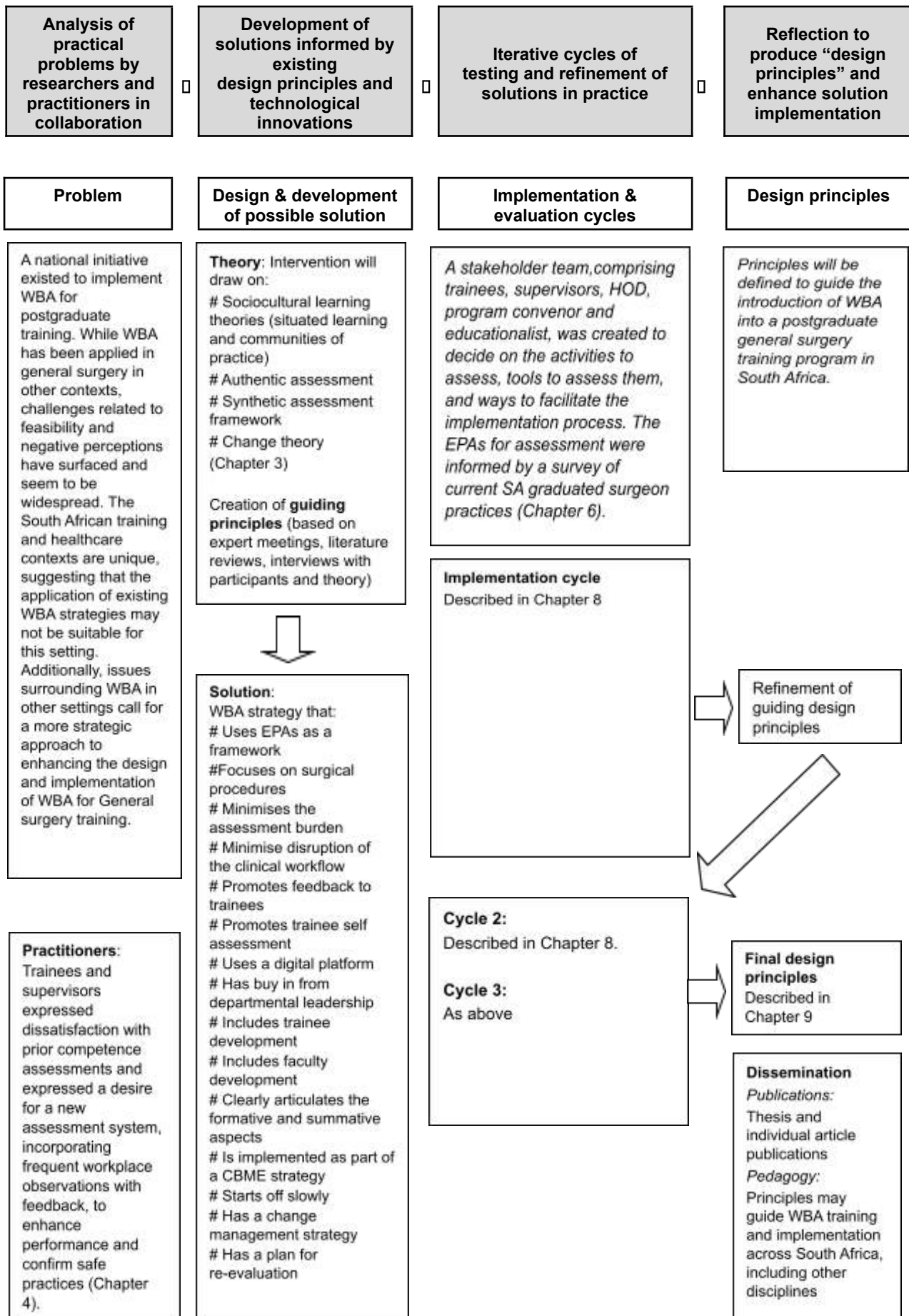
The guiding principle development, as well as the design of the solution, had two notable limitations. First, one of the key sources informing the guiding principle development were interviews with experts, all of which were from HICs. At this early stage of the study, I had little insight into the presence of WBA and CBME in LMICs, and unfortunately did not request any of the interviewees to refer me to experts in these settings. This would have

been a helpful exercise, allowing a lower-resourced perspective to influence the guiding principles. Limitations in guiding principle development from other sources are described in the relevant chapters. The second significant limitation was the omission of subspecialist trainees or final year General surgery trainees from the ST. It would have been wise to include representatives from both of these groups, as these individuals frequently provide direct supervision to junior trainees.

7.5 DBR flowchart

The design-based research flowchart, proposed by Reeves and colleagues (Reeves 2006; Herrington et al. 2007), provides an overview of the thesis up to this point, focusing on the development of the solution.

Figure 7.1: Design-based research flowchart at conclusion of Chapter 7



Chapter 8. Cycles of implementation and refinement of the solution

8.1 Rationale

Internationally, there has been a shift away from traditional paradigms towards competency-based education (CBE) in many health professions education contexts (Carraccio and Englander 2013). This shift incorporates the adoption of programmatic assessment with increased utilisation of WBA (Lambert W. T. Schuwirth and Van der Vleuten 2011; Bok et al. 2013). WBA attempts to confirm the clinical competence of trainees while also optimising the provision of feedback to promote learning, thereby enhancing experiential learning processes. However, opinions regarding WBA from surgical trainees and supervisors have been varied. Reviews on participant perceptions of WBA in surgery have highlighted several concerns, including a lack of engagement by both trainees and supervisors (Aryal, Hamed, and Currow 2021; Mughal et al. 2023). With mandatory numbers of required assessments, this may lead to WBA being perceived as a tick box exercise, with a risk of compromising both formative and summative utility.

In South Africa, there have been long standing calls for the integration of WBA into postgraduate training (Sathekge 2017). In 2021, the Colleges of Medicine of South Africa (CMSA) and the South African Committee of Medical Deans (SACOMD) initiated a national move towards CBE in postgraduate specialist education through the introduction of WBA on a national scale (Nel, Burch, et al. 2022). Locally, the perceived lack of clinical competency assessment in surgical training was confirmed through interviews with trainees and supervisors in the Division of General Surgery at UCT (Chapter 4). Participants expressed dissatisfaction with traditional assessment methods, citing their inadequacy in confirming clinical competence and their limited formative value. Both trainees and supervisors emphasised the importance of frequent observations in the workplace, with feedback to continuously benchmark progress and create opportunities for improving performance and increasing trainee autonomy.

Previous chapters have outlined the methods used to establish a set of guiding principles for the design of this strategy. These methods included a literature review (Chapter 1), informal expert interviews (Chapter 1), an exploration of relevant education theory (Chapter 2), supervisor and trainee interviews (Chapter 4), and a scoping review specifically focused on

the role of EPAs in postgraduate General surgery training (Chapter 6). These principles informed the design and implementation of a WBA ‘solution’ in collaboration with practitioners in the Division of General Surgery at UCT. This chapter details the implementation of the proposed solution, described in the previous chapter. The aim of the implementation process was to utilise iterative cycles of intervention and reflection to allow refinement of the strategy and the guiding design principles (Design-Based Research Collective 2003). By incorporating the lessons learnt in other contexts with additional input from participants, the goal was to design and implement a strategy that was deemed acceptable, appropriate and feasible by both trainees and supervisors in a South African context.

8.2 Method

This component of the thesis comprises phase three of the design-based research methodology (DBR) described in Chapter 2. The educational problem under scrutiny was delineated in conjunction with practitioners, marking phase one of the DBR process (Chapter 4). The formulation of design principles to guide the development of the implementation strategy for WBA at this institution constituted phase 2 (see Chapter 7), and are delineated in Table 8.1 (repeat of Table 7.6).

Table 8.1: Guiding design principles

No.	Design principle	Description
#1	Use EPAs as a framework	EPAs provide a useful synthetic assessment framework for WBA as they integrate competencies with the knowledge, skills and attitudes required to perform locally relevant professional tasks.
#2	Focus on surgical procedures	There should be emphasis on assessing common surgical procedures that trainees can safely perform on their own during training (falling in the zone of proximal development), and that are relevant to the role expected of them by society in a particular context.
#3	Minimise the assessment burden	Avoid high mandatory assessment quotas based on psychometric thinking, and consider adjusting other assessment requirements if needed, as WBA use is increased.

#4	Minimise WBAs disruption of the clinical workflow	By making individual assessments as simple and quick as possible to complete, to minimise cognitive load and enhance validity. Includes using simple tools that include entrustment-supervision scales with narrative feedback.
#5	Promote feedback to trainees	Provide mechanisms that encourage timely, ideally face-to-face, feedback after an activity is assessed.
#6	Promote trainee self-assessment	Provide mechanisms for trainees to compare their own EPA competence ratings to supervisor ratings
#7	Use a digital platform to capture and aggregate data	Fully digital, preferably mobile-friendly, platform to facilitate assessments as well as aggregate data for trainees to track their progress and for summative decision making by the competence committee.
#8	Get buy-in from departmental leadership	Get support from the university leadership as well as head/chair of the clinical department for WBA by having a clearly thought through and documented strategy. Includes getting approval of dedicated departmental resources to support implementation.
#9	Trainee development is essential	Continuous multimodal trainee development on concepts of WBA, CBME and EPAs, as well as how EPAs will be assessed, and how assessment data will be used to make high stakes decisions.
#10	Faculty development is essential	Ensure understanding of concepts and tools to enhance accuracy, but also of cognitive biases (e.g. leniency, halo) that may impair trustworthiness of individual and collective assessment decisions. Emphasis on the importance of providing feedback.
#11	Clear articulation of summative and formative purposes of WBA	Ensuring that assessments have, and are perceived to have, significant educational value, but at the same time provide useful data points for summative decision making.
#12	Implement WBA as part of a CBME strategy	WBA needs to be implemented along with other (although not necessarily all) elements of programmatic assessment and CBME e.g. use of a competency committee for high stakes decisions, using a competency framework, and a shift to competency focused instruction. Other assessment methods may continue to play a part in a training program's system of assessment.

#13	Start off slowly	Consider a pilot to assess feasibility of WBA implementation and provide a lived experience for later, more complete implementation.
#14	Have a change management strategy	Be intentional about change management and use it to strategically implement various aspects of WBA. Involves a core stakeholder team to drive the process, developing champions (through identifying and developing early adopters), and sustaining the change with constant, positive communication to correct misconceptions, report on progress and counteract resistance and negativity.
#15	Re-evaluate the strategy periodically	Plan to periodically assess user experiences/perceptions (especially trainees), engagement and design mechanisms for agile modification of the strategy.

8.2.1 Summary of the solution

As described in the previous chapter, the proposed solution/strategy comprised components relating to EPAs, WBA tools, digital infrastructure, trainee abs supervisor development, and practical tips relevant to change management. Ten EPAs were chosen, encompassing the management of inpatients, acute intake admissions, outpatients, and seven core/index procedural EPAs: hernia repair, laparoscopic cholecystectomy, appendectomy, gastroscopy, mastectomy, amputation, and laparotomy. WBA tools selected for use included the O-SCORE for procedures, the OCAT for outpatient consultations, and a locally modified version of the OCAT for inpatient and acute intake admitted patient management. The digital platform, designed to be fully smartphone-based, allowed trainees to request observations from supervisors and allowed supervisors to submit observation reports. It also featured a dashboard for both parties to monitor overall and individual progress through numbers of observations performed. Additionally, the platform included a portfolio feature for storing individual workplace observations, aiding CC decision-making as part of a programmatic approach to assessment. The digital platform was based on the Google suite of applications, utilising Google Forms to collect observation requests and reports, Google Drive to store information and Google Looker Studio for the dashboard. Data on the Google Drive was secured through Google's Advanced Encryption Standard (AES-256) algorithm and the account was only accessible through two factor authentication.

Faculty development included monthly information sessions commencing two months before the planned implementation. Furthermore, electronic documents containing links and video

tutorials on engaging with the digital platform, along with concepts pertinent to WBA, were disseminated. These documents were made available on team WhatsApp groups and distributed department-wide via email. In terms of change management, John Kotter's eight-step model for leading change was applied. Central to the change process was the establishment of a stakeholder team (ST) tasked with both shaping the strategy's elements and championing them within their respective clinical units. Strategies to mitigate barriers to change and celebrate short-term victories, thereby sustaining the momentum of change, were also prepared for implementation.

8.2.2 Implementation cycles with feedback from participants

The initial implementation date was set for October 1, 2022, coinciding with the commencement of the last three-month clinical rotation for the 2022 academic year. Each testing or implementation cycle spanned three months, seamlessly following the conclusion of the preceding rotation. As planned, three cycles of testing and refinement were completed by the end of June 2023. It was deemed necessary to conduct three cycles to gather sufficient information for refining the strategy and the guiding design principles. Modifications to the strategy were informed by feedback from participants during the last two weeks of each three-month cycle. Feedback was collected through surveys distributed during in-person divisional morbidity and mortality meetings, with electronic distribution for those unable to attend.

The survey comprised two parts. The first part utilised the Acceptability of Intervention Measure (AIM) tool (Weiner et al. 2017). This tool assesses three components that are crucial in the adoption phase of innovation implementation, namely acceptability, appropriateness, and feasibility. Acceptability pertains to individuals' personal perspectives, including their needs, preferences, and expectations. Appropriateness considers the technical and social aspects of the intervention and how effectively it achieves its purpose within the organisation. Feasibility assesses the practicality of implementation given existing resources such as time, money, and motivational factors. The AIM tool was selected as it offers the advantage of being pragmatic and user-friendly, comprising 12 items (four for each construct) that facilitate the measurement of implementation outcomes through five-item Likert scales (strongly disagree, disagree, neutral, agree and strongly agree). To measure trends in trainee and supervisor perceptions, the Likert scale responses for each construct (acceptability, appropriateness and feasibility) were converted to a numerical scale, with one being 'completely disagree' to five, translating to 'completely agree'. These scores were

added up and then divided by the number of respondents, to get an average for the group for that specific cycle.

The second part of the survey sought feedback through open-ended questions, focusing on key elements of the design and implementation of the current WBA strategy. While the first part of the survey remained consistent across intervention cycles, the questions in the second part were tailored based on the information considered necessary for refining the strategy at that particular point in time. Thus, after the completion of each specific cycle, the questions for trainees and supervisors were slightly adjusted. This flexibility enabled the research team, with input from the ST, to gather feedback on specific issues requiring broad input from participants. The supervisor and trainee surveys are attached as Appendices D1-D6.

8.2.3 Refinement of the solution

Each set of survey responses was compiled and presented to the ST before the onset of the subsequent intervention cycle. The feedback encompassed the number of respondents, outcomes of the AIM tool, and primary themes derived from the open-ended sections of the surveys. Due to the frequent and expedited feedback between rotations, formal qualitative analysis of these narrative responses was impractical. Consequently, the research team, including the primary researcher and supervisors, reviewed the results of each survey before presenting them to the ST.

Following the presentation of survey results to the ST, a comprehensive discussion ensued to determine necessary adjustments to various aspects of the strategy. The updated strategy was then communicated to an advisory panel, comprising stakeholders from outside the Division of General Surgery, who could provide valuable external perspectives on the proposed changes. Given the rapid pace of change between cycles, the guiding principles were not refined after each testing cycle. Instead, notes were maintained on the refinement of the strategy, facilitating amendment of the design principles at the conclusion of the implementation period.

8.3 Results

The three cycles of implementation and refinement, based on feedback from participants and stakeholder decision-making, are described below. A summary is presented in Table 8.2, followed by an elaboration of each cycle.

Table 8.2: Summary of the three cycles of implementation and refinement

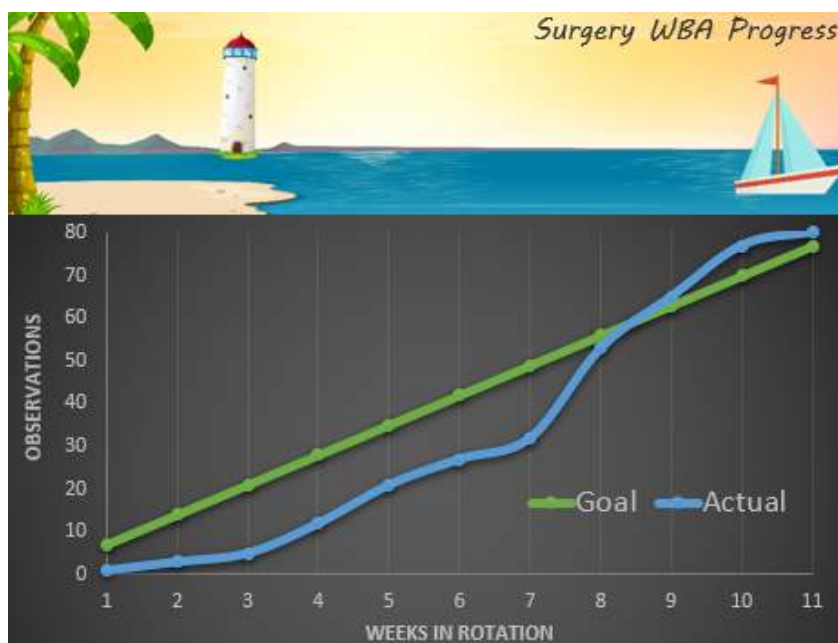
	Cycle 1	Cycle 2	Cycle 3
Date	1 Oct 2022 - 31 Dec 2022	1 Jan 2023 - 31 Mar 2023	1 Apr 2023 - 30 Jun 2023
Minimum required observations	2	3	4
Number (%) trainees completed required minimum observations	36/40 (90%)	32/40 (80%)	31/40 (78%)
Total observations done	80	107	136
Trainee survey response rate	63%	50%	35%
Acceptability (mean rating out of 5)	3.9	3.9	4.1
Appropriateness	4.1	4.1	4.0
Feasibility	4.0	4.2	4.4
Supervisor survey response rate	50%	41%	32%
Acceptability	4.4	3.9	4.4
Appropriateness	4.4	4.1	4.2
Feasibility	4.6	4.4	4.5
Key lessons learnt	<ul style="list-style-type: none"> Importance of leadership buy-in and 	<ul style="list-style-type: none"> Confirmed preference for simplified 	<ul style="list-style-type: none"> Both trainees and supervisors

	<p>HOD endorsement</p> <ul style="list-style-type: none"> • Need observations even more quick and simple to limit impact on workflow • Face-to-face feedback not occurring in 30% of observations (reported by trainees) • Trainees felt observation mainly a test (vs. formative event) • Trainees felt not all supervisors & fellows bought into idea • Minimum number of required observations per rotation = 5 (both trainees and supervisors) 	<p>assessment tool for inpatient/outpatient EPAs</p> <ul style="list-style-type: none"> • Confirmed minimum recommended observations per rotation = 5 • Most trainees still felt individual observations mainly for assessment • 40% of trainees report getting face-to-face feedback • Perceptions of inconsistent buy-in from both groups • Neglected importance of personal change 	<p>desire more procedure options</p> <ul style="list-style-type: none"> • Perception of incomplete buy-in (mainly supervisors) persists • Greater emphasis on intrinsic motivation needed • Mandatory participation directive may be required
Key changes to strategy	<ul style="list-style-type: none"> • Simplified assessment tool for inpatient/outpatient EPAs • Emphasised formative focus - remove numbers from ratings, included tips for feedback to supervisors in report form • Slowly increased number required to 3 per rotation • Added intestinal anastomosis/stoma as 8th procedure - especially requested from colorectal team 	<ul style="list-style-type: none"> • Shift in focus to personal change and widely sharing “transforming idea” to improve buy-in • Changed operation form to simplified tool - one form for all observations • Increased minimum required observations to 4 per rotation • Smartphone app designed to make finding links easier • Weekly reminder email to trainees • Built feedback prompts for supervisors into report form 	<ul style="list-style-type: none"> • Added ‘other procedure’ option as EPA • Units encouraged to identify regular observation moments in their weekly schedule • Introduced awards for best participation from trainees and supervisors • Introduced negative consequences for poor participation

8.3.1 Cycle 1

The first cycle of implementation began on October 1, 2022, and concluded by the end of December of the same year. The minimum required assessment quota was achieved by 90% of trainees. Overall, the trainees accumulated just over 80 observations, as some exceeded the minimum requirement. The progress through the three-month rotation is illustrated in the figure below, which represents the final iteration of the weekly progress charts posted on the trainee WhatsApp group.

Figure 8.1: Progress chart for Cycle 1



As depicted in the figure, progress was initially slow until week seven, when there was a sudden increase in activity. This increase can be attributed to messages sent by the HOD on both trainee and supervisor WhatsApp groups, endorsing and encouraging participation in the WBA initiative.

Survey feedback after Cycle 1

Out of the 40 trainees, 25 responded to the survey (63% response rate). Regarding the AIM tool portion of the survey, trainees rated the WBA intervention as follows: acceptability 3.9 out of five, appropriateness 4.1 out of five, and feasibility 4.0 out of five. In terms of the feedback portion of the survey, the median number of observations trainees deemed feasible in a three-month period was five, with a range from one to 10. Trainees reported difficulty

obtaining observations for outpatient clinics and amputations due to lack of on-site supervision, and suggested expanding the list of procedures or including an option for unspecified procedures to make the available EPA list less restrictive. Trainees also requested minor adjustments to the digital platform to streamline the request process. Only one trainee felt the need for more information/training, while several trainees emphasised the need for supervisor development, particularly among fellows and teams outside General surgery, such as the Intensive Care team.

In terms of supervisors, including full-time senior supervisors, junior supervisors, and fellows, 36 out of 44 (82%) completed at least one observation report. Of these, 19 responded to the survey, resulting in a 50% supervisor response rate. Supervisors' ratings on the AIM tool were more favourable than trainees', with acceptability at 4.4 out of 5, appropriateness 4.4 out of 5, and feasibility at 4.6 out of 5. Similar to the trainee response, the median number of observations supervisors deemed feasible in a three-month rotation was five, with a range of one to 24. Regarding EPAs, supervisors expressed uncertainty about less specific procedures like laparotomy and suggested clarifications and expansion of the procedure list, especially the inclusion of bowel anastomosis/stoma. Most supervisors were satisfied with the digital platform, although some suggested minor improvements for simplicity and speed of report completion.

Stakeholder team input after Cycle 1

The ST agreed to increase the observation number to three and incorporate bowel anastomosis and stoma formation as procedural EPAs. Although amputation and outpatient clinic EPAs remained on the list, the team decided to revisit their inclusion after the next cycle. Furthermore, the team decided to remove numbers from individual observation response rating scales from the observation report form to alleviate assessment anxiety among trainees. They emphasised the importance of improving the formative nature of the observation process and the need for the assessment tools to rather focus on narrative feedback (for the benefit of both trainees and the CC). This included no longer using the terms 'WBA' and 'assessment', and referring to Workplace-based observations (WBO) and 'observations' instead. Regarding the observation tools, the ST acknowledged that the adaptation of the OCAT tool for inpatient or acute intake settings was not effective. Therefore, they recommended replacing it with a simpler tool that includes a global entrustment-supervision rating and narrative feedback on performance (Appendix D7). The team planned to evaluate the response to this revised form to determine its suitability for other types of observations, i.e. inpatient management and procedures. Additionally, further

modifications were made to the digital platform to encourage the provision of in-person feedback.

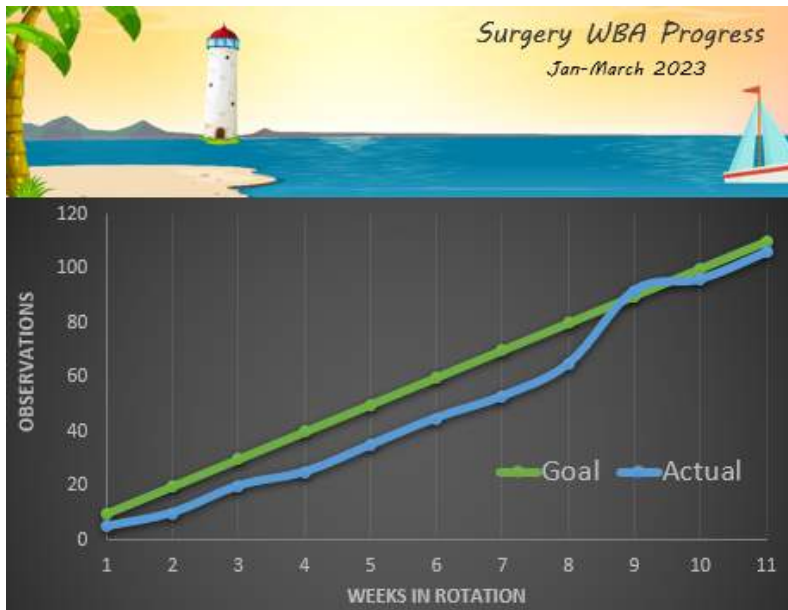
Changes to strategy and feedback to practitioners for Cycle 2

Following the ST meeting, the EPA description document underwent updates and was forwarded to the advisory panel for feedback. The feedback mainly consisted of wording adjustments and clarifications of minor aspects of the EPA details and assessment tools. In terms of addressing misconceptions and enhancing faculty and trainee development, several key points were discussed at the onset of the second implementation cycle during in-person team meetings. This included addressing trainees' misconceptions that individual observations were high-stakes, pass/fail events, and dispelling the notion that a low entrustment score equated to failure or that one 'poor' assessment would significantly impact a trainee's progress. Trainees were also advised that ideally, supervisors should be informed of an observation beforehand to provide feedback before completion of the activity, allowing them to pay extra attention to the trainee's performance across specified competency domains. Furthermore, queries related to reliability of competence assessment were clarified with supervisors, ensuring they understood how this was addressed through adequate sampling. In addition to the information given at the meetings, changes made to the strategy and efforts to address misconceptions were communicated by email to both trainees and supervisors at the beginning of the second cycle.

8.3.2 Cycle 2

The second cycle of implementation commenced on 1 January 2023 and was concluded by the end of March 2023. Out of 40 trainees, 32 (80%) managed to complete the minimum required three observations, meaning a drop in completion rate of 10% compared to the first cycle. In the figure below, the final weekly progress chart for this implementation cycle is displayed.

Figure 8.2: Progress chart for Cycle 2



The progress was noticeably steadier compared to the first cycle, although it still fell below the required standards until week eight. At that point, personal emails were sent to all trainees providing feedback on their completed numbers and the remaining required observations for the rotation.

Survey feedback after Cycle 2

Out of 40 trainees, 20 (50%) completed the feedback survey. Regarding the AIM portion of the survey, trainees rated the acceptability of the intervention at 3.9 out of five, unchanged from the previous cycle. Feasibility was rated 4.2 out of five, which was an improvement from 4 out of five in the previous cycle. Appropriateness remained the same at 4.1 out of five. Concerning the purpose of WBA, 70% of trainees said it was primarily for assessment, while 30% said it was primarily for education. Additionally, 40% of trainees reported receiving face-to-face feedback after most observations. Regarding the list of activities for assessment observation, trainees commented that emergency procedures, such as amputations and appendectomies, were difficult to get observations for as they often occurred after hours and were usually unsupervised. Regarding obstacles to implementation, trainees mentioned that some supervisors didn't support the new strategy and ignored requests to fill out observation reports.

Of the supervisors, 18 responded to the survey, resulting in a 41% response rate.

Acceptability was rated at 3.9 out of five (reduced from 4.4), feasibility at 4.4 (reduced from 4.6), and appropriateness at 4.1 (reduced from 4.4). When asked about the purpose of WBA, 33% said it was for education, 39% primarily for assessment, and 28% indicated both.

In terms of assessment tools, 80% of supervisors preferred the new tool for inpatient observations over the previously used adaptation of the OCAT. Regarding observation activities, some noted that outpatient observations didn't work well as trainees were often left unsupervised due to supervisors needing to be in theatre. In terms of obstacles to implementation, some supervisors mentioned that trainees didn't initiate assessments from their end and frequently failed to notify them beforehand of activities they wished to have observed.

Stakeholder team input after Cycle 2

The ST agreed to increase the number of observations to four per rotation. Additionally, it was recommended to abandon the O-SCORE and OCAT and adopt the simpler tool used for inpatient observations. Most of the supervisor members of the ST had experience with both sets of tools and found the simpler one more intuitive and easier to complete. They believed that a global rating, such as an entrustment-supervision scale with narrative feedback of the trainee's performance, was more effective than having multiple questions regarding discrete elements of performance.

Up to that point, the team had predominantly concentrated on what would be observed, such as selecting EPAs, and how they would be assessed by refining the assessment tools and digital system. Most of the effort had been directed towards refining the 'product', which was deemed acceptable at this stage and was expected to naturally evolve as implementation continued. The ST acknowledged that while efforts had focused on institutional change, they had not adequately addressed issues of personal change, including attitudes, beliefs, and fears among individuals. During the discussion, Satir's model of introducing change was referenced, emphasising the importance of conveying transformative idea(s) to both trainees and supervisors to advance from implementation towards integration.

The team brainstormed that from a supervisor perspective, the transformative ideas would be that workplace-based observations served as a powerful educational tool, and were thus a critical responsibility of supervisors for training competent, safe surgeons who would make a significant societal impact throughout their careers. Additionally, supervisors should be reminded that these observations provided crucial data for assessing trainee progress towards safe independent practice, something traditional knowledge focused assessments could not achieve. From a trainee perspective, the ST felt it was important to emphasise that workplace observations were primarily educational, offering feedback from supervisors on completing key clinical tasks with increasing autonomy and identifying areas for improvement. In addition, trainees had to understand that workplace observations allowed

monitoring of their progress, enabling early intervention and assistance if they required additional support.

Changes to strategy and feedback to practitioners for Cycle 3

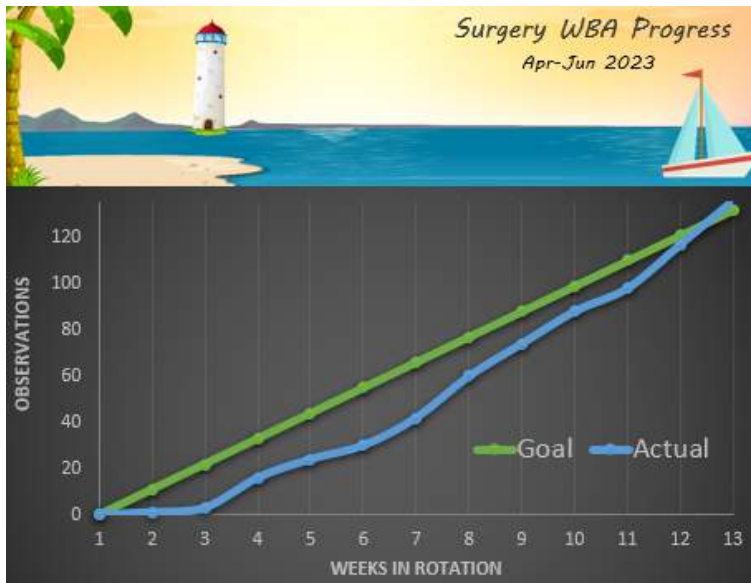
Following the ST meeting, the EPA description document underwent minor updates and was subsequently sent to the advisory panel for feedback. Once again, there were no significant concerns raised by the panel.

Supervisors were informed of the adjustments in the observation tool usage for outpatient and procedural EPAs during a team meeting early in the second cycle of implementation. Additionally, they were briefed on the transforming ideas by the HOD. Similarly, the HOD communicated the transforming idea to the trainee group at one of their weekly online tutorials. Both supervisors and trainee groups received an email update on the aforementioned changes, along with the key transforming ideas. In addition, constant communication via the team WhatsApp group served to reiterate the educational value of these observations. To further enhance the educational value, prompts were built into the smartphone system, to remind supervisors to provide in-person feedback. Finally, to improve accessibility, the links to request and complete observations, as well as to the dashboard, were built into a simple app that could be downloaded to participants' smartphones.

8.3.3 Cycle 3

The third and final cycle of implementation began on 1 April 2023 and finished by the end of June 2023. During this cycle, 31 trainees (78%) successfully completed the minimum required number of observations, a similar proportion to the previous cycle. Compared to previous cycles, the number of observations done throughout the rotation were more consistent, as illustrated in the figure below.

Figure 8.3: Progress chart for Cycle 3



Throughout this cycle, there were no special meetings or announcements. Instead, weekly WhatsApp progress updates were posted on the trainee group, along with automated (but personalised) weekly email reminders for all trainees. This cycle was also unique in that the first ever CC meeting occurred midway through the rotation.

Survey feedback after Cycle 3

Only 14 trainees (35%) responded to the survey. Regarding acceptability, the strategy received a mean rating of 4.1 out of 5 (up from 3.9). Feasibility increased to a mean score of 4.4 out of 5 (from 4.2) and appropriateness decreased to a mean of 4.0 out of 5 (from 4.1). In terms of survey feedback, some trainees noted that a lack of universal supervisor buy-in continued to hinder the integration of WBA into the training program. Motivating factors for requesting observations included the desire for feedback to improve performance, the opportunity to gain greater autonomy in performing procedures, and the fact that it was a requirement by the Division leadership. Suggestions from trainees included adding an option for 'other procedures' to broaden the scope of workplace observations. Additionally, trainees felt that supervisors should be encouraged to initiate observations when they believed the trainees would benefit from them.

From the supervisor side, there was a similar drop in responses to 14 (32%). The acceptability rating increased to a mean of 4.4 from 3.9 in the previous cycle. Feasibility increased to a mean of 4.5, while appropriateness increased to a mean of 4.2 out of five. Supervisors expressed concerns about the lack of universal commitment from trainees and their failure to request observations, which was limiting the integration of WBA into the training program. Suggestions from supervisors included designating recurring weekly

activities as 'observation events' to integrate them into weekly routines. Additionally, supervisors also felt that there should be more procedural options available, rather than the limited list of index procedures.

Stakeholder team input after Cycle 3

The ST agreed to increase the minimum number of observations per rotation to five, aligning with what both trainees and supervisors had deemed feasible within a three-month rotation. Additionally, the option of 'other procedure' was added to allow any procedure to be utilised for observation, supplementing the specified list of index procedures. This category could also inform the researcher the frequency of previously unlisted procedures that eventually could be included in the formal list of EPAs if sufficiently used. Amputation was replaced as a defined procedural EPA with colonoscopy/flexible sigmoidoscopy, considering that lower GI endoscopy procedures were considered to be both frequently supervised and among the top procedures performed by qualified South African surgeons (Chapter 6). Another suggestion from the ST was to encourage each unit to identify regular 'observation moments' in their weekly schedule, and finally, to implement a monthly reminder for supervisors to initiate observations.

After the previous cycle, efforts were made to communicate the transformative ideas effectively, to further enhance buy-in and participation. However, the ST concluded that the role of intrinsic motivators had not been fully explored. To address this, the team brainstormed ideas to leverage the intrinsic motivation of both trainees and supervisors. For trainees, a 'Trainee of the Year' award was proposed for the trainee with the most observations, including full funding to attend a local conference. Negative consequences for non-participation, which could impact the trainees' opportunity to progress to the next phase of training, were also considered. For supervisors, a similar award with funding for a local conference was suggested. Additionally, poor participation would be discussed at the annual HOD faculty review. Other motivators, such as Continuous Professional Development (CPD) points and public recognition (e.g. on the Division website) as 'excellent surgical trainers', were also considered for future action.

Changes to strategy and feedback to practitioners after Cycle 3

The recommended changes from the ST were actioned, with trainees and supervisors informed of the changes by email. Both groups were also notified of the introduction of awards for best participation. Additionally, the negative consequences of poor participation were highlighted. The final email congratulated participants and thanked them for their nine months of participation and feedback. It was crucial to acknowledge the success up to that

point and reassure them that moving forward, the strategy would remain unchanged without immediate further increases in assessment requirements. It was also important to indicate that going forward, WBA was being integrated into the training program.

Notes from the first Competence Committee meeting, midway through Cycle 3

In early May 2023, the first CC meeting took place. The committee consisted of the HOD, program convenor, and three other attending surgeons. The trainees' portfolios were distributed evenly among the committee members. Each trainee's portfolio, comprising workplace observations and end-of-block assessments in PDF format, was reviewed. Before the meeting, a document delineating the purpose and principles of the meeting was circulated among committee members. Based on the Canadian 'Competence By Design' template, this document was simplified (Appendix D8). Committee members were tasked with recording the number of observations per EPA as well as providing an entrustment level for each EPA, based on the recorded observations. During the meeting, this information was presented alongside an overarching assessment of whether the trainee's progress was considered adequate. Identified gaps in progress were discussed for further scrutiny and intervention. Discussions were particularly crucial for trainees on the cusp of advancing to the next phase of training or preparing for the final certification examination, to ensure their clinical competency for independent practice.

Several insights emerged from this first meeting. First, the process proved time-consuming for committee members due to the volume of data reviewed. Second, navigating through individual PDF documents, especially for trainees with large numbers of observations, proved cumbersome. Third, it was imperative to continuously reinforce the importance of basing decisions solely on documented evidence. Lastly, providing feedback to trainees, particularly in the early stages of WBA implementation, revealed potential pitfalls. While positive feedback was well-received, any identified concerns, even minor, elicited significant anxiety among trainees.

8.3.4 Performance over next three months

Although the nine-month study period was concluded by the end of June 2023, monitoring of participation continued through the established dashboard. Review of participation three months later, essentially a full year after implementation, revealed the impact of the changes made after the final cycle. As demonstrated in the figure below, the number of observations obtained in this cycle exceeded the required amount, indicating much broader uptake.

Figure 8.4: Progress report for three months after completion of the nine month study period



The figure suggests that all trainees managed to attain the minimum requirement of five observations. However, this was achieved by only 90%, or 36 out of 40 trainees (up from 78% in Cycle 3). The high numbers can be attributed to several individuals who obtained far more than the minimum required observations, demonstrating their enthusiasm for utilising these observations to improve their performance.

8. 4 Discussion

This chapter highlights the introduction of a WBA strategy through cycles of implementation and refinement. Throughout the cycles, many lessons were learned about what an acceptable, appropriate and feasible WBA solution might look like for postgraduate General surgery training in South Africa.

8.4.1 WBA can be implemented in our local context

The first and most important lesson learned is that WBA can be implemented for General surgery in a South African context. This is an important finding, considering the scepticism expressed about WBA in a recent SA paper (Ras et al. 2023). Key to the success of this implementation process was the importance of tailoring the strategy using lessons learned in other contexts (D. Nel, Marty, et al. 2024). These lessons from multiple sources provided guiding principles for the design of our strategy, ensuring that it was well-informed from the start. This is reflected in the AIM scores, which showed reasonably high mean acceptability, feasibility, and appropriateness ratings from both trainees and supervisors from initial

implementation. These ratings remained reasonably stable throughout the cycles of implementation and refinement, with mean ratings being between four and five.

Additionally, it appears that at these early stages, the perception of WBA was generally quite positive, in contrast with other settings where it has been less favourable (Mughal et al. 2023). This likely reflects that the strategy implemented was not simply copied from another context but was carefully designed based on lessons learned elsewhere and careful consideration of the local context. However, these early positive perceptions may also reflect the novelty phase of this new intervention and thus need to be reassessed in the future to determine whether the positive perception remains. Another way to measure participation and buy-in is through the number of observations achieved within a rotation. As can be seen from the post-study cycle, far more observations were achieved than the minimum required, reflecting much better participation by the end of the 12-month period. This shows that it takes time to implement WBA in a new setting (Stahl, Collins, et al. 2020), in our experience, at least 12 months. Thus, it is helpful to continue monitoring participation through the number of observations achieved and to regularly communicate and apply effort in the early phase of implementation.

During the study period, the first CC meeting was also held. This marked a significant milestone as the first of its kind for postgraduate General surgery training in South Africa and among the first for any postgraduate specialist program in the country. However, one important lesson learned from this process was that feedback to trainees on the summative element of workplace-based assessment may counteract early attempts at emphasising a formative focus. Therefore, deferring such discussions until WBA integration becomes routine within the team may be advisable.

8.4.2 Leadership support

The second lesson learned was the critical importance of ensuring active leadership support, which is consistent with what has been reported previously (Lindeman et al. 2021; Stahl, Collins, et al. 2020). We found that it was crucial to include the HOD from the planning phase with updates right throughout implementation, as certain resources needed can most effectively be unlocked with HOD support. These include human resources, which involve allocating time in personal schedules to drive and monitor the implementation process, financial resources, which cover funding for software and app development, and finally team development opportunities, which involve creating opportunities to engage with the various stakeholders. Another important contribution from the HOD was continuous input based on personal experience and wisdom as the strategy was designed and refined. The HOD had

an overview of all the moving parts, not only within the team, but also through contact with other training centres and regulatory bodies, for example the College of Surgeons of South Africa. In addition, this study found that while HOD was important, public support and endorsement for the introduction of WBA within a team were also highly beneficial. As part of this implementation process, the HOD reinforced support for the strategy at in-person meetings, online meetings, and through digital media, such as group WhatsApp messages. The importance of public support and endorsement by departmental leadership has not been clearly highlighted before.

In addition to leadership support from the HOD, it was also important to involve other senior supervisors and trainee leaders. This was initially done via the ST, allowing them become champions for WBA in their respective groups. An example of this occurred during a staff meeting, when one of the senior supervisors volunteered that it was very quick and simple for them to complete an observation report on their phone, and that they felt it added benefit to the trainees' learning. This had a clear impact in shifting perceptions among the supervisor group.

8.4.3 Simplicity

The next important lesson was the value of simplicity. Introducing a new observation system was a challenging endeavour, and keeping things simple and clear facilitated not only uptake but also the sustainability of such an introduction (Stahl, Collins, et al. 2020). The first example from this study was the use of a single observation form. Whereas we started with three observation forms, each unique to a particular clinical activity, feedback from the surveys showed that supervisors preferred a shorter, simpler, generic form. One advantage of a form that is simple and quick to complete is that it minimises workflow interruption as supervisors can complete the report in a very short time which has been shown to be a key factor aiding implementation (Moore, Young, and Hong 2017; Stahl, Collins, et al. 2020). It is still important, however, that enough information is generated for the trainee to receive adequate feedback, and for the CC to make high-stakes decisions.

The next example of prioritising simplicity was the selection of relatively few EPAs. The number of EPAs selected here was less than in other contexts such as the USA, Australia, Ethiopia, the Netherlands, Canada, Brazil, and India (American Board of Surgery 2021; Australian Board in General Surgery 2017; Het Concilium Chirurgicum 2021; Canadian Association of General Surgery 2022; Delbone 2022; Department of General Surgery, Sri Balaji Vidyapeeth University, n.d.). However, it was more than in the UK, Singapore, and Colombia (Joint Committee on Surgical Training 2023; Singapore Residency Advisory

Committee for General Surgery 2023; Domínguez-Torres et al. 2021), where index surgical procedures have not been defined as separate EPAs but rather incorporated under broader EPAs (D. Nel, Jonas, et al. 2024). Fewer EPAs may mean fewer actual assessments or observations required, depending on the defined minimum number for each. This allows for a slow and gradual start, avoiding overwhelm and early dismissal of the new initiative by users (Brasel et al. 2019; Lindeman et al. 2021). Assuring adequate institutional volumes of specified procedural EPAs is important when selecting EPAs for observation.

8.4.4 Assessment burden

Another key lesson learned was to keep the assessment burden as low as possible. Assessment quotas have been identified as one of the major contributors to poor engagement and lack of buy-in (Mughal et al. 2023). In the UK, this has led to the abandonment of minimum required numbers of assessments, opting instead for an individualised approach with the numbers being agreed upon between the trainee and their educational supervisor.

While we feel it is important that there should be a defined minimum requirement, numbers should be kept low. The value of getting broad input from supervisors and trainees on what's feasible in terms of numbers is really important. Allowing trainees and supervisors to influence this decision makes them co-creators of the strategy, and less likely that they would claim the burden to be too great in the future. It is also important to look to other assessment strategies and accordingly modify or reduce them (Stahl and Minter 2020). In our program, this meant adjusting the three-monthly end-of-rotation assessments so that the sections commenting on competence at managing in/outpatients and performing procedures were removed, so that these assessments instead focused on professional attributes and knowledge achieved during the rotation.

8.4.5 Formative-summative dilemma

With WBA, specifically in the context of programmatic assessment, the aim is to optimise the formative value through provision of feedback while simultaneously providing data points for summative decision-making at a future point in time (Bok et al. 2013). The most important part of a training program is the training or learning itself, and therefore, any assessment strategy should enhance this rather than detract from it. It has been described that the educational benefit perceived by trainees is a crucial aspect to improve engagement in WBA (Aryal, Hamed, and Currow 2021; Mughal et al. 2023). However, it is also important for supervisors to understand that their assessments contribute to high-stakes decisions

regarding trainee progress and certification. We were transparent with the trainees from the start, explaining that these individual observations were primarily low-stakes, formative events, but that the cumulative set of data would be used to track and review their progress periodically.

The survey showed that face-to-face feedback wasn't occurring regularly and that trainees primarily perceived the individual observations as assessments rather than educational events, which is consistent with what has been found elsewhere (Aryal, Hamed, and Currow 2021; Mughal et al. 2023). This may account for the lower AIM scores in trainees, especially regarding acceptability. We attempted to address this issue in various ways. This included frequent communication through in-person meetings and WhatsApp group messages to reinforce that individual observations were low-stakes and intended for educational purposes. Additionally, we removed all numerical ratings from our entrustment-supervision scales and included prompts encouraging feedback for the supervisors from the WBA smartphone app.

Despite aggressive promotion of the formative aspect of WBA, it was not fully realised, as reflected in the participant surveys. Potential reasons may include a lack of an established feedback culture and insufficient training for clinical supervisors on how to provide effective feedback. Additionally, there are potential time constraints, especially after a surgical procedure when a supervisor may leave the trainee to complete the procedure without having the chance to discuss the case. A potential lack of buy-in from all supervisors might also have contributed. Apart from continuing education about the formative value of WBA, more innovative strategies are required to enhance trainees' sense of control over how low-stakes observations are utilised for high-stakes decisions (Schut et al. 2018).

8.4.6 Fostering participation

Previous studies, particularly from the UK where WBA has been a mandatory component of surgical training since around 2007, have shown significant concerns regarding user perceptions of WBA (Aryal, Hamed, and Currow 2021; Mughal et al. 2023). These concerns include a lack of engagement by both trainees and trainers, a tick-box mentality, a lack of perceived educational benefit, and frustrations faced by trainees who do not have their observations signed off. The lack of buy-in and the tick-box mentality have even led to gaming the system, where supervisors provide their login details to trainees to complete their own reports (Mughal et al. 2023). This lack of authentic engagement limits the educational and summative value of WBA. Therefore, a major focus of our strategy was to foster participation and buy-in, which included prioritising feasibility and acceptability. This involved

co-creation by the trainees and supervisors of critical elements of the strategy; participants decided how many observations were reasonable during a rotation, how many EPAs there should be, and what they should entail. They also had a say in the assessment tools used and the functionality of the smartphone app.

Another strategy employed by the ST was to brainstorm transformative ideas related to Satir's change model (Satir 1991). These ideas included emphasising the educational value of direct observation and feedback for trainees and supervisors, as well as for supervisors, the role that these data points would play in confirming that trainees were competently progressing and exiting as competent independent specialists. These transformative ideas were widely communicated to promote integration of this new initiative into the training program. However, participation in this strategy, as reflected by the numbers achieved, only truly took off once the importance of intrinsic motivation was appreciated and leveraged. This included both positive and negative consequences for adequate participation in the strategy. The value of emphasising intrinsic motivation for WBA implementation has also been demonstrated in other disciplines (E. Collins et al. 2021). Therefore, there needs to be more emphasis on various ways to foster intrinsic motivation in both trainees and supervisors, in order to promote WBA implementation.

8.4.7 Limitations

This study had a number of limitations. First was the attrition in the survey response rate. While we started with a 63% trainee response rate and a 50% supervisor response rate, it decreased to a 35% trainee response rate and a 32% supervisor response rate in Cycle 3. This attrition may imply a selection bias, meaning that mainly 'early adopters' and the 'early majority' were responding (Rogers 2010). This was more likely for the supervisors, as those who had not done any observations would not have provided feedback as they had no experience to report on in the surveys. Conversely, trainees and supervisors who were satisfied with the system may have stopped providing feedback, feeling they had nothing new to add. An additional limitation with the surveys was that they were not properly validated, as per current guidelines (Artino et al. 2014). The authors could not find an appropriate validated survey published previously. Additionally, rapid changes from one cycle to the next made it challenging to perform a proper validation process for each new survey. While the wording and choice of questions were reviewed by the three study supervisors, no further validation processes were possible.

Another limitation was the interpretation of the AIM tool results. From Satir's work, we know that once new changes are introduced to a system, the system enters a period of chaos with

fluctuations in performance (Satir 1991). Therefore, using this tool repeatedly over brief periods may simply reflect these fluctuations. These results were also vulnerable to the same selection described for survey respondent attrition. Thus, in the short term, it may be more effective to monitor participation through the number of observations completed per trainee and the rate at which the minimum numbers of observations are completed, and rather use the AIM tool at longer intervals, perhaps every six or twelve months.

The final limitation to highlight is that the resources available at UCT may not be generalizable to other settings. The Division of General Surgery has a larger pool of potential supervisors compared to some of the other training institutions in South Africa. In addition, there are numerous subspecialist trainee fellows who can also act as supervisors for General surgery trainees. Finally, the WBA implementation process required significant planning and organisational time, and not every institution may have the human resources necessary to support implementation at the pace achieved in this study.

8.5 Conclusion

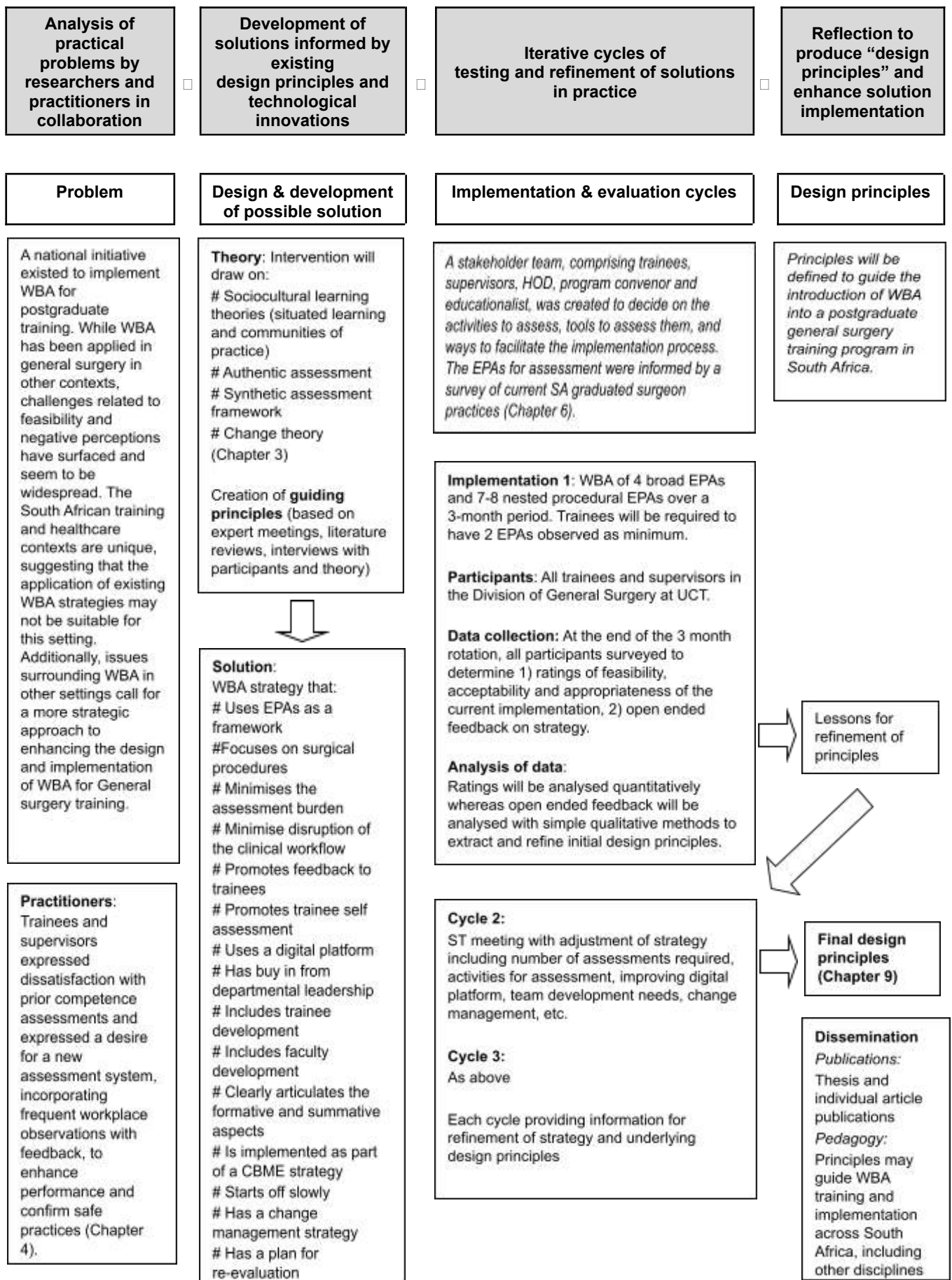
A carefully designed strategy for WBA was successfully introduced for postgraduate General surgery training in a South African context. Key elements for successful implementation included using guiding principles derived from multiple sources, including relevant education theory. In addition, it was crucial to combine insights from other contexts with the active involvement of a local stakeholder team, including supervisors and trainees, in the design process.

The cycles of implementation and refinement yielded several important lessons. These lessons can be used to modify the initial set of guiding design principles, leading to a revised set of principles for the design and implementation of WBA in the SA context. This is described in the next chapter. Although these design principles were derived and revised in a specific context, their potential broader application and the implications of other lessons learned during the implementation cycles are discussed in Chapter 11.

8.6 DBR flowchart after cycles of implementation

The design-based research flowchart in Figure 8.5 provides an updated overview of the thesis, after completion of three cycles intervention.

Figure 8.5 Thesis according to design-based research process after implementation phase



Chapter 9. Reflections on producing the final design principles

9.1 Rationale

This chapter describes the fourth and final phase of the design-based research (DBR) method. The aim of this phase is to reflect on the entire process, particularly the cycles of intervention and refinement, to produce a final set of design principles (Design-Based Research Collective 2003). The final principles have been divided into substantive and procedural principles (Plomp 2007). The former describes principles for informing the characteristics of the actual solution (or 'product'), while the latter focuses on how the solution was implemented longitudinally (the 'process').

Reflection on, and discussion of, the final design principles will be through a socio-cultural lens, as elaborated in Chapter 3. This perspective acknowledges that social relationships are essential for learning and proposes that learning occurs through the interaction between an individual and their social environment (Taylor and Hamdy 2013). As learning and assessment are intricately interconnected (James 2006), the assessment of authentic tasks in the workplace may also be considered through this lens. Through WBA, supervisors assess not only knowledge and skills but also compare trainees to an expected standard for other facets such as work ethic, professionalism, communication, teamwork, and leadership. In this way, supervisors continuously assess whether trainees are demonstrating the characteristics expected of members of their community of practice, enabling them to move from being peripheral participants to full members of the community (Wenger 1999). Therefore this lens serves to connect learning theories that underpin the role of WBA as a way of assessing the achievement of clinical competence with the role of serving as a tool to promote learning (Castanelli 2023).

9.2 Final design principles

This study was a 'developmental' rather than a 'validation' DBR project (Dolmans and Tigelaar 2012; Plomp 2007). Thus, the primary aim was to address an educational problem with a focus on the practicality of the intervention. The scientific output, therefore, is not a specific instructional theory but rather a broadly applicable set of design principles. These

design principles constitute a design theory or intervention theory as their theoretical yield (Wademan 2005; Reeves 2006). The principles described may allow for greater generalizability to other contexts, as opposed to merely describing the solution itself.

Table 9.1 lists the final set of revised principles along with the original design principles proposed at the start of the study. While none of the original principles were completely discarded, some were combined as new principles. In addition, three new principles were described. The first six final design principles are substantive, whereas the last nine principles are procedural. A discussion of each principle follows, with consideration of the education theory underpinning the lessons learned during the implementation phase.

Table 9.1: Final set of revised design principles and related original guiding principles, modified after the cycles of intervention

No.	Final revised design principles	Related original guiding design principle(s)
Substantive principles		
1	Select locally relevant EPAs	GP#2: Focus on surgical procedures
2	Formulate EPAs that are broad and inclusive	GP#1: Use EPAs as a framework
3	Use one simple assessment tool	GP#4: Minimise WBAs disruption of the clinical workflow
4	Select a feasible number of required observation events	GP#3: Minimise the assessment burden
5	Use a smartphone-based system to capture and aggregate data	GP#5: Promote feedback to trainees; GP#6 Promote trainee self-assessment; GP#7: Use a digital platform to capture and aggregate data;
6	Recruit a broad range of supervisors	NA - new principle
Procedural principles		
7	Start very slowly	GP#13: Start off slowly
8	Obtain authentic leadership support and endorsement	GP#8: Get buy-in from departmental leadership
9	Focus team development on practicalities	GP#9: Trainee development is essential; GP#10: Faculty development is essential
10	Emphasise the formative value of WBA when starting out	GP#11: Clear articulation of summative and formative purposes of WBA; GP#5: Promote feedback to trainees

11	Implement WBA as part of programmatic assessment	GP#12: Implement WBA as part of a CBME strategy
12	Integrate WBA observations into weekly work routines	NA - new principle
13	Utilise a flexible change management strategy	GP#14: Have a change management strategy
14	Ensure regular monitoring, follow up and communication	NA - new principle
15	Get regular feedback from multiple stakeholders	GP#15: Re-evaluate the strategy periodically

9.2.1 Select locally relevant EPAs

This principle recommends that the activities or targets for assessment in the workplace should be defined by locally or contextually relevant EPAs. Authentic assessment insists on outcomes manifesting as a performance or a product (Ashford-Rowe, Herrington, and Brown 2014). EPAs represent a synthetic framework for assessment, combining practice domains or intrinsic competencies with the necessary knowledge, skills, and attitudes needed to perform real-world tasks (Pangaro and Ten Cate 2013). This pragmatic approach sensibly assumes that complex social tasks require the simultaneous application of multiple domains of competence by the trainee. Thus, EPAs offer a strong connection with workplace activities.

However, it is crucial to ensure that the selected EPAs are relevant to the society where they are applied. There are numerous ways to achieve this, such as utilising a local expert panel or group, a Delphi consensus procedure, or less formal methods like surveys or logbook reviews to assess what practitioners are doing in the workplace (Hennus et al. 2024). For this thesis, we utilised a local expert panel (stakeholder team) with representation from trainees and supervisors, as well as an educational expert, to aid in EPA development. This was supplemented with a study looking at procedures most frequently performed by newly qualified surgeons in practice, to guide selection of the procedural EPAs (Chapter 6).

Authentic assessment of workplace activities implies that trainees are not just assessed for their worthiness to join a community of practice but also actively engage in the clinical space. By conducting the tasks they are being assessed on, they transform the community they are working in (McArthur 2023). Therefore, it is important that WBA, as is recommended for

authentic assessments, ensures the social value of the tasks being assessed. This aligns with sociocultural learning theories, which recognize the important influence of cultural and historical factors on practices (Gandamihardja and Nestel 2019). These theories acknowledge the significance of social relations in shaping the context in which learning and assessment are supported. The social context will therefore be unique to a specific cultural and societal milieu.

This does not downplay reviewing what others have done as a useful starting point. On the contrary, it is helpful to evaluate the EPAs that have been identified and described in other contexts (Hennus 2024). However, it is critically important that these are reviewed by members of the local community of practice, whether within a program or on a broader, perhaps national, scale. Failure to select tasks that are locally relevant compromises not only the validity of assessing whether competence has been achieved for that society but may also compromise the contribution that the assessment process may play in shaping and forming society, as trainees engage with and are assessed on authentic real-world tasks by their supervisors.

9.2.2 Formulate EPAs that are broad and inclusive

The next principle relates to both EPA selection and description. One factor which has negatively impacted the perception of WBA in surgery, is the administrative and assessment burden created by this strategy (Aryal, Hamed, and Currow 2021; Mughal et al. 2023). A large number of very specific EPAs, each needing multiple assessments by multiple supervisors at various points to provide an accurate picture of the trainee's competence for each task, is just not sustainable.

As EPAs deconstruct a discipline into units of practice that can be assessed in the workplace, these units form the basis of the minimum requirements for an independent specialist to practise safely and competently without supervision (Ten Cate 2005). A program must ensure that all the components making up this foundation have been seen, tested, and are sturdy enough.

To reduce the assessment burden and enhance the acceptability, appropriateness, and feasibility of a WBA strategy, the assessment burden must be minimised. One of the ways to achieve this is by limiting the number of selected EPAs. However, simply selecting an index subset of EPAs presents certain problems, such as trainees potentially only focusing on the index activities, especially procedures. This can be mitigated by making EPAs broader and

more inclusive rather than too narrow and specific. Keeping EPAs broad allows for a range of clinical activities to be included, preventing trainees from missing valuable learning opportunities for activities not listed. It also enables trainees to request observations or assessments on more complex or advanced activities, allowing them to challenge themselves. This aligns with the principle of authentic assessment, which emphasises challenging assessments (Ashford-Rowe, Herrington, and Brown 2014).

To illustrate this principle I will use an example from this study. Consider the EPA 'managing General surgery inpatients'. This EPA (Appendix E1) covers the management of inpatients with any pathology that General surgeons typically handle, including stable patients in the ward, those admitted during an acute intake, and acutely ill patients in the ward. This approach avoids limiting assessment to a subset of pathologies and instead focuses on the trainee's competence at integrating their knowledge with the necessary skills and tasks to manage both stable and acutely ill surgical inpatients. These tasks typically include checking and reviewing the medication chart, writing up fluids/nutrition support, giving clear instructions to the nursing staff, and communicating the day's plan clearly to the team and the patient.

Knowledge is thoroughly assessed through the College of Surgeons' primary, intermediate, and final written exams, so it is not essential that knowledge of all General surgery pathologies or conditions are assessed through WBAs (College of Surgeons of South Africa 2024). As mentioned, authentic assessment emphasises challenging assessments, and in surgery, the most challenging task is executing surgical procedures (Ashford-Rowe, Herrington, and Brown 2014). The prevailing strategy is to select a core set of procedures to infer competence for similar procedures. However, some countries have described grouping procedures together, though it is unclear how these are practically assessed.

During the implementation cycles, much effort was spent defining a core set of procedures. Feedback consistently suggested broadening the list to include more procedures, even less frequently performed ones. We added an option for 'other procedures' to allow any procedure beyond the specified core list to be included for observation. This provided more feedback opportunities for trainees and, during CC meetings, data from these other procedures offered valuable insights into trainee competence. We recognize this is an area where further work is needed to resolve the dilemma regarding index versus broader EPAs for procedures, and we are currently exploring a method of clustering/nesting similar types of procedures under broader EPA titles.

9.2.3 Use one simple assessment tool

There are a plethora of assessment tools that have been described for reporting on WBAs (Burch 2019). Many of these tools predate the EPA era and often use scales that include numbers or percentages. Initially, we started with three separate assessment tools specific to the broad categories of activities: inpatient, outpatient, and procedural. Ultimately, we consolidated these into one simple, generic assessment form for all EPAs. This approach had been recommended by one of the experts we interviewed before implementation (Chapter 1), but we initially did not heed this advice. However, during the implementation phase, we recognized the wisdom of this recommendation and adapted accordingly.

The key features of this assessment tool (Appendix D7) included a prospective entrustment-supervision scale to describe the level of supervision required and a narrative description of the trainee's performance, detailing what they could do with and without supervision. The form also recorded context regarding the observation and included space for feedback on what the trainee did well and where they could improve. Using a single form enhanced uptake by supervisors as they became familiar with it quickly. Its simplicity reduced the cognitive load and assessment burden for supervisors, who already had significant administrative and clinical responsibilities. The form was straightforward to understand and read, and the entrustment supervision scale aligned with what supervisors implicitly practise daily, thereby enhancing the tool's validity (Ten Cate 2020). The form's lack of multiple questions and sections for rating makes it quick to complete, minimising disruption to the clinical workflow. Supervisor preference for this simple form was evident during the implementation phase. CC meetings also showed that the data from the simple form, especially the narrative descriptions of performance, provided the necessary information to make high-stakes decisions regarding trainee competence and progress.

While different teams in different contexts may have their own ideas on how to modify this form, the principle remains to keep it as simple and short as possible, trimming away any excess that does not provide essential data required for both formative and summative purposes.

9.2.4 Select a feasible number of required observation events

High assessment requirements are one of the main issues contributing to the negative perceptions toward WBA in surgery (Mughal et al. 2023). If the assessment burden is

perceived to outweigh the benefits, WBA may devolve into a box-ticking exercise, undermining its value for summative decision-making and educational input.

Assessment requirements have largely been informed by psychometric theories related to reliability. In General surgery, several studies have attempted to determine the number of observations needed to reliably assess a trainee's competence for performing specific procedures (Beard et al. 2011; Williams, Kim, and Dunnington 2016; Williams et al. 2019). These studies have led to requirements ranging from three to 60 observations, depending on the context and individual procedure. The reliance on psychometric parameters to define reliability can result in a high assessment burden, depending on the number of activities that need to be assessed.

However, there is a growing movement to consider WBA beyond the psychometric paradigm, emphasising the value of human judgement in assessment (Schuwirth and van der Vleuten 2020; Hodges 2013). This shift represents a move from a behaviourist paradigm to a more constructivist, social-psychological approach to assessment (Govaerts et al., 2007). In this paradigm, assessment relies more on narrative descriptions and qualitative aspects rather than numerical metrics. The trustworthiness of narratives may be described in terms of credibility, dependability, aligning with the principles of validity and reliability, as articulated by Messick and Kane (Guba E & Lincoln, 1989). This modern approach to validity considers broader arguments rather than isolated psychometric parameters (Messick 1995; Kane 1992).

Although some have done away with minimum quotas entirely (Joint Committee on Surgical Training 2023), there may still be a need to set a minimum within a specific time period to ensure broad participation. While some early adopters will influence an early majority to engage in a new WBA strategy (Rogers 2010), a significant portion of the team, especially the trainees, will participate only if required. Having some degree of participation is necessary for all trainees to benefit from the formative value of workplace observations, and also to generate enough data points for the CC to make high-stakes decisions. We believe this number should be determined collaboratively with both trainees and supervisors to ensure the assessment burden is acceptable. This can be achieved by starting with a very low assessment requirement during the initial implementation of the strategy. Once most team members have some experience, they can suggest a reasonable number of observations within a defined period, such as during a clinical rotation/placement.

This approach enables the participants, who will be involved with the WBA strategy, to be co-creators of the strategy and take ownership of the assessment requirements. This reduces the likelihood of complaints about the feasibility of the requirements or their impact on clinical practice demands. While there may be a temptation from an educational perspective to set higher requirements to gather more data points for summative decision-making, this risks inhibiting the formative potential, which is crucial for participants to buy into the process, especially early on. In our study, supervisors and trainees suggested a mean number of five observations over a three-month rotation period, equating to 20 observations per trainee per year. This is similar to what has been suggested to be feasible by surgical trainees elsewhere (Mughal et al. 2023). It is always possible to gradually increase the requirement once the team is accustomed to the strategy and more invested in it, but setting difficult targets initially is ill-advised.

From a summative perspective, rather than counting whether a trainee has received enough 'level four' entrustment ratings for specific EPAs according to a predetermined numerical requirement, the CC members' wisdom can determine whether adequate data points are present. Competence committee members generally know both the trainees and supervisors who are conducting the assessments and can subjectively judge whether sufficient information or data has been presented to make an accurate and trustworthy decision regarding a trainee's competence for a specific EPA. This certainly does not mean that reliability is unimportant; the competence committee still must ensure adequate sampling (Swanson and Norcini 1989). However, whether this has been achieved adequately should depend more on the subjective judgement of the competence committee, rather than a mathematically calculated number. That being said, a low minimum required number of observations per EPA may still be advisable to provide some guidance, especially for inexperienced teams. For example, a CC may require at least three observations for high-stakes decisions (e.g. readiness for progression in training, readiness for certification), but acknowledge that more may be required depending on the trainee.

9.2.5 Use a smartphone-based system to capture and aggregate data

A comprehensive, fully smartphone-based system was crucial for the implementation of WBA in our setting. While paper-based systems have been utilised, they come with significant limitations and are discouraged (Marty et al. 2023). It is essential that the system can operate entirely on smartphones, as these devices have become integral to daily life, often replacing laptops.

When we initially implemented WBA, the forms were based on an online system, but access links were distributed through PDF documents and WhatsApp group posts. This method proved cumbersome. To streamline the process, we introduced a smartphone app that allowed trainees to request observations, enabled supervisors to initiate observations without waiting for links from trainees, provided a dashboard for all users to review their participation, and made the EPA description document widely accessible. Additionally, the app used instant messaging services, including sending reminders to supervisors to complete observations, as forgetting to do so limited trainee engagement and could induce negative perceptions (Mughal et al. 2023). Given the context, it was important for the smartphone system to have low data usage, as Wi-Fi access was not always available. It was also important to ensure confidentiality of information and overall low cost, as funding for app development was not available and our low cost option would be suitable in other settings with similar resource constraints.

Two important features built into the smartphone system included feedback prompts for supervisors and self-assessment prompts for trainees. The feedback prompts reminded supervisors of the value of providing face-to-face feedback after observing an activity, which was crucial for driving engagement and buy-in, especially from trainees. Feedback enhances the situated learning potential of WBAs. Supervisor feedback was also critical in guiding trainees from peripheral participants to full members of the community of practice. The smartphone app ensured that this information is elicited, as growth cannot occur optimally without trainees knowing what to do to improve their performance.

The self-assessment component required trainees to select their own perceived prospective entrustment ratings and identify areas for improvement (through narrative descriptions of what the trainees felt they did well and what they could do differently), before sending assessment requests. This allowed trainees to compare their self-assessment with supervisor feedback, including both the entrustment rating and identified growth opportunities. This approach aligns with sociocultural, and situated learning theories, which emphasise the cultivation of learning identities and the facilitation of self-assessment practices (James 2006).

9.2.6 Recruit a broad range of supervisors

The assessment burden on supervisors has been mentioned several times. Selecting a feasible list of EPAs and simplifying the assessment process and forms were effective strategies to limit this burden. Another strategy was to distribute the assessment load so that

it did not fall solely on senior supervisors (attending surgeons) but was shared among all the regular supervisors of trainees.

This distribution allowed for more data points from a more diverse pool of supervisors and included multiple raters, which aligns with one of the principles of programmatic assessment (PA) (Lambert W. T. Schuwirth and Van der Vleuten 2011). In our context, this meant including intensivists from the ICU team, where trainees rotate for three months. Supervisors from satellite training hospitals, fellows from subspecialist teams, and senior trainees who have passed their exams but are still completing their last few months of contract time were also involved. All these individuals were added to the assessment system, enabling trainees to request observations from any of them.

One characteristic of our training program, which applies to many others, is that trainees rotate through different units to gain the broad training exposure required for General surgery. During their training, trainees join multiple communities of practice. It is important to gather perspectives from each of these communities to gain a clearer perspective on the 'landscape of practice' which constitutes General surgery training (Etienne Wenger-Trayner et al. 2014).

Although not implemented in our WBA strategy, interprofessional input—such as from nursing or other allied health professionals—has been described (Ten Cate and Pool 2020). Competency-based education in health professions is relatively new in South Africa, and there is limited knowledge or expertise in other health professions. Due to the significant effort required to train surgeons and trainees, there wasn't sufficient time or resources in this project to incorporate interprofessional inputs. However, this is something to consider for the future. Certainly, the perspectives and input from other team members would be valuable. This input might not necessarily come from direct observation but could be integrated through multisource feedback, as has been described in other contexts (Ten Cate 2024).

9.2.7 Start very slowly

The first procedural principle is to start very, very slowly. The emphasis on the word 'very' emphasises that the implementation of a new WBA strategy should be extremely gradual, and more so than initially thought. This advice came from an expert from the Netherlands who was involved in the nationwide implementation of WBA across all postgraduate training specialties. Despite thinking that our initial plan was conservative, the expert advised us to

start from an even lower base due to the challenges of implementing such a significant change within a team.

Starting with a small number of EPAs, equates to a low assessment burden in the early phases of implementation. It takes several months to conduct adequate faculty development and for the majority of the team to understand and get on board with the new strategy (Stahl, Collins, et al. 2020). Streamlining digital systems and clearing up misconceptions also needs time. Introducing a significant assessment requirement or burden too early risks cognitive overload and may create perceptions of overwhelm, which could negatively impact the long-term acceptability and sustainability of the intervention. It is better to start slow even if at the cost of not immediately meeting the educational requirement for data points necessary for high-stakes decisions. The focus should be on getting the team on board and demonstrating the feasibility of the new strategy.

We began with an assessment requirement of two observations per trainee per three-month rotation. While this was insufficient for providing adequate data points for a CC assessment, the initial focus was not on summative assessment but on familiarising the team with the process. In the second cycle, the assessment requirement increased to three per trainee per rotation, and both supervisors and trainees indicated they could handle more. Consequently, the median number was set at five, which is what we maintained. Imposing an unmanageable requirement early on and then having to scale back is not an optimal approach for gaining full team support.

9.2.8 Obtain authentic leadership support and endorsement

Strong leadership support is essential for the successful implementation of a new assessment strategy (Stahl, Collins, et al. 2020; Lindeman et al. 2021). However, simply having support in the form of remote endorsement without active participation from leaders will jeopardise a project. We recognized that participation improved dramatically when there was public endorsement from leaders in the department, especially the HOD. We utilised this support in both digital posts and in-person and online meetings.

In the surgical community of practice, the HOD and senior supervisors hold significant influential roles in determining the community's activities and shaping perceptions. Public endorsement from these leaders was considered an essential part of the change management approach. While some senior consultants or supervisors may have been early adopters and could influence the early majority (Rogers 2010), it remained paramount that

high-level management was convinced of the necessity, benefit, and feasibility of the assessment strategy before it was implemented.

In our study, the HOD was part of the stakeholder team that designed the strategy, maintaining a continuous, active role in its design and implementation. Without this degree of support and endorsement, implementation may have been far more difficult or could have faltered entirely. The HOD's involvement ensured that the strategy was not only supported in principle but actively championed, fostering a positive environment for change and enhancing the likelihood of successful adoption of WBA in the team.

9.2.9 Focus team development on practicalities

One of the lessons learned during the implementation phase was to focus more on the logistics of what trainees and supervisors needed to do, rather than trying to explain the underlying concepts or theory. Participants essentially wanted to know: "Okay, seems it's important that this is done, but what do I have to do? How does this affect me?" Despite efforts to create detailed presentations on CBME and PA, as well as leaflets and documents describing the EPAs, it was clear that most participants did not read these materials or even review the EPA descriptions. While it is crucial for both trainees and supervisors to understand why WBA is necessary and why they should participate, the theoretical details of the strategy were of limited interest to most participants.

For supervisors, after communicating the importance and benefits of WBA for trainees, supervisors, and society (Satir 1991), the focus should shift to logistics. This includes how to give feedback. From a sociocultural perspective, for situated learning to take place, there must be meaningful, quality feedback (Castanelli 2023). Most supervisors had neither experienced this nor received formal training in giving feedback. It was also important for supervisors to be trained on how to use the assessment tools, with live demonstrations being particularly helpful from a learning perspective. This also showed supervisors how simple and quick it could be to complete an observation report.

Faculty development is crucial to improve the quality of human judgement needed for assessment of authentic workplace tasks (Wiggins 1990). In addition trustworthiness is a key principle of authentic assessment (Ashford-Rowe, Herrington, and Brown 2014). The role of the assessor is thus vital for a valid assessment. Factors such as cognitive biases, cognitive load restrictions, and assessor fallibility can all threaten the validity of workplace assessments (Schuwirth and van der Vleuten 2020). Additionally, leniency bias, halo effect,

and significant variability between supervisors as assessors might occur to a greater degree if faculty development is inadequate (Pangaro and Ten Cate 2013). Thus, these issues need to be addressed during faculty development.

While most of the effort for team development focused on the supervisory side, it was also important for trainees to understand the purpose of WBA, how to request observations and use WBA to build their self-assessment capacity. However, the most critical part of trainee development in the context of WBA was conveying the educational benefits. Very few trainees were willing to subject themselves to assessments unless they could see the educational benefit. Therefore, it was incredibly important for trainees to understand and buy into the educational value they could derive from participating in WBA.

9.2.10 Emphasise the formative value of WBA when starting out

Situated learning, as described by Lave and Wenger, suggests that expertise develops when participants actively engage in community activities (Lave and Wenger 1991). In this way, learning occurs through immersion in an environment with a group sharing a common goal. One of the principles of authentic assessment is that it emphasises the value of including opportunities for discussion and feedback (Ashford-Rowe, Herrington, and Brown 2014). Therefore, authentic assessment of workplace activities can enhance the situated learning experience within a community, as its members engage both as recipients and deliverers of authentic assessments. That is the theory. However, in practice, it requires significant effort to convince trainees of the educational value of being assessed. Assessment invokes significant anxiety in trainees (Ott et al. 2022; Schut et al. 2018). Traditionally, performing poorly on an assessment, or 'failing' it, had or was perceived as having dire implications for progress. Despite our reassurances, trainees persistently felt that individual observations were primarily for assessment rather than observations for learning.

Several attempts were made to limit the perceived test anxiety and high stakes as much as possible. This included using the word 'observations' instead of assessments, and describing the strategy as workplace-based 'observation' rather than workplace-based 'assessment'. We also removed all numerical scales or levels from the assessment forms, using only narrative entrustment supervision scales and narrative descriptions of performance. The entrustment ratings were not even labelled 'A' to 'E' but rather were presented as simple bullet point statements.

While it is important to be transparent about how individual assessments will eventually contribute to summative decisions, utilised summatively, it is best to defer focusing on the summative or high-stakes component until the learning value of observation and feedback has truly taken a foothold in the team. This takes considerable time and patience—at least a year in our case. Trainees and supervisors needed to believe that the new system, which adds to their cognitive load, workload, and administrative duties, had real benefits for them. This is consistent with findings from other studies (Mughal et al. 2023; Aryal, Hamed, and Currow 2021). Other potential ways to de-escalate the perceived high-stakes situation, which were not introduced during the implementation phase of this study, will be discussed in the following chapter.

9.2.11 Implement WBA as part of a program of assessment

This principle may seem obvious to those who are familiar with CBME. Certainly, when one understands CBME (Van Melle et al. 2019) and PA (Lambert W. T. Schuwirth and Van der Vleuten 2011), it seems hard to imagine WBA functioning outside this framework. However, for those new to a competency-based approach to education, these terms may be confusing at first, and the importance of PA for the implementation of WBA may not be initially appreciated.

PA embodies a systems approach that aims to integrate assessment holistically across the educational continuum. At its core, PA focuses on assessment for learning rather than only on assessment of learning (Lambert W. T. Schuwirth and Van der Vleuten 2011). Thus, it emphasises how assessments should be embedded in the learning process to promote feedback. Progression and certification decisions remain important. However, with PA, they are grounded in the triangulation of assessment data collected longitudinally from various sources.

Practically, the key way that PA allows WBA to realise its educational potential is that it enables individual data points to be primarily low-stakes, formative events. An assessment event is rarely without any perceived stakes (Schut et al. 2018). However, PA allows the individual observations or assessments to be low-stakes, and then when high-stakes decisions are made, the data can be reinterpreted at that time. Not implementing WBA as part of a PA strategy would mean that teams may try to turn individual assessments into mini-tests with scores that can be utilised for some kind of high-stakes calculation to be made.

PA also integrates different assessment types longitudinally. WBA is not a magic bullet for trainee assessment; it has a specific role in providing direct observations of specific moments in time, focusing on the trainee's ability to execute key workplace tasks independently. It is not possible to capture the breadth of theoretical knowledge that a surgeon needs to have in order to assess and manage the spectrum of General surgery patients using a feasible number of workplace-based assessments. Therefore, modalities like multiple-choice questions, which allow for broad sampling of knowledge in a more feasible manner, still have a place, as is the case with the College of Surgeons' primary, intermediate, and final exams (College of Surgeons of South Africa 2024).

Similarly, there may still be a place for portfolio or case-based discussions for conditions or scenarios that may not be commonly encountered in a manner that would enable direct observation in the workplace. In addition, traditional end-of-rotation assessments or multi-source feedback may retain a role in providing a longitudinal perspective from multiple sources (supervisors or colleagues) for the spectrum of encounters between designated workplace-based assessment events. These are especially helpful in commenting on other important competencies like professionalism, collaboration, and communication. However, it may be necessary to reduce or modify these other assessment modalities to avoid overload (Stahl and Minter 2020). An example of the end-of-rotation assessment, which remained as a longitudinal assessment modality while observation of EPAs were introduced in this team, is included as Appendix E2.

Finally, it is important to be transparent about how multiple low-stakes observations are gathered to make high-stakes decisions down the line. However, it's not necessary for everyone to understand the details of how the CC works. It is also advisable to defer the CC meeting's high-stakes function until observations are fully integrated and the formative focus has been well established.

9.2.12 Integrate WBA observations into weekly work routines

Both trainees and supervisors reported in the surveys (Chapter 8) that they sometimes simply forget to request or complete observation reports. This design principle suggests that WBA should be integrated into the team's weekly work routine. For example, most teams have a weekly academic 'Grand Round' where more time is spent on bedside teaching. This could be a useful weekly event where one or more trainees receive an observation on their inpatient management. Surgical teams usually have at least one theatre list a week, which could also serve as a weekly event where a trainee receives at least one observation.

Another reason why regular events are important is that if observations are not designated from the start of a rotation, trainees tend to defer requesting them until the last few weeks to demonstrate better performance (Huffman et al. 2021). This practice reduces the formative potential of receiving directed feedback throughout the rotation. Although trainees should be encouraged to request observations, the responsibility for integrating WBA into weekly routines should be delegated to supervisors. Having a system that allows supervisors to initiate observations without trainee requests is crucial (Stahl, Collins, et al. 2020). It must be easy for supervisors to find the link to submit an observation report. To this end, we created a supervisor app, which has evolved to include many features but was primarily designed for supervisors to easily find the link and record observations. Making WBA a regular part of the team's weekly activities can help it become a habit and is more likely to be sustained in the long term. In time, as WBA becomes a frequent feature in the team's weekly activities, it is more likely to be integrated and accepted as part of the community's standard working rhythm.

9.2.13 Utilise a flexible change management strategy

This is arguably the most critical principle for the introduction of WBA. Although a tremendous amount of energy was poured into writing and reviewing EPAs, developing or selecting assessment tools, and other substantive parts of WBA strategies, the most challenging aspect of implementing WBA in surgery was getting wide participation and buy-in (Mughal et al. 2023; Aryal, Hamed, and Currow 2021).

WBA introduction represented a major change to a system or surgical team, the magnitude of which must not be underestimated. Almost two-thirds of change projects reportedly fail, mainly due to poorly motivated staff and insufficient communication factors linked to the implementation plan (Higgs and Rowland 2005; Nelson-Brantley and Ford 2017). It was crucial in launching a new innovation like this to be grounded in the principles of change research to leverage the existing body of knowledge developed by experts or scholars in the field (Reinholz and Andrews 2020). Doing so also meant that the findings would be more generalizable, building on what is already known in the field.

There are a number of different change strategies for guiding WBA implementation, and each may have a role to play at a specific time point or for a specific purpose. As with PA, there is not a one-size-fits-all strategy, and the different strategies have to be deployed at the correct time to optimally facilitate the required change. We found that John Kotter's model

was helpful in the beginning as it is very practical and provided a logical sequence of steps to initiate the process (Kotter 2009). Kotter's model emphasises the importance of creating a sense of urgency to create space for change to enter the established historical status quo. It also stressed the importance of building a guiding coalition in the early phases, which, in our case, was a stakeholder team to help drive, champion, and design the process. The model also describes enlisting a volunteer army of champions that can help disseminate the new intervention and affect attitudes towards it. This step can be linked to diffusion of innovation theory, where the champions can be considered the early adopters who may then exert influence on the early majority, and once they're on board, the late majority will follow (Rogers 2010). Thus, the first four steps of Kotter's cycle provided a useful starting point and really assisted a team in getting a team off the ground.

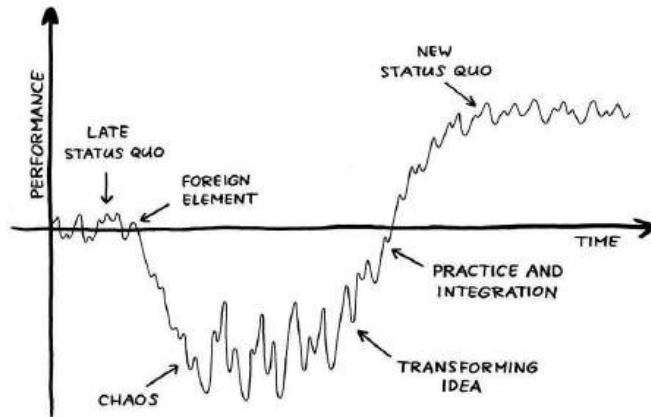
Figure 9.1: Kotter's cycle of change (Kotter 2021)



However, a weakness of Kotter's model is its limited emphasis on personal change, which is important when considering the fifth step in the cycle, i.e. removing barriers to enable action. These barriers are better explained by other change models, such as the model proposed by Virginia Satir (Satir 1991). Her model, similar to Bridges' model (Bridges and Mitchell 2000), has the advantage of not just giving indications of what needs to be done, but also describing the change process to give insight to the change agents of what to expect and what to do. In addition the model appreciates the importance of personal change and ensuring that individuals truly understand why it is important to buy into the new initiative i.e. the 'transforming idea'. We had to identify and brainstorm what the transforming ideas would

be for both supervisors and trainees to convince them that WBA was worth investing in. This was then communicated widely to trainees and supervisors.

Figure 9.2: Satir's change model



Virginia Satir Change Curve © Jurgen Appelo

(<https://www.flickr.com/photos/jurgenappelo/5201852636>). CC-BY 2.0

In addition to Satir's model, Chip and Dan Heath's model of the rider, elephant, and the path illustrates very eloquently the importance of addressing personal change, especially the power of intrinsic motivation in driving change on a personal, individual level (Heath and Heath 2010). It may be enough for some to describe how a new strategy like WBA benefits the system and society, but many need to see how participation will benefit them, and what the negative consequences of non-participation may have (E. Collins et al. 2021). We therefore introduced incentives for trainees and supervisors by rewarding best participation but also consequences for poor participation. Although the focus was winning hearts and minds, ensuring full participation required some form of enforcement. We therefore made participation for trainees a compulsory part of our program and included it in the Faculty Handbook, which introduced negative implications for poor participation, impacting trainees' ability to progress and complete the training.

Figure 9.3: Heath's elephant, rider, path model

Keys to behavior change

Direct the rider

Give clear direction, ensure understanding of why change is necessary

Motivate the elephant

Leverage intrinsic motivation, find the emotional connection

Shape the path

Reduce obstacles, modify the environment to make the journey easier



Adapted from (Heath and Heath 2010)

Introducing change is not simply stepping through a door with transformation from one state to another, but rather it is a long-term process. Satir's model demonstrates that when a new change is introduced, the system will enter a chaos phase where performance will be reduced until integration occurs. It is therefore important, as Kotter's seventh step states, to sustain the momentum.

9.2.14 Ensure regular monitoring, follow up and communication

This principle is a crucial part of the change management process, but is significant enough to be a standalone principle. Introducing WBA was akin to raising an infant: a lot of intensive support was required in the beginning, and although the degree of support lessened over time, constant monitoring, follow-up, support and oversight are needed in the long term (C. I. Anderson et al. 2018).

According to Satir's change model, the chaos phase, where there is a reduction in team performance, is an important period for intensive engagement. This is especially true for communication, aiming to shorten the duration of this period and reduce the degree and length of performance decline (Satir 1991). However, reaching the integration phase does not necessarily mean that the new status quo will be self-sustainable. Without ongoing communication, there is a tendency for the system to regress towards entropy, as per Newton's second law of thermodynamics (Zivieri 2023). Clinicians, who are chronically stretched by service delivery demands, will initially view an educational addition as extra work, not yet a habit, and it required persistent monitoring and reminders to facilitate embracing the change.

For us, this meant sending weekly reminder emails to the trainees and ensuring easy and constant access to the links to request observations. It also meant consistently expressing appreciation for supervisors participating. Additionally, it required following up with the trainees to ensure they participated in every rotation. While some managed to get the required observations, there was a proportion who forgot or neglected this part of their training and needed to be reminded. Of course, the CC meeting, which for most teams occurs every six months, allowed for a more detailed assessment of the number of data points. However, the time between CC meetings was too long to alert trainees that they were not benefiting from the formative opportunities that WBA provides. It also meant that the CC may not have had enough data points to decide whether trainees were on track and how they could have been assisted in their path towards independent practice.

It is therefore necessary for the individual or team that has oversight and is driving the implementation process to constantly monitor and communicate. To this end, a dashboard of participation is quite helpful. This allows one to have oversight of the number of observations done by trainees over a defined period, as well as the types of activities that have been assessed and those that have not.

9.2.15 Get regular feedback from multiple stakeholders

The final principle emphasises the importance of co-creation and ownership of the strategy in the long term. Initially, input from all stakeholders was crucial during the initial implementation phase, but maintaining this collaborative approach remained important over time.

One of the principles of authentic assessment is emphasising the collaborative aspect of assessment (Ashford-Rowe, Herrington, and Brown 2014). This aligns with the concept of situated learning, which considers evaluation or assessment to be a continuous and dynamic process that not only assesses learner progress but also evaluates teaching strategies and the learning environment (Mclellan 1993). Thus, when assessment is combined with learning, it acknowledges that knowledge is situated within a specific community of practice. Over time, sustained interaction within the community, including its assessment practices, results in a shared repertoire of resources, including experiences and tools (Gandamihardja and Nestel 2019). This ensures that the strategy functions well in the context where it is applied and remains adaptable as the community evolves.

Feedback can be obtained in various ways, including sending out surveys to both groups and eliciting feedback at meetings, such as trainee committee meetings or regular supervisor meetings. Feedback may also be elicited opportunistically, for example, when a specific trainee struggles to reach the minimum required observations or is not getting any observations of a particular EPA. This may identify issues within the specific unit or system that need to be addressed to make the process easier to engage with for the trainee and/or supervisor, i.e., removing barriers to participation. One may also use the AIM tool, used in the implementation phase of this study, to specifically monitor trends in acceptability, appropriateness and feasibility over time (Weiner et al. 2017).

It is important to get input from the department leadership, including the HOD and senior supervisors, as well as from the trainees, to ensure that the formative value is continuously realised and improved upon. For supervisors, it's also important to ensure that the system is as easy as possible for them to engage with and that the assessment burden remains manageable. Keeping an open mind and having the flexibility to change with input from participants is key (C. I. Anderson et al. 2018). Competency-based medical education, PA, EPAs, and WBA are all topics of ongoing research internationally, making the field ever-evolving with new insights that may improve the understanding and implementation of WBA. Therefore, it is important to stay up to date with the literature or engage in a community where issues related to WBA are discussed.

9.3 Other outputs

The final set of design principles represents the primary output of this DBR study. However, there are also other potentially valuable outputs from a DBR study, besides design principles (Herrington et al. 2007; Plomp 2007). The first is related to the solution itself, i.e., the WBA strategy and its elements. This includes the list of selected EPAs, as well as the EPA description document that outlines the specifications, limitations, competencies, risks of failure, and assessment strategy for each of the General surgery EPAs in this context. In our context, this document may provide a foundation for the national discussion on WBA for General surgery in South Africa. Although the smartphone app was designed before the study was initiated, the fact that a low-cost platform could be used in this context may provide ideas and inspiration for other low- and middle-income countries where resources to invest in an expensive digital app platform for WBA may not be available. The locally modified CC guide may also assist others who have started with WBA implementation in South Africa to incorporate WBA into a PA approach. Another example is the simple

assessment form that was refined through input from the participants. It has been demonstrated to work in this context and therefore may be considered by others who wish to implement a simple and effective tool.

In addition to the solution and its elements, a second set of outputs are related to the development of participants through the DBR process (Herrington et al. 2007; Plomp 2007). This includes the research team, who gained experience with the DBR methodology, especially in the context of a doctoral thesis, and a more expanded understanding of learning and assessment theory and principles. The members of the stakeholder team were exposed to the concepts of change agency and change theories, as well as gaining a greater depth of understanding of EPAs and competency-based education. More in-depth team development occurred with this core group of trainees and supervisors, enabling them to make the decisions regarding design and implementation that were required. For trainees, participation in the process exposed them to CBE concepts like intrinsic competencies and the opportunity to receive feedback on the performance of daily workplace activities. Supervisors were similarly exposed to CBE concepts as well as to principles of giving feedback. Finally, the Postgraduate Committee, which was a separate group from the stakeholder team that drove the process, developed their understanding of PA and how high-stakes decisions are made with the collated individual low-stakes observations.

9.4 Conclusion

The description of the final set of design principles and other outputs from the study concludes the fourth and final phase of the DBR process. The thorough discussion of these principles through a socio-cultural lens, and the fact that the principles are based on existing theory, may assist others in refining or designing their own strategies. Implications for those outside the Division of General surgery at UCT are discussed in the final chapter.

The next chapter, however, discusses the remaining practical and conceptual challenges around WBA, both within General surgery and beyond, and explores potential ways to overcome them.

Chapter 10. Addressing remaining practical and conceptual challenges in workplace-based assessment: in surgery and beyond

Note that this chapter is based on the following publication: Nel D, Marty A, Frick S, Hennis M, Linsenmeyer M. *Addressing practical and conceptual challenges in the implementation of workplace-based assessment*. In: ten Cate O et al. (Eds). *Entrustable Professional Activities and Entrustment Decision Making in the Health Professions*, Chapter 20. [2024] Ubiquity Press.

10.1 Introduction

Previous chapters have focused on designing, implementing, and refining a local WBA strategy, drawing lessons from previous experiences with the implementation of WBA in the field of surgery. The emphasis of the locally designed strategy was on feasibility and acceptability, which were identified from the literature review as the major concerns with WBA implementation in surgery thus far. However, there are other aspects of an assessment strategy that are also important to consider. The 2018 Ottawa Consensus Statement for good assessment includes seven components (Van Der Vleuten 1996). These include validity, reliability, and equivalence, which are related, and along with acceptability and credibility, can be discussed from the perspective of a validity argument. Feasibility was emphasised in this work, but other dimensions of feasibility can also be commented on in a broader sense. The educational effect of the assessment strategy is also a key consideration, as is the catalytic effect, which refers to how the assessment strategy may enhance the overall educational process and curriculum.

At the end of this local study, some practical and conceptual issues persisted, especially those related to the other components of a 'good' assessment strategy. Many of these remaining issues are common to other disciplines and settings (Massie and Ali 2016). Based on my work with the implementation of WBA in South Africa, I was invited to contribute a chapter to a book on EPAs, edited by Professor Olle ten Cate. The chapter is written from the perspective of a low-resource environment, where many initially believed that implementing WBA would not be feasible (Ras et al. 2023). Several colleagues from

high-income countries provided input to ensure the chapter would be broadly applicable to all settings, while still emphasising the low-resource context. The goal was for the chapter to be particularly helpful to those in low-resource regions who wish to implement WBA, while remaining relevant to high-income settings where WBA may already be established. Although there is much to learn from high-resource settings due to their longer experience with WBA, the perspective from a low-resource setting, as presented in this work, may also offer valuable lessons for high-resource environments, demonstrating that we can learn from each other.

Therefore, this chapter takes a step back from the local context to provide a broader commentary on common challenges related to WBA, and suggest ideas to overcome them that may apply to various settings. These issues have been identified based on lessons learned from this thesis, discussions with colleagues outside of surgery and in other countries, and trends forthcoming from recent publications on the topic. The chapter also identifies areas where further research is needed, both in our training program and in general.

The following topics are discussed in this chapter:

1. Concerns regarding validity and the validity argument.
2. Limitations in human resources and the impact this has on feasibility.
3. The lack of interprofessional inputs for direct observations.
4. The tension between the formative and summative intents of assessment.
5. Issues related to autonomy provision within training and how this is related to assessment.
6. The need for data collection and management of data points of WBAs.
7. Issues specific to low-resource settings.

Finally, the chapter concludes by discussing curricular misalignment that may be introduced through incorporating a new assessment strategy.

10.2 Validity

A number of issues with the implementation of WBA are related to limitations in the validity argument. Table 10.1 summarises some of the challenges that may be addressed in WBA, in the context of Kane's validity model.(Kane 1992)

Table 10.1: How the validity argument in WBA can be undermined by practical challenges: some examples.

Inferences in Kane's validity model (Kane 1992; Cook et al. 2015)	Purpose of the inference	Examples of practical challenges to be solved
Scoring	Judgement and scoring of observed performance should reflect the quality of this performance	Observers (often clinicians as raters) who do not have a good understanding of how to judge and report trainee performance and have little time or interest to be trained; tools used are not construct-aligned to a discipline
Generalisation	Multiple scores of similar activities should provide a fair picture of required competence for that activity	High assessment quota required; however, activities are infrequently observed
Extrapolation	Required competence should hold across all possible or relevant contexts	Activities are observed in one context or by one observer only
Implications (consequences)	The summative decision of entrustment or progress/certification is warranted, as associated risks are acceptable	Summative decisions are made in a too simplified manner, leading to substandard performance with little supervision; assessment burden on students, supervisors, and educational system

In terms of scoring, supervisors are frequently confused about the high stakes/low stakes conundrum related to the dual-purpose use of WBA. In addition, many have a poor understanding of how to judge a trainee's performance using WBA tools or how to provide high-quality feedback, and often lack the time or the interest to be adequately trained (such as frame of reference or performance dimension training). In terms of generalisation, although multiple observations should give a clearer picture of a trainee's competence, this may result in high assessment quotas required per trainee. With service pressures and the service burden in the clinical workspace, workplace activities (defined as EPAs) may not be observed frequently enough to enable trustworthy high-stakes decision making. In terms of extrapolation, although WBAs are grounded in authentic clinical situations, performing assessments in one training or clinical context only, may not necessarily translate into different practice situations or contexts trainees may find themselves in. Finally, in terms of implications or consequences, summative decisions may be made in a too simplified manner under duress from service delivery pressures or due to inadequate or low-quality assessment data for proper high-stakes decision making. In addition, there are also

unintended consequences on the trainees, the faculty, and the educational system from an assessment that requires significant input and may add to the administrative burden of all concerned.

Often, criticism regarding the validity of WBA stems from approaching it through a quantitative psychometric lens (Govaerts and van der Vleuten 2013). However, educators are increasingly realising that this framework or lens may not be as important or relevant as previously thought. As discussed in earlier chapters, a shift in understanding learning and assessment from a socio-cultural perspective, is making it more clear that competence and assessment are highly dependent on the context in which they occur. A more context-specific approach to validity from an interpretivist perspective may allow the generation of trustworthy evidence through sound validity argumentation (Govaerts and van der Vleuten 2013). These arguments provide defensible analyses of the components that can be utilised to support high stakes decisions with regard to trainee competence (Touchie et al. 2021). It is also important to determine who the audience is that will judge the argument, i.e., where validity decision-making is situated (Kinnear et al. 2024). Therefore, the validity argument for General surgery at UCT may look different compared to General surgery in another country.

The validity concerns identified in Table 10.1 are fairly broad, and the onus rests on individual teams or educational bodies to determine who the validity argument is for, to combine or generate the applicable evidence for that specific context, and to deliver the argument using modern approaches to validity, such as those proposed by Kane and Messick (Kinnear et al. 2024). Collating and further developing the validity argument for WBA in General surgery, both locally and more broadly, remains an area for future research.

10.3 Human resources in the clinical teaching environment

International and local critics of WBA often highlight its time-consuming nature, which translates into increased costs and adds to the administrative burden within an already demanding work environment (Ras et al. 2023). Additionally, sceptics question the value of WBAs, citing a lack of demonstrated improvement in patient outcomes as well as lack of real educational impact (Anderson, Kurtz, and West 2021; Barrett et al. 2017). This prompts the fundamental question: why invest time and resources into WBA? A succinct response to such scepticism echoes a quote often attributed to Abraham Lincoln: 'If you think education is expensive, try ignorance.' While this might seem clichéd, the underlying objective should

be to cultivate competency efficiently, addressing the obstacles—money, time, administration—that hinder this process.

Despite the academic roots of medical professions, their real-world application unfolds in practical workplace settings. The pivotal task is to transfer theory into practice, emphasising the importance of supervision and feedback in the workplace. One way to overcome the time constraint issue is to employ WBA within the structured framework of EPAs, where assessments take only three minutes per event (Cheung et al. 2022). Furthermore, the assessment workload can be distributed between various stakeholders, including supervisors from other specialties and subspecialist trainee fellows, provided they understand their own role, the role of the trainee, and the WBA concept. To facilitate this process, EPA-related entrustment–supervision scales for WBA can be used as they articulate a concept familiar to most supervisors, one they have implicitly used throughout their careers—entrustment, assigning the responsibility for doing something to someone (Ten Cate 2020). Emphasising this point helps alleviate the common fear of something new and challenging. However, it is not necessarily straightforward for supervisors to explicitly elaborate an entrustment decision, and faculty development focusing on this process is important (Gingerich 2015).

In addition to assessor training, the increased emphasis on WBAs demands ongoing education for all involved parties to prevent assessment overload and subsequent stress. If trainees and supervisors do not perceive the benefits of WBA to outweigh the effort required, they may lose the motivation to participate. Establishing a cadre of ‘champions’ with dedicated time for introducing, teaching, and supervising the WBA process within an institution is crucial. These individuals must be well versed in the challenges of a feedback and assessment culture, addressing issues such as peer comparison, time pressures, overcontrol, and unrealistic expectations (Ott et al. 2022). In addition, and as described in this work, specific WBA meetings for all supervisors and trainees explicitly showing the benefits within an institution, especially the educational value, can facilitate the positive impact of WBAs and serve to increase buy-in. Strategies to optimise the educational or formative potential of WBA are discussed later in the chapter.

10.4 Gathering interprofessional input

Working, learning, and collaborating in an interprofessional team are indispensable for achieving safe, effective, and sustainable health care (Stalmeijer and Varpio 2021). While

multisource feedback has demonstrated high reliability, validity, and feasibility in evaluating trainees (Donnon et al. 2014), the incorporation of inter-professional direct observation for WBA remains uncommon (van Keulen et al. 2023) and as described earlier, was something we could not achieve in our strategy. The reliance on a single assessor, typically a supervisor, may not be as valid and defensible as incorporating input from diverse professional perspectives (Van der Vleuten et al. 2010).

Overcoming the scarcity of interprofessional WBA involves addressing practical and conceptual challenges. First, recognizing and highlighting the benefits and value of interprofessional input is crucial. This is especially pertinent when identifying and engaging a diverse range of assessors, including supervisors, nurses, physician assistants, dietitians, and other health care professionals that collaborate with the trainee on a regular basis. Furthermore, attending to the challenges associated with disparate professional perspectives, potential reluctance, and divergent opinions on competence is imperative.

To help establish a robust interprofessional assessment process, faculty development initiatives should extend beyond mono-professional supervisors to consciously include all interprofessional stakeholders. Creating a standardised and seamless assessment process is pivotal, as is overcoming logistical hurdles such as ensuring access to digital platforms and addressing limited participant experience. In addition, legal considerations necessitate clear delineation of accountability and responsibility in the interprofessional team. For instance, how should the CC, as the decision-making group responsible for evaluating trainees' progress in their specialty, value and utilise entrustment decisions made by interprofessional colleagues regarding their own trainees. Building trust and aligning expectations are essential in this context, requiring careful consideration to ensure a cohesive and effective decision-making process within the CC. Finally, financial implications, particularly in regions linking remuneration to assessment outcomes, demand a balanced approach that ensures accuracy without compromising the assessment process integrity.

By centering on interprofessional collaboration, WBA has the potential to become a more inclusive and effective tool in health professions education. This approach promotes a comprehensive and contextually relevant evaluation of trainee performance, contributing to the evolution of a more robust and holistic health care workforce.

10.5 The formative–summative tension

As previously mentioned, it is key for trainees and supervisors to appreciate the educational value of WBA, to ensure sustained participation. There are several challenges to optimising every assessment situation for learning. Even though WBAs can be used to make summative decisions regarding progress or promotion, individual WBAs should be weighted more formative. Even if it is termed ‘formative,’ from the trainee’s perspective just the mere use of the term ‘assessment’ might create anxiety (Schut et al. 2018), which is why we preferred to avoid this term during faculty and trainee development. In addition, if done infrequently, the assessment situation might feel like a summative test. As a result, trainees might only ask for a WBA if they are already proficient in a specific task. In a culture where assessments may be perceived as a high-stakes event, much of the trainee’s energy may go into impression instead of actual learning (Huffman et al. 2021). On the supervisors’ side, similar challenges exist as they might feel hesitant to use the lower spectrum of a performance scale because it might negatively impact a trainee’s career or their relationship (McQueen et al. 2016).

In order to address these challenges in implementing WBA, the focus should shift to reducing stress and anxiety, and decreasing the perceived stakes as much as possible (for both trainees and supervisors). Every system of assessment needs to be transparent about the purpose and goals of WBAs and how the data points are used to inform entrustment decisions of trainees. There is always some stake, even in formative assessment situations and especially if aggregated in an e-portfolio (Watling and Ginsburg 2019). Instead of using the terms ‘formative’ and ‘summative,’ terms such as ‘low-stakes’ and ‘high-stakes’ or a ‘continuum of stakes’ may be used, as is described in programmatic assessment (Lambert W. T. Schuwirth and Van der Vleuten 2011). In addition, it may be recommended to avoid the term ‘assessment’ altogether, and instead use ‘observations’ of performance in the workplace, as was done during our implementation process. Thus, rather than seeing it as an assessment, a workplace observation can be considered a perfect starting point for a ‘learning conversation.’ Trainees and supervisors should initiate frequent WBAs or ‘observations’ for facilitating learning from the first day of training until certification (and not just at the end). Using only the narrative descriptions of the entrustment–supervision scale in assessment tools (like ‘direct supervision’) emphasises the clinical relevance of the rating, while using quantitative scales or levels at any point may still feel to the trainee like they are getting marked, which is why we removed them from our observation tool. In addition, no pass/fail decision or high-stakes decision should be made based on one single WBA.

It is also important for trainees to have control over their portfolios and the data used to make summative decisions. Without this control, it is difficult to convince trainees of the low-stakes nature of individual observations (Schut et al. 2018). Since we completed the implementation cycles of this study, we have introduced an option for trainees to remove an observation from their portfolio. In other settings, where the technology allows, trainees may also decide which elements of the portfolio are presented to the CC. In our team, deleting an observation from a trainee's record at the trainee's request means that they still need to complete further observations to meet their minimum requirement, which is currently quite low. This means that they benefit from the formative feedback received for both the deleted and the replaced observation, while still having control over what is used for summative purposes. The impact of this adjustment has not been well studied, and there needs to be more research on how to enhance trainee control genuinely to shift perceptions from a test to an educational activity. Applying a socio-cultural lens may help us better understand the contextual and relational elements that increase stakes and find ways to better shape WBA for learning (Castanelli 2023).

Apart from training supervisors on feedback mechanisms, mechanisms could also be included to provide feedback for supervisors on how they give feedback after an assessment. From a socio-cultural perspective, this gives trainees the opportunity to contribute more to the community of practice activities, allowing them to better shape their environment and influence their training context (Billett 2016). If we succeed in our quest of decreasing trainee anxiety by carefully designing and communicating a system of assessment that is building on a growth mindset (Richardson et al. 2021), we can optimise each assessment situation for learning. In addition, for supervisors, we can make our way toward teaching styles that fosters students' intrinsic motivation to learn (Reeve and Cheon 2021).

10.6 Promoting autonomy through assessment

The transition from being a trainee to becoming an independent specialist often occurs abruptly and somewhat artificially at the time of certification or upon exiting the training program. When trainees are not given the opportunity to develop autonomy during their training, they lack the time to strengthen this essential skill within the relative safety of a training centre, where support is usually readily available. Insufficient opportunities for granting autonomy in training may also arise due to legal and regulatory constraints and concerns about patient safety (Ten Cate and Jarrett 2023). In particular, supervisors may not

always trust the assessments of their colleagues, especially for higher-risk tasks like surgical procedures.

To promote autonomy, the use of prospective entrustment decisions is one strategy to consider. Whereas retrospective scales reflect the actual performance or supervision provided during an activity, prospective entrustment decisions require an estimation of the student's readiness for a specific level of supervision, focusing on future performance (Postmes et al. 2021). This means that these ratings carry more weight and may have a greater influence on decisions regarding autonomy provision (Postmes et al. 2021), which is one of the reasons we used prospective entrustment ratings in our observation tool. While entrustment decisions may not directly impact supervision levels in all contexts, they can lead to advancement within training, with senior roles carrying increased responsibility and autonomy. Though changing regulatory and legal frameworks is challenging, in some settings the trustworthiness of a CC's prospective entrustment decisions, based on multiple observations from multiple supervisors, may enable trainees to legally assume more senior roles and thus experience greater autonomy in training. More research is needed to translate high-stakes CC decisions into greater granting of autonomy in the clinical space. This process may be aided by developing and presenting a strong validity argument that is tailored to the specific context and intended audience, who can then make informed decisions about autonomy provision during training, based on WBA.

10.7 Technology solutions to address practical challenges

WBA has challenges and limitations for which technological solutions could serve as a resource to overcome. Examples of challenges are: (a) competing clinical demands that interfere with the time available for faculty to complete assessments; (b) the need for the collection of multiple data points to support a decision regarding readiness; (c) the analysis and visualisation of data points to support both self-reflection, progression decisions, and program evaluation, and (d) the security and confidentiality of data. In the past, assessment data was collected in paper form. While the paper-based method of data collection has benefits (e.g., more comprehensive feedback), it makes the collection, storage, analysis, presentation, and security of a large number of data points cumulatively and across time less effective. (Young et al. 2020)

Looking into the future, it has been noted that technology such as mobile applications and dashboards or e-portfolios, if designed correctly, can provide efficient means to collect data

immediately following a clinical interaction and allow instantaneous storage of data for analysis and further review in aggregate and across time. In addition to the efficiency in the collection, storage, and cumulation of data, technology also offers further ways for trainees and institutional entities (e.g., programs, directors, CCs, or institution administrators) to use the data. Trainees can benefit from seeing their progress across time and against other trainees, and from reviewing the feedback from each assessment as they consider their accomplishments and gaps toward unsupervised practice. In addition, institutions can use the data more effectively for overall and longitudinal analysis, which is something we showed was important in our implementation. Competence committees, which are limited in their time to review trainee progress, can quickly see data displayed in multiple ways (e.g., individual data points, longitudinal progression, individual against aggregated group data) as they consider the next steps for a trainee. Regarding program evaluation, technology allows expansion from analysis of a trainee to broader perspectives of curriculum and the program. Finally, it can provide a mechanism for digital 'badging' - electronically showing the qualifications for scope of practice of a trainee (O. Ten Cate 2022).

While technology certainly has benefits, it may also present challenges such as cost, design, security and data safety, Wi-Fi coverage and networks, legal and ethical issues, reporting, standardisation, disinfecting or sanitising devices, and training and support (Young et al. 2020; Marty et al. 2023; George et al. 2020). Of these, cost is probably the major concern, especially in resource- challenged settings like ours, as is discussed in the next section.

10.8 Strategies in low-resource countries or areas

The costs of an authentic assessment strategy like WBA may be substantial (Wiggins 2019). Although low-resource countries or regions encounter similar but often more intense challenges as those experienced in high-resource areas, some challenges are unique to resource-limited settings. In many resource-challenged environments, constraints in terms of resources extend to higher service delivery pressures due to a shortage of healthcare providers, which is perpetuated by high disease and patient burdens, which may result in less time for educational initiatives like WBA (Frenk et al. 2010). Cultural dynamics as well as underdeveloped assessment systems and medical education departments may provide additional difficulties (Atta 2023). Further limiting factors include the cost of digital platforms to make WBA user-friendly in the clinical space, as well as the limited availability of Wi-Fi or cell phone data coverage. In summary, low-resource settings may struggle to implement

WBA strategies designed for high-income settings, with many in South Africa feeling that they altogether lack the resources for WBA implementation (Ras et al. 2023).

Addressing these challenges in low-resource settings like ours requires a focus on feasibility within that specific context. As previously discussed, this involves the lowest possible assessment burden for clinicians and the use of simple tools, ensuring quick observation capture and minimal disruption to the clinical workflow. Local design of low-cost tech platforms for WBA, such as using Google packages, RedCap, or commercially available survey software, is possible. Paper-based systems, even in low-resource settings, are discouraged due to the limitations that were detailed earlier (Marty et al. 2023). Implemented tech platforms should ideally have low data requirements or cache features for data syncing when data coverage is available.

While guidance on selection and description of activities for WBA from other contexts is helpful (Chapter 5), it is crucial for low-resource settings to ensure that these are appropriate and that the resultant assessment requirements are feasible to implement locally. Examples of strategies to improve feasibility include selecting a limited core group of activities or EPAs or opting for fewer, broader EPAs, both resulting in a lower assessment burden (Hennus et al. 2024). To ensure greatest feasibility, including the perspective of the lowest-resourced area in a particular context is needed when selecting national activities for assessment/EPAs. Low-resource settings can seek assistance from colleagues in well-resourced environments with experience in WBA implementation, but must ensure the advice is feasible. As local expertise grows, a community of practice within a low-resource setting will likely facilitate the exchange of ideas and strategies for overcoming resource restrictions. The SA National WBA Steering Committee is an example of this. Finally, although collaboration between areas with varying resource levels may have significant value, collaboration among different low-resource areas is important for the creation of platforms where potential solutions and even collective development can be discussed.

10.9 Curriculum redesign

Using WBA of key clinical tasks (as may be defined as EPAs) contrasts with the traditional approach where assessment is primarily based on knowledge objectives. Although a significant amount of experiential learning occurs in the clinical environment, formal teaching and learning activities, as well as the curriculum content, may remain rooted in the traditional

approach. This can lead to a misalignment between what is assessed in the workplace and the other components of the curriculum.

Therefore, it is important, as a next step after introducing WBA, to review the curriculum to ensure alignment between its different elements (Biggs 1996). Generally, the focus of WBA is on clinical competence for authentic workplace activities. Thus, the principles of competency-based education in the health professions may provide guidance on how to adjust or ensure constructive alignment across the curricular elements. When considering competency frameworks like CanMEDS, it may be helpful to assess whether all competencies are well represented in the content and learning activities of a particular program. For example, for the domain of 'collaboration', it may be assumed that trainees will naturally develop these skills in the clinical space. However, introducing specific learning activities, such as workshops, can guide trainees in managing conflict and stress, dealing with difficult interpersonal situations, and addressing bullying. Similarly, for the 'scholarship' competency domain, formal teaching on research methodologies, critical appraisal activities, instituting a journal club, or assigning specific research tasks can build trainees' competence in this area. Even for the core domain of being a 'medical expert', it is crucial to ensure that the program equips trainees for the selected assessment activities/EPAs. If certain activities are not sufficiently covered in the clinical space, it may be necessary to supplement exposure to them by, for example, using simulation-based training.

The specific gaps will depend on the context. However, whenever a change is introduced in any part of the curriculum, it is essential to consider the impact and potential need to adjust other aspects to ensure constructive alignment is maintained. In addition, the definition of key activities for assessment (e.g. EPAs) by experts in a particular setting allows curricula to be aligned to train graduates who are fit for purpose in that specific context. Since the formulation of EPAs and introduction of WBA, we have continued to modify our curriculum to ensure that our content and teaching strategies adequately prepared our trainees to perform these EPAs in the workplace. Periodic re-evaluation of the curriculum will enable us to ensure that this process continues.

10.10 Conclusion

Whether it is a new WBA strategy being implemented like we did, or an existing one being refined, challenges are inevitable. It is imperative for drivers of educational change to understand what we can do to limit the magnitude and shorten the duration of the initial

period of disarray that inevitably follows the introduction of change. This chapter highlights many such strategies that can be used to create a more supportive external environment, as well as to address some of the common remaining cognitive and other internal challenges to WBA implementation (summarised in Table 10.2). In addition, a number of areas for further research have been identified, relevant not only to General surgery in South Africa, but also to other postgraduate disciplines in different healthcare contexts.

Table 10.2: Practical and conceptual challenges to WBA and strategies to overcome them.

Challenge	Strategies
Lack of validity evidence for high stakes decision making	<ul style="list-style-type: none"> • Interrogate validity argument, compiling available evidence relevant to local context • Strengthen validity evidence by addressing concerns • Deliver validity argument to relevant local audience(s) • Strengthen argument continuously based on feedback from local context
Assessment burden for busy clinicians	<ul style="list-style-type: none"> • Use EPA-based assessments with simple tools that include entrustment–supervision scales • Distribute the load through interprofessional involvement • Ensure continuous education of all involved parties • Establish ‘champions’ with dedicated time for introducing and supervising WBA process • Arrange WBA meetings for all supervisors and trainees showing local progress and stressing benefits to individuals and the team
Scarcity of interprofessional WBA	<ul style="list-style-type: none"> • Ensure faculty development initiatives include all interprofessional stakeholders • Create a standardised and seamless assessment process, including digital platform • Ensure clear delineation of accountability, legal responsibility, and remuneration
Tension between formative and summative purposes in WBA	<ul style="list-style-type: none"> • Avoid term ‘assessment’—instead use ‘observations’ of performance in the workplace/‘workplace-based observation’ • Use only narrative descriptions of the entrustment–supervision scale in assessment tools • Completely avoid numbers or ‘levels’ in rating scales • Ensure transparency about purpose of WBAs and how data points are used for high-stakes decision making
Promoting autonomy through assessment	<ul style="list-style-type: none"> • Use prospective entrustment ratings • Utilise a CC that reinterprets multiple data points from multiple supervisors, to make summative decisions • Interrogate and strengthen the validity argument
Logistics of continuous data collection in the	<ul style="list-style-type: none"> • Avoid paper-based system • Use mobile/smartphone-based applications to capture individual observations

workplace, and need to aggregate for later use	<ul style="list-style-type: none"> ● Use e-portfolios for trainees to review own progress ● Develop digital dashboards to aid CC review and analyse aggregated data points
Resource restrictions in lower-income countries/contexts	<ul style="list-style-type: none"> ● Ensure lowest possible assessment burden ● Use of extremely simple tools ● Local design of low-cost tech platforms ● Incorporate low data requirements or cache features for data syncing when data coverage is available ● Ensure selection of activities for assessment is appropriate and feasible locally
Curricular misalignment due to introduction of new assessment	<ul style="list-style-type: none"> ● Review entire curriculum, ensuring content, teaching and learning experiences prepare trainees for new assessments ● Consider CBE principles, especially competence domains, to aid in identifying and addressing teaching gaps ● Explore alternatives options where teaching and learning in clinical space does not prepare trainees for assessment e.g. simulation, workshops, etc.

Chapter 11. Conclusion

11.1 Introduction

This chapter discusses the significance and implications of the study, particularly in relation to the planned national implementation of WBA in South Africa. It also outlines the main contributions of the study to knowledge, practice, and theory, as well as its limitations. Finally, it concludes with a reflection on the doctoral journey and some closing remarks.

11.2 Significance

Currently there is an initiative to implement WBA in South Africa as a measurement of clinical competence of postgraduate trainees. However, there have been concerns regarding feasibility in this context, in the light of the resource requirements needed for authentic assessment of competence like WBA (Wiggins 1990). There is a general concern that resource-challenged settings like South Africa may not have the resources to implement it successfully (Ras et al. 2023).

The Department of General Surgery at UCT represents one of the early sites of WBA implementation in South Africa. Acceptability and feasibility were prioritised during the implementation process, not only because multiple disciplines in South Africa have highlighted them as major issues, but also because these concerns have been identified within surgery internationally (Aryal, Hamed, and Currow 2021; Mughal et al. 2023).

This study describes a strategy for WBA implementation at the University of Cape Town and reports the findings using design principles to increase generalizability, ensuring that the findings are broadly useful to multiple disciplines (Dolmans and Tigelaar 2012). Finally, as far as we know, this is the first use of the design-based research (DBR) method to study WBA implementation.

11.3 Implications of the study

The first implication of the study is that it has demonstrated that WBA can be successfully implemented for General surgery in South Africa. Not only is WBA feasible, but programmatic assessment is also achievable. That WBA can be implemented, along with

design principles for a feasible WBA strategy, may help other surgical teams and disciplines with their own implementation processes. Demonstrating that programmatic assessment is feasible may also catalyse the introduction of competency-based education in South Africa (Nel, Burch, et al. 2022).

This study also showed that WBA in postgraduate General surgery training can be designed to avoid the negative perceptions previously described (Mughal et al. 2023). This may assist those who have already implemented WBA for General surgery in other countries, to refine their strategies based on the lessons and principles described in this work.

11.4 Contributions to the field

11.4.1 Contribution to knowledge

This work provides another demonstration of the utility of the DBR methodology for a PhD thesis (Herrington et al. 2007). It also shows how multiple sub-studies and different methodologies can contribute to the overall DBR process, particularly for the comprehensive formulation of guiding principles to inform the proposed 'solution'.

Another contribution to knowledge is the comprehensive literature review in Chapter 1, which provides an overview of various aspects of WBA in General surgery. The chapter also presents insights from six international experts, reflecting on WBA and how it may be better understood and its implementation optimised. The manuscripts published from the work in this and chapters are available as Appendices E1-E6.

Chapter 4 demonstrated that competence assessment is desired in a context where CBME has not been prominent before, and it showed that this need may best be met with continuous assessment of workplace activities, coupled with feedback provision. Chapter 5 presented the first review of EPAs in General surgery, defining what a General surgeon is from a global context and highlighting lessons learned from others with WBA implementation. Additionally, it presented a useful list of facilitators and barriers to EPA implementation, which is closely linked to WBA implementation as EPAs are increasingly used to define the activities for workplace assessment. Finally, Chapter 8 demonstrated what worked and what did not for WBA implementation in this context, using feedback from participants and a stakeholder team for refinements.

11.4.2 Contribution to practise

The first practice-related contribution is to the Division of General surgery at UCT. The study had a major impact on the local team, not just in providing data points for summative decision-making, but also in the significant benefits of continuous formative input that trainees have received since implementation. At the time of writing this text, more than 1000 observations had been recorded since implementation in October 2022, and three CC meetings have taken place. Although much work is still needed, a culture of feedback in the workplace is slowly being developed, especially among the more junior members of the team. The study also affected the local team by stimulating a curriculum review, leading to shifts in other facets of the curriculum towards competency-based education.

Two Editorials, based on the knowledge from Chapter 1, were published in national journals, and provided a basic understanding for others in South Africa, particularly regarding new terms like WBA, EPAs, CBME, and PA (Nel, Burch, et al. 2022; Nel, Cairncross, et al. 2022). These editorials were not just informative but also calls for action, potentially assisting the drive for national implementation.

The results presented in Chapter 6 aided in the national EPA selection for General surgery and identified gaps in training. This presents opportunities for surgical teams in South Africa to review their teaching and learning strategies to ensure that key outcomes are met. Chapter 8 described the lessons learned from our context in implementing the initial solution described in Chapter 7. This, along with the design principles reported in Chapter 9, may allow others to implement their own WBA strategy with guidance from the principles defined in this work. Finally, Chapter 10 suggested practical solutions to common issues in General surgery and beyond, and also identified gaps to guide future research into WBA, specifically to address remaining conceptual and practical concerns.

11.4.3 Contribution to theory

Chapter 3 provided an overview of relevant education theory, primarily focusing on learning and assessment which was performed to guide the theoretical underpinnings of the guiding principles for the design of the WBA strategy. However, this chapter also discussed WBA in the context of socio-cultural theories. There have been recent calls to do so, in order to address current issues with WBA, particularly its use in assessment for learning (Castanelli 2023). This study also demonstrated the utility of socio-cultural and situated theories in not

only aiding the design of a WBA solution, but also in interpreting the results of the implementation process.

Chapter 2 described how DBR captures and makes explicit the implicit decisions of a design process. In this way, DBR transformed these decisions into guidelines, allowing others to address similar educational problems in their contexts. The formulation of guiding principles and their refinement through reflection on implementation was based not only on literature but also on theory, and were thus theory-inspired (Plomp 2007). Thus, the design principles can be considered a theoretical yield of DBR, constituting an intervention or design theory, referring to the knowledge generated in this context (Reeves 2006; Wademan 2005). A rich description of the context was provided in Chapter 1, which may allow others to consider the extent to which these principles or this intervention theory applies to their own contexts.

Finally, this study described the utility of a flexible approach to change management, using different change theories depending on what was needed for a specific aspect or phase of the study. The work also highlighted the value of theories that focus on personal change and intrinsic motivation to aid in WBA uptake.

11.5 Limitations

The limitations of some Chapters (4-8) have already been detailed in the chapters themselves. Here, we will discuss the limitations of the study as a whole, especially the final phase of the DBR process to produce the final set of design principles (Chapter 9).

The first limitation, common to DBR, is that the study is based on a single context (Dolmans and Tigelaar 2012). Although the study presents valuable insights into an educational innovation within this context, its applicability to other contexts may therefore be limited. To mitigate this, a rich description of the context was provided to help readers understand the extent to which the findings may be applied to their settings. This includes the level of educational resources available at UCT, which may differ from other South African or resource-challenged settings. Specifically, the Division of General surgery at UCT has a relatively large supervisor base, with more attending surgeons and subspecialist trainee fellows than available than many other surgical training centres in South Africa. Additionally, although being a surgeon, I was employed as a senior lecturer for the duration of this study, allowing more time in my schedule to drive the design and implementation process. The WBA strategy and principles need to be tested in other South African contexts to

demonstrate broad feasibility and equivalence (Norcini et al. 2018). Despite the limitation of context specificity, the study's grounding in theory and its use of theory to explain findings may aid generalizability (Dolmans and Tigelaar 2012). Additionally, instead of just describing the intervention and its achievements, design principles were generated to provide an extensive description of how to implement WBA in other contexts.

The next limitation refers to bias. My position as the researcher may have biased the findings, as I played a major role in identifying the problem, designing the solution, and evaluating its success (Dolmans and Tigelaar 2012; Plomp 2007). This may have led me to be less critical of the design, and in retrospect may have prematurely been convinced of its efficacy. Additionally, it has been noted in DBR that learners or teachers may find it difficult to criticise the design, which may have further contributed to this issue (Dolmans and Tigelaar 2012).

Strategies to address this issue included reflexivity, as described in Chapter 1, where I attempted to fully disclose my background, expectations, and assumptions (Bunniss and Kelly 2010). More importantly, decisions regarding the design and interpretation of aspects related to its implementation were triangulated (Dolmans and Tigelaar 2012; Raqib 2019; Plomp 2007). This included input from my supervisors on various aspects of the study, particularly the practical construction of the design and the design principles extracted from the literature, as well as their refinement. Furthermore, the stakeholder team played a crucial role in decision-making regarding the design and its adaptation after each intervention cycle. Thus, these decisions were made by an informed group, including the supervisors, an educationalist, surgical supervisors, and trainees. It was essential for me to remain open-minded during these discussions and to be critically aware of my own assumptions based on my extensive reading of the literature, which exceeded that of most other stakeholder team members. In addition, an external advisory panel, including members from other surgical departments in South Africa and an international EPA expert, also aided in reviewing the process and findings. These strategies enhanced the trustworthiness of the findings, especially the final design principles and conclusions (Plomp 2007).

One aspect that was not addressed, but perhaps should have been and may be a future project, was involving the stakeholder team in the review of the design principles. This task, requiring extensive knowledge of the literature and education theory, was undertaken by myself with input from my supervisors only. In hindsight, stakeholder input could have increased the validity of the findings (Plomp 2007).

Finally, the main focus of the study was on feasibility, as this was the primary issue identified in introducing WBA in surgery from the international literature, as well as by other disciplines in South Africa. However, other important components of a good assessment strategy, as defined in the Ottawa 2018 consensus, were also considered (Norcini et al. 2018). Attempts were made to comment on some of these other elements in Chapter 10. However, it was not possible to investigate them fully, having left gaps which may present opportunities for future research, as delineated in the chapter.

11.6 Key areas for future research

While some general gaps in knowledge and potential areas for future research were highlighted in the previous chapter, several specific key areas in this context present valuable opportunities for further exploration.

11.6.1 Implementation in other surgical services

The first area relates to the introduction of WBA in other surgical services across South Africa. At UCT, WBA was successfully implemented in general surgery; however, this was done within the context of a PhD thesis, which meant that additional resources were available. Scaling this initiative beyond UCT presents both opportunities and challenges.

As noted in Chapter One, South Africa is a highly diverse country, with surgical services varying significantly in scope, resources, and institutional cultures due to historical inequities in resource allocation. Unlike UCT, most general surgery teams in South Africa do not have a dedicated surgeon focusing primarily on postgraduate training, and the oversight of initiatives such as WBA. Furthermore, UCT benefits from a relatively higher number of consultants and supervisors compared to other surgical services in the country.

The decision-making process behind the WBA strategy implemented at UCT was guided by a stakeholder team, as well as an advisory panel that included two heads of departments from other General surgery services in South Africa. Their contributions helped shape the solution and the underlying design principles to enhance its generalizability. However, the true test of its applicability will come through broader implementation, which may yield new insights and necessitate adaptations to the existing design principles.

There is significant interest among other surgical centers in South Africa to adopt the WBA model developed at UCT. Seeing that WBA has been successfully introduced in this setting

has motivated other departments to pursue similar initiatives, which may facilitate a national rollout in the near future. This, in turn, presents an exciting research opportunity—both during and after implementation—to evaluate the process across multiple settings in South Africa. Through qualitative and quantitative methods, the experiences of different institutions could be captured and analyzed to assess how the design principles evolve when applied on a national scale. These findings could have broader implications for other countries with similar resource constraints, offering a model for WBA implementation for General surgery in low- and middle-income settings.

Furthermore, UCT holds a unique position on the African continent as its leading university. Many trainees from across Africa have completed or are currently completing their surgical training at UCT, taking their experiences back to their home countries. In the coming years, it is possible that exposure to WBA at UCT will generate interest in similar implementations in these countries. This could open up new opportunities for collaboration with surgical teams and universities across Africa, supporting the introduction of WBA in diverse contexts. Such expansion would not only contribute to strengthening surgical education across the continent but also provide valuable research opportunities to refine and validate the principles established in this thesis. Testing these concepts in different low- and middle-income settings would further enhance their applicability and impact, ultimately contributing to broader improvements in surgical education globally.

11.6.2 Clustering procedures into broader EPAs

The assessment or observation of procedures in General surgery remains a contentious issue. One important reason for this is the broad nature of general surgery, which has become increasingly sub-specialized in recent years. Many procedures that still fall under general surgery are now primarily performed by surgeons with subspecialty or fellowship training.

Different approaches have been proposed to define which general surgical procedures should be assessed as EPAs for WBA. One common strategy is to identify a subset of core or "index" procedures that are both frequently performed and commonly supervised in general surgery. This has been our approach in defining procedural EPAs. However, as discussed previously in the thesis, this approach presents a dilemma: it excludes a significant number of other procedures that are also crucial for trainees to learn. These procedures may be less commonly performed or more challenging to observe frequently enough to reach the threshold needed for reliable summative decisions on entrustment and

competence. Furthermore, the absence of certain procedures from the EPA list may lead trainees to engage with them less enthusiastically, potentially missing valuable learning opportunities and feedback.

To address this issue, we are actively exploring the concept of clustering similar procedures into broader EPAs rather than assessing each procedure individually. This approach assumes that certain surgical skills or procedural steps are transferable across related procedures and that mastering one procedure may shorten the learning curve for another within the same cluster. While there is limited direct evidence of this in surgery, studies in medical education have demonstrated that simulation-based training can significantly accelerate the acquisition of psychomotor skills, enabling trainees to perform procedures more efficiently and safely in real clinical settings.

Designing a controlled study to test this concept in our environment is challenging due to the heterogeneity in trainees' prior surgical experience. However, a study is currently underway to explore the perceptions of consultant supervisors regarding skill transferability between similar procedures. This research aims to determine whether supervisors believe these skills are transferable and, if so, how procedures might be grouped into broader EPAs. We are hopeful that this alternative approach will be particularly useful in resource-limited settings like ours, where it is not feasible to assess every possible general surgical procedure with sufficient frequency to ensure reliable summative judgments on competence.

11.6.3 WBA implementation into undergraduate General surgery training

At UCT, medical students are exposed to general surgery during their fifth and sixth years of training. In the sixth year, students are more fully integrated into the clinical environment. They participate in morning ward rounds, present patients, attend outpatient clinics where they discuss cases with supervisors for feedback, and assist in theatre during major procedures. They also perform or assist with minor surgical procedures.

This contrasts with the fifth-year program, which focuses primarily on theoretical knowledge acquisition and basic skill development in the skills lab. Given the hands-on nature of the sixth-year general surgery rotation, WBA presents a valuable opportunity to enhance experiential learning. Additionally, it could serve as a tool to assess students' readiness for graduation and their transition into internship.

All South African medical graduates spend between three to four months of their two-year internship in surgery. During this time, they are expected to function with a degree of

autonomy while having supervision available when needed. Ensuring that students are adequately prepared for these responsibilities is therefore essential.

The undergraduate general surgery curriculum is currently transitioning from a traditional model to a competency-based approach. With the department's experience in implementing WBA at the postgraduate level, as explored in this thesis, incorporating it into undergraduate training may be a logical and feasible next step. This has been an area of discussion within the department and is being actively considered for future research and further curriculum transformation.

11.7 Reflections on the doctoral journey

Every PhD student, at one or multiple points during their doctoral journey, wonders, "Is this enough? Will this work satisfy the requirements for doctorateness?" There are different opinions on what constitutes doctorateness. However, there are two critical elements that I could ascertain from the literature. The first is the use or development of theory, and the second is that the study makes a significant contribution to the field (Kiley 2015; Wellington 2013).

Research on doctoral examinations suggests that the ways in which doctoral students both utilise and/or develop theory are critical to the success of a doctoral thesis, regardless of discipline (Mullins and Kiley 2002; Tinkler and Jackson 2004). The student may adopt someone else's theory or develop a theory of their own. Emphasis on theory is an important component of quality research, especially in education, and it is also a part of sound doctoral education (Kiley 2015). In terms of contribution to the field, some have postulated that this is the single most important quality that makes up a doctorate (Wellington 2013). The thesis must build on previous arguments and advance, refute or add to them. Additionally, and ideally, the contribution must make an impact or bring about a change in thinking, knowledge, theory, or practice.

When I started this journey, my main aim was to make a significant contribution to the field that may inform assessment practice, especially in South Africa. Although there is room to expand, I hope that I have demonstrated this contribution. I also made an effort to situate my findings in education theory and have utilised DBR to generate a theory of intervention/design as described by the final set of design principles (Reeves 2006).

When I first met with one of my supervisors to discuss the possibility of a PhD, he told me that a PhD, in essence, is a 'research education'. I fully agree and can reflect on how this journey has taught me a number of lessons. Firstly, I learned how to conduct qualitative research, which also opened my eyes to the interpretivist paradigm. Previously, I had only been exposed to positivist ways of thinking about research and was unaware of even the existence of different ontologies/epistemologies. Secondly, I learned how to conduct a scoping review, which was my first attempt at a systematic search-based study. Thirdly, I became very familiar with the DBR method and its utility in answering this type of educational question.

However, an important change is not just the knowledge and skills gained, but also the identity formation that occurred through this journey. I started this PhD in 2022 with no health professions education background and little insight into concepts such as WBA, EPAs, and CBME. In the beginning, I carried an impostor syndrome as a health professions education researcher undertaking the daunting task of a PhD in the field. I also had little understanding of education theory. Undertaking the PhD forced me to fill the gaps in key aspects of medical education theory, especially learning and assessment. At the end of the first year of the PhD, I spent a few weeks taking a deep dive into theories of learning and assessment, which led me to sociocultural and situated theories, and how they relate to learning and assessment. That whole process represented a shift from a state of liminality (Kiley 2015) to understanding the theoretical grounding of my research and where it fits into the broader spectrum of health professions education theory. Following this theoretical exploration, I could see the PhD come together. In addition, I felt like I understood the field better and could contribute more meaningfully.

My growing expertise and participation in various educational activities allowed me to join the National WBA Steering Committee, as one of the four workstream leaders, tasked with WBA implementation for postgraduate medical training in South Africa. Over the last two years, this has given me the opportunity to help shape how WBA will be implemented in this country. The Steering Committee includes leaders in health professions education from across SA (Appendix G1).

I have also become a member of the International Competence-Based Health Professions Education (ICBHPE) collaborative. The goal of the collaborative, formed in 2009, is to promote understanding of Competence-Based Education in the health professions and accelerate its uptake worldwide. Being a member of this group has allowed me to regularly interact with leading international health professions education experts (Appendix G2). Apart

from local and international publications from the PhD, I have contributed to the field via ICBHPE blog posts (D. Nel 2023b, 2024) and as speaker at international webinars, providing more opportunities to impact the discourse around WBA. I have also been invited to write a book chapter on WBA and review for international education journals. In addition to the publications from this thesis, I have been invited by ICBHPE colleagues to join other projects, including a study to develop EPAs for undergraduate medical training in Global South contexts (Ten Cate et al. 2024). Finally, I have recently been invited to join the editorial team of the South African Journal of Surgery.

Nearing the end of this journey, I no longer feel like an impostor but rather that I have moved from a peripheral participant to a true member of the community (Lave and Wenger 1991). I am grateful to have had the opportunity to undertake this journey, which has equipped me with the expertise and agency to continue research on this topic and contribute to the field on both national and international levels. To quote Winston Churchill: "Now this is not the end. It is not even the beginning of the end. But it is perhaps the end of the beginning."

11.8 Concluding remarks

The research question of the study was: In a resource-limited area like South Africa, can WBA be implemented and, if so, how can it be done? I'm satisfied that, using the DBR methodology, the research question has been answered and that the primary and secondary objectives of the study, as described in Chapter 1, were met.

Personally, I truly believe that WBA addresses a critical gap in postgraduate assessment in South Africa and elsewhere, ensuring that graduates who are given the licence to practise independently have the competence to do so. However, an authentic assessment strategy like WBA is highly complex and resource-intensive, especially to design and implement initially. My hope is that this work provides insights and guidance to enable broader implementation of WBA, especially in LMICs where 80% of the global population lives. For many, as in South Africa, the implementation of WBA is a first step towards implementing programmatic assessment and ultimately, competency-based medical education. I, like many others, believe that this is a better approach to training and certifying professionals, equipping them to serve their communities better and ultimately provide more holistic care to patients.

Nelson Mandela once said, "Education is the most powerful weapon that we can use to change the world." It is important that we utilise WBA to ensure competence has been achieved. However, if it can be harnessed to enhance the educational process, then that would certainly be a worthwhile endeavour, contributing to changing the medical field and ultimately making the world a better place for all.

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Appendix A1 - HREC approvals



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



Room 45 E-52-E-Floor- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492

Email: hrec-submissions@uct.ac.za

Website: www.health.uct.ac.za/fhs/research/humanethics/forms

13 June 2022

HREC REF: 246/2022

Prof E Jonas

Department of General Surgery
J-Floor OMB
Email: Eduard.jonas@uct.ac.za
Student: daniel.nel87@gmail.com

Dear Prof Jonas

PROJECT TITLE: THE INTRODUCTION OF WORKPLACE-BASED ASSESSMENT FOR GENERAL SURGICAL TRAINING AT A SOUTH AFRICAN UNIVERSITY (PHD DEGREE –DR DANIEL NEL)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19. Please refer to guidance letter dated 02 February 2022 on our website:

<http://www.health.uct.ac.za/fhs/research/humanethics/forms>

Approval is granted for one year until the 30 June 2023.

Please submit a progress form, using the standardised Annual Report Form (FHS016) if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: - Dr Daniel Nel will also be involved in this study.

Please quote the HREC REF 246/2022 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

HREC/ref 246.2022

**HUMAN RESEARCH
ETHICS COMMITTEE**

- 1 JUN 2023




UNIVERSITY OF CAPE TOWN
UNIVERSITEIT VAN KAPSTAD

HEALTH SCIENCES FACULTY
FACULTY OF HEALTH SCIENCES
UNIVERSITY OF CAPE TOWN

FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee



FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
<input checked="" type="checkbox"/> Approved	Annual progress report	Approved until/next renewal date	30/6/2024
<input type="checkbox"/> Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee			Date Signed 1/6/2023

Note: Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Please clarify your plan for research-related activities during COVID-19 lockdown.

Please use the latest form found on our website:

<http://www.health.uct.ac.za/fhs/research/humanethics/forms>

Comments to PI from the HREC

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	1/6/23		
HREC REF Number	246/2022	Current Ethics Approval was granted until	30/6/23
Protocol title	The introduction of Workplace-Based Assessment for General Surgical training at a South African University		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, could you please provide the HREC Reference number for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study.	478/2022		
Principal Investigator	Prof Eduard Jonas		



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



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Website: www.health.uct.ac.za/fhs/research/humanethics/forms

24 June 2022

HREC REF: 242/2022

Prof E Jonas
Division of General Surgery
E23, Room 37 NGSH
Email: Eduard.jonas@uct.ac.za
Student: danielnel87@gmail.com

Dear Prof Jonas

**PROJECT TITLE: IN-TRAINING COMPETENCY ASSESSMENT IN GENERAL SURGERY:
CONSULTANT AND REGISTRAR PERSPECTIVES FROM THE UNIVERSITY OF CAPE TOWN-
(PHD CANDIDATE-DR DANIEL NEL)**

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19. Please refer to guidance letter dated 02 February 2022 on our website:
<http://www.health.uct.ac.za/fhs/research/humanethics/forms>

Approval is granted for one year until the 30 June 2023.

Please submit a progress form, using the standardised Annual Report Form (FHS016) if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Dr Daniel Nel will also be involved in this study.

Please quote the HREC REF 242/2022 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

HREC/ref 242.2022



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



Room 45 E-52-E-Floor- Old Main Building
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15 August 2022

HREC REF: 477/2022

Prof E Jonas
Department of General Surgery
E23 NGSH
Email: eduard.jonas@uct.ac.za
Student: danielnel87@gmail.com

Dear Prof Jonas

**PROJECT TITLE : WHAT ARE THE COMMONEST PROCEDURE PERFORMED BY GENERAL SURGEONS IN SOUTH AFRICA?
(PHD DEGREE - DR DANIEL NEL)**

Thank you for response letter, addressing the issues raised by the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 August 2023.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Dr Daniel Nel will also be involved in this study.

Please quote the HREC REF 477/2022 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637. Institutional Review Board (IRB) number:
IRB00001938 NHREC-registration number: REC-210208-007

HREC.REF477.2022



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



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Website: www.health.uct.ac.za/fhs/research/humanethics/forms

11 August 2022

HREC REF: 478/2022

Prof E Jonas

Department of General Surgery
E-23 NGSH
Email: eduard.jonas@uct.ac.za
Student: danielnel87@gmail.com

Dear Prof Jonas

PROJECT TITLE : ACCEPTABLE, APPROPRIATE AND FEASIBLE WORKPLACE-BASED ASSESSMENT FOR GENERAL SURGERY TRAINNESS: A DESIGN-BASED RESEARCH PROJECT (PHD DEGREE - DR DANIEL NEL)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study, subject to the following:-

- The HREC do hope that the protocol itself is more substantial to benefit a PhD and that while not essential, consideration be given to including the theoretical aspects of learning into the registrar WBA project.

Approval is granted for one year until the 30 August 2023.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Dr Daniel Nel will also be involved in this study

Please quote the HREC REF 478/2022 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

HREC.REF 478.2022



FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
<input checked="" type="checkbox"/> Approved	Annual progress report	Approved until/next renewal date	30/8/2024
<input type="checkbox"/> Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee			Date Signed 1/6/2023

Note: Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Please clarify your plan for research-related activities during COVID-19 lockdown.

Please use the latest form found on our website:

<http://www.health.uct.ac.za/fhs/research/humanethics/forms>

**HUMAN RESEARCH
 ETHICS COMMITTEE**
 - 1 JUN 2023
**HEALTH SCIENCES FACULTY
 UNIVERSITY OF CAPE TOWN**

Comments to PI from the HREC

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	1/6/23		
HREC REF Number	478/2022	Current Ethics Approval was granted until	30/8/23
Protocol title	Acceptable, appropriate and feasible Workplace-Based Assessment for General Surgery trainees: a design-based research project		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
If yes, could you please provide the HREC Reference number for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study.	478/2022		
Principal Investigator	Prof Eduard Jonas		

Appendix A2 - University approvals

HR194a	ACCESS TO UCT STAFF FOR RESEARCH PURPOSES (Fulfilment of a Degree)	UNIVERSITY OF CAPE TOWN <small>UYUNIVESITHI YASEKAPA - UNIVERSITEIT VAN KAAPSTAD</small>
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NOTES

- Forms must be downloaded from the UCT Administrative Forms website: <http://forms.uct.ac.za/forms.htm> .
- This form must be completed by applicants who are requesting to access UCT staff for the purpose of research for the fulfilment of a degree.
- A copy of the research proposal as well as the Ethics Committee approval must be attached.
- It is the **responsibility of the researcher/s to apply for ethical clearance** from the relevant Faculty's Research in Ethics Committee (RIEC).
- If you are requesting staff information, you are required to complete the [HR Information Request Form \(HR190\)](#) and submit it together with all the required documentation.
- The turnaround time for a reply is **approximately 10 working days unless specified as urgent**.
- Please submit your application including the completed application form and all the above documentation directly to Zoe Cosmopoulos via email (zoe.cosmopoulos@uct.ac.za) for the attention of the Director: Analytics, Risk, System, Payroll & Admin. Please do not submit these to the Director directly.

SECTION A: APPLICANT DETAILS

Title	Dr	Name	Daniel Nel
Telephone number	0825434780	Email address	danielnel87@gmail.com
Student number	nixdan002	Staff number	
Visiting researcher ID / passport number			
University or institution at which employed or a registered student	UCT		
Faculty or department in which you are registered or work	Health Sciences		
Address (if not UCT)			

SECTION B: SUPERVISOR DETAILS


	Title and name	Telephone number	Email address
Supervisor	Prof Eduard Jonas		eduard.jonas@uct.ac.za
Co-Supervisor	Prof Vanessa Burch		vanessa.burch@cmsa.ac.za

SECTION C: APPLICANT'S FIELD OF STUDY / TITLE OF RESEARCH PROJECT / STUDY

Degree	PhD		
Research project or title	In-training competency assessment in general surgery: consultant and registrar perspectives from the University of Cape Town		
Research proposal attached	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Target population	Registrars and consultants in general surgery		
Number of UCT staff required	20		
Research method	<input checked="" type="checkbox"/> Interviews	<input type="checkbox"/> Questionnaire	
Amount of time required for the above	3 months		
Lead Researcher details	Daniel Nel		

SECTION D: FOR OFFICE USE (Approval status to be completed by the Executive Director, Human Resources or Nominee)

UCT Proof of ethical clearance status attached	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Proof of ethical clearance status from the University/Institution, if registered outside of UCT	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Not Applicable
Support or approval	Role	Signature	Date
Supported? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Zoe Cosmopoulos (Specialist: HR Analytics)	<i>Zoe Cosmopoulos</i>	28/07/2022
Approved? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Naeema Brey (Director: Analytics, Risk, System, Payroll & Admin)	<i>N Brey</i>	28/07/2022

HR194a	ACCESS TO UCT STAFF FOR RESEARCH PURPOSES (Fulfilment of a Degree)	 UNIVERSITY OF CAPE TOWN <small>IYUNIVESITHI YASEKAPA - UNIVERSITEIT VAN KAAPSTAD</small>
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NOTES

- Forms must be downloaded from the UCT Administrative Forms website: <http://forms.uct.ac.za/forms.htm>.
- This form must be completed by applicants who are requesting to access UCT staff for the purpose of research for the fulfilment of a degree.
- A copy of the research proposal as well as the Ethics Committee approval must be attached.
- It is the **responsibility of the researcher/s to apply for ethical clearance** from the relevant Faculty's Research in Ethics Committee (RIEC).
- If you are requesting staff information, you are required to complete the [HR Information Request Form \(HR190\)](#) and submit it together with all the required documentation.
- The turnaround time for a reply is **approximately 10 working days unless specified as urgent**.
- Please submit your application including the completed application form and all the above documentation directly to Zoe Cosmopoulos via email (zoe.cosmopoulos@uct.ac.za) for the attention of the Director: Analytics, Risk, System, Payroll & Admin. Please do not submit these to the Director directly.

SECTION A: APPLICANT DETAILS

Title	Dr	Name	Daniel Nel
Telephone number	0825434780	Email address	danielnel87@gmail.com
Student number	nixdan002	Staff number	
Visiting researcher ID / passport number			
University or institution at which employed or a registered student	UCT		
Faculty or department in which you are registered or work	Health Sciences		
Address (if not UCT)			

SECTION B: SUPERVISOR DETAILS

	Title and name	Telephone number	Email address
Supervisor	Prof Eduard Jonas		eduard.jonas@uct.ac.za
Co-Supervisor	Prof Vanessa Burch		vanessa.burch@cmsa.ac.za

SECTION C: APPLICANT'S FIELD OF STUDY / TITLE OF RESEARCH PROJECT / STUDY

Degree	PhD		
Research project or title	Acceptable, appropriate and feasible Workplace-Based Assessment for General Surgery trainees: a design-based research project		
Research proposal attached	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Target population	Registrars and consultants in general surgery		
Number of UCT staff required	70		
Research method	<input type="checkbox"/> Interviews	<input checked="" type="checkbox"/> Questionnaire	
Amount of time required for the above	9 months		
Lead Researcher details	Daniel Nel		

SECTION D: FOR OFFICE USE (Approval status to be completed by the Executive Director, Human Resources or Nominee)

UCT Proof of ethical clearance status attached	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Proof of ethical clearance status from the University/Institution, if registered outside of UCT	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Not Applicable
Support or approval	Role	Signature	Date
Supported? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Zoe Cosmopoulos (Specialist: HR Analytics)	<i>ZoeCosmopoulos</i>	24/08/2022
Approved? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Naeema Brey (Director: Analytics, Risk, System, Payroll & Admin)	<i>NBrey</i>	24/08/2022

Appendix A3 - Hospital approval



GROOTE SCHUUR HOSPITAL

Enquiries: Dr Bernadette Eick

e-mail: GSHReserach.Request@westerncape.gov.za

Professor E. Jonas
Department of General Surgery

E-mail: eduard.jonas@uct.ac.za

Dear Professor Jonas

RESEARCH PROJECT: Acceptable, Appropriate and Feasible Workplace-Based Assessment for General Surgery Trainees: A Design-Based Research Project

Your recent letter to the hospital refers.

You are granted permission to proceed with your research, which is valid until **30 August 2023**

Please note the following:

- a) Your research may not interfere with normal patient care.
- b) Hospital staff may not be asked to assist with the research.
- c) Confidentiality must always be maintained.**
- d) No additional costs to the hospital should be incurred as indicated in your Annexure 2 i.e. Lab, consumables or stationery. If access to TRACK Care/NHLS is required, kindly attach our letter of approval to the application form and approach Information Management to assist with data.**
- e) **No patient folders may be removed from the premises or be inaccessible.**
- f) Please provide the research assistant/field worker with a copy of this letter as verification of approval.
- g) Should you at any time require photographs of your subjects, please obtain the necessary indemnity forms from our Public Relations Office (E45 OMB or ext. 2187/2188).**
- h) Should you require additional research time beyond the stipulated expiry date, please apply for an extension.
- i) Please discuss the study with the HOD before commencing.
- j) Please introduce yourself to the person in charge of an area before commencing.
- k) On completion of your research, please forward any recommendations/findings that can be beneficial to use to take further action that may inform redevelopment of future policy / review guidelines.
- l) If the researcher is not GSH staff member, a supernumerary contract is required before commencement of the research.
- m) Please contact Michelle Riley (Patient Fees) at ext. 2276 to ascertain if there will be charges for conducting the Research and to obtain a quote or to discuss charges
- n) Kindly submit a copy of the publication or report to this office on completion of the research.**
- o) At no time should any posters encouraging patients to partake in research, be displayed within a clinical area.**
- p) Please adhere to ALL COVID-19 regulations and Groote Schuur Hospital policies.**

I would like to wish you every success with the project.

Yours sincerely

DR BERNADETTE EICK
CHIEF OPERATIONAL OFFICER

Date: 04 January 2023

C.C: Mr. L. Naidoo, Mr. A. Mohamed, Professor L. Caimcross, Dr. B. Jacobs

G46 Management Suite, Old Main Building,
Observatory 7925
Tel: +27 21 404 6288 fax: +27 21 404 6125

Private Bag X,
Observatory, 7935
www.westerncape.gov.za/health

Appendix B1 - Search strings (Chapter 5)

All searches were limited from 2005 onwards.

Database	Search strategy
<i>PubMed (detailed output shown below*)</i>	("Entrustable professional activity" OR "Entrustable professional activities" OR EPA [tiab] OR EPAs [tiab] OR Epa's [tiab] OR EPA's [tiab] OR Entrustment OR Entrustable OR Entrustability) AND (Surgeon OR Surgery OR Surgical) AND (Assessment OR Educational Measurement[Mesh] OR Evaluation OR Appraisal OR Competence OR Clinical competence [MeSH] OR Proficiency OR Ability OR Education OR Education, Medical [Mesh] OR Education, Medical, Graduate[Mesh] OR Training OR Teaching [Mesh] OR Curriculum OR Program OR Programme OR Syllabus)
<i>Ebscohost</i>	("Entrustable professional activit*" OR epa* OR entrust*) AND (surgeon* OR surgery OR surgical)
<i>Scopus</i>	("Entrustable professional activit*" OR epa* OR entrust*) AND (surgeon* OR surgery OR surgical)
<i>Web of science</i>	("Entrustable professional activit*" OR epa* OR entrust*) AND (surgeon* OR surgery OR surgical)
<i>Google Scholar</i>	("entrustable professional activities" AND "general surgery")
<i>Google</i>	Search 1: ("entrustable professional activities" AND "general surgery") Search 2: ("EPA" AND "general surgery")
<i>Grey literature</i>	Grey literature databases, thesis/dissertations, regulatory body websites, and conference abstracts repositories searched with similar combinations of keywords as for Google search.

**Detailed output from Pubmed search:*

("Entrustable professional activity"[All Fields] OR "Entrustable professional activities"[All Fields] OR "EPA"[Title/Abstract] OR "EPAs"[Title/Abstract] OR "Epa's"[Title/Abstract] OR "entrust"[All Fields] OR "entrustability"[All Fields] OR "entrustable"[All Fields] OR "entrusted"[All Fields] OR "entrusting"[All Fields] OR "entrustment"[All Fields] OR "entrusts"[All Fields]) OR ("entrust"[All Fields] OR "entrustability"[All Fields] OR "entrustable"[All Fields] OR "entrusted"[All Fields] OR "entrusting"[All Fields] OR "entrustment"[All Fields] OR "entrusts"[All Fields]) OR ("entrust"[All Fields] OR "entrustability"[All Fields] OR "entrustable"[All Fields] OR "entrusted"[All Fields] OR "entrusting"[All Fields] OR "entrustment"[All Fields] OR "entrusts"[All Fields])) AND ("surgeon s"[All Fields] OR "surgeons"[MeSH Terms] OR "surgeons"[All Fields] OR "surgeon"[All Fields] OR ("surgery"[MeSH Subheading] OR "surgery"[All Fields] OR "surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND

"operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "general surgery"[MeSH Terms] OR ("general"[All Fields] AND "surgery"[All Fields]) OR "general surgery"[All Fields] OR "surgery s"[All Fields] OR "surgerys"[All Fields] OR "surgeries"[All Fields]) OR ("surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgical"[All Fields] OR "surgically"[All Fields] OR "surgicals"[All Fields]) OR "surgery"[MeSH Subheading]) AND ("assess"[All Fields] OR "assessed"[All Fields] OR "assessment"[All Fields] OR "assesses"[All Fields] OR "assessing"[All Fields] OR "assessment"[All Fields] OR "assessment s"[All Fields] OR "assessments"[All Fields] OR "educational measurement"[MeSH Terms] OR ("evaluability"[All Fields] OR "evaluate"[All Fields] OR "evaluated"[All Fields] OR "evaluates"[All Fields] OR "evaluating"[All Fields] OR "evaluation"[All Fields] OR "evaluation s"[All Fields] OR "evaluations"[All Fields] OR "evaluative"[All Fields] OR "evaluatively"[All Fields] OR "evaluatives"[All Fields] OR "evaluator"[All Fields] OR "evaluator s"[All Fields] OR "evaluators"[All Fields]) OR ("appraisal"[All Fields] OR "appraisals"[All Fields] OR "appraise"[All Fields] OR "appraised"[All Fields] OR "appraiser"[All Fields] OR "appraisers"[All Fields] OR "appraises"[All Fields] OR "appraising"[All Fields]) OR ("compete"[All Fields] OR "competed"[All Fields] OR "competences"[All Fields] OR "competencies"[All Fields] OR "competently"[All Fields] OR "competents"[All Fields] OR "competes"[All Fields] OR "competing"[All Fields] OR "mental competency"[MeSH Terms] OR ("mental"[All Fields] AND "competency"[All Fields]) OR "mental competency"[All Fields] OR "competence"[All Fields] OR "competency"[All Fields] OR "competent"[All Fields]) OR "clinical competence"[MeSH Terms] OR ("proficiencies"[All Fields] OR "proficiency"[All Fields] OR "proficient"[All Fields] OR "proficiently"[All Fields]) OR ("aptitude"[MeSH Terms] OR "aptitude"[All Fields] OR "abilities"[All Fields] OR "ability"[All Fields]) OR ("educability"[All Fields] OR "educable"[All Fields] OR "educates"[All Fields] OR "education"[MeSH Subheading] OR "education"[All Fields] OR "educational status"[MeSH Terms] OR ("educational"[All Fields] AND "status"[All Fields]) OR "educational status"[All Fields] OR "education"[MeSH Terms] OR "education s"[All Fields] OR "educational"[All Fields] OR "educative"[All Fields] OR "educator"[All Fields] OR "educator s"[All Fields] OR "educators"[All Fields] OR "teaching"[MeSH Terms] OR "teaching"[All Fields] OR "educate"[All Fields] OR "educated"[All Fields] OR "educating"[All Fields] OR "educations"[All Fields]) OR "education, medical"[MeSH Terms] OR "education, medical, graduate"[MeSH Terms] OR ("education"[MeSH Subheading] OR "education"[All Fields] OR "training"[All Fields] OR "education"[MeSH Terms] OR "train"[All Fields] OR "train s"[All Fields] OR "trained"[All Fields] OR "training s"[All Fields] OR "trainings"[All Fields] OR "trains"[All Fields]) OR "teaching"[MeSH Terms] OR ("curriculum"[MeSH Terms] OR "curriculum"[All Fields] OR "curricula"[All Fields] OR "curriculums"[All Fields] OR "curriculum s"[All Fields] OR "education"[MeSH Subheading] OR "education"[All Fields]) OR ("program"[All Fields] OR "program s"[All Fields] OR "programe"[All Fields] OR "programed"[All Fields] OR "programes"[All Fields] OR "programing"[All Fields] OR "programmability"[All Fields] OR "programmable"[All Fields] OR "programmably"[All Fields] OR "programme"[All Fields] OR "programme s"[All Fields] OR "programmed"[All Fields] OR "programmer"[All Fields] OR "programmer s"[All Fields] OR "programmers"[All Fields] OR "programmes"[All Fields] OR "programming"[All Fields] OR "programmings"[All Fields] OR "programs"[All Fields]) OR ("program"[All Fields] OR "program s"[All Fields] OR "programe"[All Fields] OR "programed"[All Fields] OR "programes"[All Fields] OR "programing"[All Fields] OR "programmability"[All Fields] OR "programmable"[All Fields] OR "programmably"[All Fields] OR "programme"[All Fields] OR "programme s"[All Fields] OR

"programmed"[All Fields] OR "programmer"[All Fields] OR "programmer s"[All Fields] OR "programmers"[All Fields] OR "programmes"[All Fields] OR "programming"[All Fields] OR "programmings"[All Fields] OR "programs"[All Fields]) OR "Syllabus"[All Fields]) AND (2005:2022[pdat])

Appendix B2 - List of included sources (Chapter 5)

List of resources included in scoping review, organised by year and author:

Year	Author	Source	Title
2017	Moore D, et al.	ANZ J Surg	Implementing entrustable professional activities: the yellow brick road towards competency-based training?
2018	Anderson CI, et al.	J Am Coll Surg	Comprehensive Multicenter Graduate Surgical Education Initiative Incorporating Entrustable Professional Activities, Continuous Quality Improvement Cycles, and a Web-Based Platform to Enhance Teaching and Learning
2018	Wagner JP, et al.	JAMA Surg	Use of Entrustable Professional Activities in the Assessment of Surgical Resident Competency
2019	Brasel KJ, et al.	J Surg Educ	Entrustable Professional Activities in General Surgery: Development and Implementation
2019	Stahl CC, et al.	J Am Coll Surg	Integration of Entrustable Professional Activities into General Surgery Residency: A Practical Guide
2019	Tobin S	Advancing Surgical Education (book)	Entrustable Professional Activities in Surgical Education
2020	Albright JB, et al.	J Surg Educ	Association Between Entrustable Professional Activities and Milestones Evaluations: Real-time Assessments Correlate With Semiannual Reviews
2020	Gupta A, et al.	J Surg Educ	Entrustable Professional Activities: Do General Surgery Residents Trust Them?
2020	Stahl CC, et al.	J Surg Educ	Implementation of Entrustable Professional Activities into a General Surgery Residency
2020	Stahl CC, et al.	J Surg Educ	Entrustable Professional Activities in General Surgery: Trends in Resident Self-Assessment
2020	Stahl CC, et al.	Advances in Surgery	New Models of Surgical Training
2021	American Board of Surgery	American Board of Surgery website	Entrustable Professional Activities - General Surgery
2021	Domínguez LC, et al.	Revista Colombiana de Cirugía	Fundamentos para un currículo nacional en Cirugía General basado en competencia: Consenso Delphi de la División de Educación de la Asociación Colombiana de Cirugía
2021	Kearse LE, et al.	J Surg Educ	American Board of Surgery Entrustable Professional Activities (EPAs): Assessing Graduating Residents' Perception of Preoperative Entrustment
2021	Lindeman B, et al.	Acad Med	A Phased Approach: The General Surgery Experience Adopting Entrustable Professional Activities in the United States
2021	Netherlands Council of Surgery	Netherlands Medical Association website	Structuur Curriculum Heelkunde voor Reflectieve Professionals - SCHERP 2.1
2022	Amare EM, et al.	J Surg Educ	Development of an Entrustable Professional Activities (EPA) Framework to Inform Surgical

			Residency Training Programs in Ethiopia: A Three-round National Delphi Method Study
2022	Amare EM, et al.	ResearchSquare	Faculty and resident perceptions/judgments of Entrustable Professional Activities (EPA) performance in the context of Ethiopian medical education
2022	Australian Board in General Surgery	Australian Board in General Surgery website	General Surgery Education and Training (GSET) Program - EPAs and PBAs
2022	Brazelle M, et al.	J Am Coll Surg	Concurrent Validity Evidence for Entrustable Professional Activities in General Surgery Residents
2022	Canadian Association of General Surgery	Canadian Association of General Surgery website	Resident Handbook
2022	Cheung KT, et al.	Journal of Surgical Education	Elective Laparoscopic Cholecystectomy as an Entrustable Professional Activity (EPA) for General Surgical Trainees in Australia
2022	Delbone RM, et al.	EPAs series in health training - Medical Residency Notebooks: vol 1 (e-book)	Curriculum based on EPAs from the general surgery medical residency program, Faculdade Santa Casa de BH
2022	Division of General Surgery, University of Cape Town	Unpublished document	Entrustable Professional Activities for postgraduate general surgery training
2022	Padilla EP, et al.	Ann Surg	Gender Differences in Entrustable Professional Activity Evaluations of General Surgery Residents
2023	Amare EM	Heliyon	Differences in perceptions of capability, autonomy, and expectations between residents and surgical team members in executing EPAs in Ethiopian medical education
2023	Joint Committee on Surgical Training	United Kingdom Intercollegiate Surgical Curriculum Programme website	Intercollegiate Surgical Curriculum Programme - General Surgery Curriculum
2023	Singapore Residency Advisory Committee for General Surgery	Unpublished document	General Surgery Entrustable Professional Activities - draft
Not dated	Department of General Surgery, Sri Balaji Vidyapeeth University	Sri Balaji Vidyapeeth University website	Competency based postgraduate curriculum

Appendix B3 - EPA lists from each country (Chapter 5)

USA

Link: https://www.absurgery.org/default.jsp?epa_gs

1. RLQ pain/Appendicitis
2. Benign or malignant breast disease
3. Benign or malignant colon disease
4. Gallbladder disease
5. Inguinal hernia
6. Abdominal wall hernia
7. Acute abdomen
8. Benign anorectal disease
9. Small bowel obstruction
10. Thyroid and parathyroid disease
11. Dialysis access
12. Soft tissue infection
13. Cutaneous and subcutaneous neoplasms
14. Severe acute or necrotizing pancreatitis
15. Perioperative care of the critically ill surgery patient
16. Flexible GI Endoscopy
17. Evaluation/initial management of a trauma patient
18. Provide general surgery consultation

Canada

Link:

<https://cags-accg.ca/wp-content/uploads/2022/06/Resident-Handbook-E-2022-2023-Final.pdf> and

<https://www.royalcollege.ca/content/dam/documents/ibd/general-surgery/epa-guide-general-surgery-e.pdf>

Foundations:

1. Assessing and providing initial management plans for patients presenting with a simple General Surgery problem
2. Recognizing and initiating management for patients with a surgical abdomen/acute abdomen
3. Performing fundamental skills in General Surgery
4. Performing the pre-procedural assessment and risk optimization for patients undergoing endoscopy
5. Developing a proposal for a scholarly project

Core:

1. Providing surgical consultation
2. Providing initial assessment and management of patients with multiple traumatic injuries
3. Leading the team providing care for an inpatient surgical service
4. Providing follow-up care
5. Performing procedures on the stomach and duodenum

6. Performing procedures on the small bowel
7. Performing procedures on the appendix and colon
8. Performing procedures on the rectum and anus
9. Performing procedures on the hepatobiliary system
10. Performing procedures on the pancreas
11. Performing procedures on the spleen
12. Performing procedures on the lymph nodes
13. Performing procedures on the breast
14. Performing procedures on the abdominal wall and hernia
15. Performing procedures on the skin and soft tissue
16. Performing procedures for patients with traumatic injuries
17. Performing the skills of minimally invasive surgery (MIS)
18. Performing procedures for patients with disorders of the thyroid and/or parathyroid glands
19. Performing esophagogastroduodenoscopy
20. Performing colonoscopies
21. Completing a scholarly project
22. Delivering scholarly teaching to a variety of audiences, including peers, junior trainees, and/or other health professionals

Transition to practice:

1. Managing an outpatient clinic
2. Managing the day's list of endoscopy procedures
3. Managing the day's list of operative procedures
4. Performing therapeutic endoscopic interventions of the upper and lower gastrointestinal tract (OPTIONAL)
5. Performing the administrative, human resource and financial aspects of independent practice

Santa Casa de Belo Horizonte (Brazil)

Link:

<https://faculdadesantacasabh.org.br/wp-content/uploads/2023/01/Cadernos-da-Residencia-Medica-Cirurgia-Geral-VOL.1-2022.pdf>

1. Admitting the Surgical Patient
2. Caring for the Preoperative Patient
3. Caring for the Postoperative Patient
4. Caring for the Critically Ill Surgical Patient
5. Surgically Treating Patients with Abdominal Wall Defects
6. Accessing the Abdominal Cavity of the Surgical Patient
7. Treating Patients with Acute Appendicitis
8. Surgically Approaching Patients for Alternative Nutritional Route
9. Treating Patients with Gallbladder Pathology
10. Surgically Approaching the Patient in Surgical Emergency
11. Surgically Approaching Patients with Digestive System Cancer
12. Approaching the Patient for Catheterization and Probing
13. Approaching the Patient for Central Venous Access/Venous Dissection
14. Approaching the Patient for Minor Surgical Procedures
15. Surgically Approaching Patients with Morbid Obesity

16. Managing Excellence in General Surgery Care

Colombia

Link: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S2011-75822021000400582

1. Evaluate adults with urgent surgical conditions of medical and traumatic causes in emergency and hospital services
2. Assess adults with elective surgical conditions in outpatient services and outpatient services
3. Perform specific surgical procedures (includes list of 117 procedures)
4. Evaluate surgical patients in the perioperative period

Netherlands

Link:

https://assets.heelkunde.nl/p/491520/none/0_%20SCHERP%202_1%20compleet%20per%2001-05-2023.pdf

EPAs

Year 1:

1. Outpatient clinic
2. Independent management of a ward
3. Consult for an acute patient in the ER
4. Afterhours shift
5. Surgical intervention

Year 2-4:

1. Acute limb ischemia
2. Diagnosis and management of acute appendicitis
3. Symptomatic gallstones
4. Basic skin cancers
5. Surgical wound care
6. Vascular access surgery
7. Management of fractures
8. Primary assessment and triage of trauma patients
9. Supervision of junior students as well as the ER, ward and simple operations
10. Leadership in MDT meetings
11. Teaching/clinical teaching
12. Surgical consult in the ICU

Key procedures (up to year 4)

1. Tendon repair
2. Large wound toilet, debridement, skin graft
3. Groin/femoral hernia (adult)
4. I + D abscess
5. Ingrown toenail
6. Dorsal ganglion
7. Local and regional anaesthesia

8. Vascular access (venous)
9. Surgery in children - Appendectomy
10. Surgery in children - Fractures (Prevot and K-wires)
11. Colorectal - (laparoscopic) appendectomy
12. Colorectal - Right Hemicolectomy
13. Colorectal - Sigmoid Resection
14. Proctology - abscess drainage
15. Proctology - hemorrhoidectomy or pexy, intersphincteric fistula
16. Lap chole
17. Breast Local excision (+/- localization)
18. Breast Sentinel node procedure
19. Primary care and treatment of (multi) trauma patient - Securing airway
20. Primary care and treatment (multi) trauma patient - Assessment of ventilation and performing chest drainage
21. Primary care and treatment (multi) trauma patient - Assessment of circulation, initial bleeding control, create access route
22. Injuries of the musculoskeletal system - reduction and immobilisation fracture/dislocation
23. Injuries of the musculoskeletal system - Assessment/care for hand injuries
24. Injuries of the musculoskeletal system - Achilles tendon rupture repair
25. Injuries of the musculoskeletal system - Osteosynthesis/Prosthesis Proximal Femoral Fracture
26. Injuries of the musculoskeletal system - Osteosynthesis ankle fracture
27. Extremity - Extremity operative / groin release
28. Venous - Venous Varices - invasive primary
29. Amputation - Upper or lower
30. Amputation - Amputation

Year 5-6 has further EPAs and procedures per sub-specialisation (Paediatric surgery, Vascular, GI/oncology, Trauma)

UK

Link: <https://www.iscp.ac.uk/iscp/curriculum/general-surgery-curriculum/1-introduction/>

EPAs (termed "Capabilities in Practice"):

1. Manages an out-patient clinic
2. Manages the unselected emergency take
3. Manages ward rounds and the on-going care of in-patients
4. Manages an operating list
5. Manages multi-disciplinary working

Entrustment level for each EPA rated at an end of rotation multi-consultant review (MCR), informed by WBA of "index procedures" and "critical conditions":

- Index procedures (up to end of phase 2/year 6):
 - Inguinal hernia
 - Cholecystectomy

- Segmental colectomy
- Emergency laparotomy
- Appendicectomy
- Critical conditions:
 - Assessment of the acute abdomen
 - Strangulated / obstructed hernia
 - Intestinal ischaemia
 - Intestinal obstruction Post-operative haemorrhage
 - Acute gastrointestinal haemorrhage
 - Blunt / penetrating abdominal injury
 - Necrotising fasciitis
 - Sepsis
 - Anastomotic leak
 - Acute colitis / toxic megacolon
 - Faecal peritonitis
 - Biliary sepsis
 - Acute pancreatitis
 - Oesophageal perforation
 - Upper GI anastomotic leak
 - Ruptured AAA
 - Acute limb ischaemia
 - Compartment syndrome

Ethiopia

Link: <https://www.sciencedirect.com/science/article/pii/S193172042100177X?via%3Dihub>

1. Collecting information (history, physical examination) in an organised fashion
2. Recommending screening and diagnostic tests, interpreting and understand the implication test, and communicating the result of a test with the patient or a peer
3. Documenting clinical encounters
4. Identifying urgencies/emergencies and initiating early management for critically ill surgical patients
5. Communicating with co-workers, patients, and families including breaking bad news
6. Educating patient and obtaining informed consent in preparation for surgical care
7. Leading and Conducting routine ward rounds in collaboration with interprofessional teams
8. Consulting health care providers and supervising resident students caring for surgical patients
9. Performing preoperative preparation and optimization of patients for surgical procedures
10. Managing postoperative patients (complicated and uncomplicated)
11. Performing basic (minor) surgical procedures
12. Repairing Hernias (Herniorrhaphy)
13. Performing creation of an opening (stoma) into the windpipe (tracheostomy, cricothyroidotomy)
14. Performing removal of part or all of the thyroid gland (Thyroidectomy)

15. Performing removal of some or all breast tissue, 1 or both breasts, axillary lymph nodes,(Mastectomy)
16. Performing removal of stone from gallbladder (open Cholecystectomy)
17. Performing Common Bile Duct (CBD) exploration
18. Performing partial or complete removal of spleen (Open splenectomy)
19. Evaluation and surgical management of patient with Peptic Ulcer Disease (Performing vagotomy, pyloroplasty, antrectomy, and gastrojejunostomy /Billroth procedure)
20. Performing removal of appendix, appendiceal mass, and appendiceal Abscess (Open appendectomy)
21. Performing an exploratory laparotomy for trauma
22. Evaluation and surgical management patient with partial or complete blockage of the small intestine
23. Evaluation and surgical management of patient with the colonic and /or rectal disease
24. Evaluation and management of abnormal twisting of part of the large or small intestine (Volvulus)
25. Evaluation and surgical management of patient with hemorrhoid (Hemorrhoidectomy)
26. Rectal/anal fistula repair
27. Diagnosis and management of patient with Benign prostatic hyperplasia, benign prostatic hypertrophy (BPH)
28. Providing initial management for trauma / fracture patients
29. Performing below knee, above knee, and upper limb amputation

University of Cape Town (South Africa)

Link:

https://docs.google.com/document/d/1ZICNM2rfGNL_GVijVLBOg6po6yjWnx4b/edit?usp=sharing&oid=109585347221124307439&rtpof=true&sd=true

1. Managing general surgery outpatients
2. Managing general surgery inpatients
3. Managing a general surgery acute intake
4. Performing appendectomies
5. Performing amputations
6. Performing cholecystectomies
7. Performing hernia repairs
8. Performing laparotomies
9. Performing intestinal stomas/anastomoses
10. Performing gastroscopies
11. Performing mastectomies/lumpectomies

Sri Balaji Vidyapeeth University (India)

Link: <https://sbvu.ac.in/sbvcourse/ms-general-surgery/>

1. Gathering a history and performing a physical examination
2. Prioritising a differential diagnosis following a clinical encounter
3. Recommending and interpreting common diagnostic and screening tests

4. Entering and discussing orders and prescriptions and giving the necessary instructions to the patients
5. Documenting a clinical encounter in patient records and provide an oral presentation of a clinical encounter
6. Form clinical questions and retrieve evidence to advance patient care
7. Give or receive a patient handover to transition care responsibility
8. Collaborate as a member of an interprofessional team
9. Obtain informed consent for tests and/or procedures
10. Perform general procedures of a physician
11. Identify system failures and contribute to a culture of safety and improvement, Effective communication with peers and superiors
12. Attitudes towards patient, relatives, peers and supervisors
13. Effective relevant systemic examination in OPD and bedside clinics
14. Ability to make a diagnosis and DD
15. Pre-operative counselling of patient and attendant
16. Basic Pre & Post-operative care
17. Basic surgical skills like handling energy devices, suturing techniques and OT techniques
18. Performing minor General Surgery procedure (performing simple swelling excision, appendectomy, hydrocele, haemorrhoids, fissure, hernia)
19. Basic trauma management
20. Reading and interpreting all basic X-rays and CT abdomen relevant to General surgery
21. Reading and interpreting all basic X-rays and CT abdomen relevant to General surgery (repeat)
22. Endoscopy, Colonoscopy, Laparoscopy, Laparotomy Skills
23. Perform basic procedures like breast lumpectomy, thyroidectomy, and varicose vein surgeries.
24. Gastrectomy, Hemicolectomy, Pancreatic Surgery
25. Able to write scientific papers, make podium Presentations
26. Able to conduct bedside clinics to undergraduate students

Australia

Link:

<https://generalsurgeons.com.au/home/for-trainees/training-program/gset-program/epas-pbas/>

EPAs

Core (year 1-3):

1. Arrange and Complete Surgery for a Simple Acute Case
2. Assessing Simple New Elective Case in Outpatient Clinic
3. Delivering Results to a Patient
4. Discharge Planning for a Complex Patient
5. Leading A Team Ward Round
6. Management of Acute admissions - Evening or Weekend Shift
7. Opportunistic Student Teaching Session
8. Present at MDM/X-Ray Meeting

9. Presentation at Departmental Meeting
10. Run a Student Teaching Session - Topic Based

Principal (year 4-5):

1. Arranging Acute Surgery for a Complex Condition
2. Management of a New Cancer Patient in the Outpatient Clinic
3. Delivering News to a Patient - End of life Prognostic Discussion
4. Delivering News to a Patient - Unable to Undertake Procedure on the Day
5. Operative Supervision of a Junior Colleague
6. Present at MDM/X-Ray Meeting of a Complex Case

Procedural based activities ("EPA subtype")

Core:

1. Anastomosis
2. Appendectomy - Laparoscopic or Open
3. Examination Under Anaesthetic Anus - Incision and Drainage of Perianal Abscess
4. Groin Hernia - Laparoscopic or Open
5. Open and Closing Abdominal Incision
6. Simple Laparoscopic Cholecystectomy with or without Intraoperative Cholangiogram
7. Small Bowel Resection
8. Stoma Formation

Principal:

1. Axillary Node Dissection
2. Colonoscopy
3. Hartmann's Procedure or Acute Left Colectomy
4. Laparotomy or Adhesiolysis
5. Right Hemicolectomy - Laparoscopic or Open
6. Sigmoid Colectomy/Anterior Resection
7. Thyroidectomy
8. Upper GI Endoscopy
9. Wide Local Excision/Mastectomy

Singapore

Not available online.

- EPA 1: Managing Surgical Outpatient Clinics
- EPA 2: Leading Ward Rounds
- EPA 3: Managing Patients During Calls
- EPA 3A: Performing Calls
- EPA 3B: Performing Emergency Surgical Procedures. Includes:
 - Appendectomy
 - Cholecystectomy
 - Exploratory Laparotomy
 - Emergency endoscopy
 - Emergency surgery for incarcerated hernias
 - Start a Colectomy

- EPA 4: Running Elective Outpatient Endoscopy Sessions (includes upper and lower GI scopes)
- EPA 5: Performing Elective Surgical Procedures. Includes:
 - Ray or partial foot amputation for peripheral vascular disease
 - Open inguinal hernia repair
 - Laparoscopic cholecystectomy with or without intraoperative cholangiogram
 - Open segmental colectomy
 - Small bowel resection or gastrojejunostomy
 - Hemithyroidectomy
 - Simple mastectomy

Appendix B4 - Combined EPAs (Chapter 5)

Procedural EPAs:

<i>EPA title</i>	<i>Included as standalone EPA</i>	<i>Included in specifications of broader EPA</i>	<i>Number of countries</i>
Broad EPAs (service provision)			
Managing the day's list of operative procedures	Canada, UK		2
Managing an endoscopy list	Canada, Singapore		2
Performing surgical procedures	Colombia		1
Performing Emergency Surgical Procedures	Singapore		1
Performing Elective Surgical Procedures	Singapore		1
Specific EPAs (disease/procedure(s))			
Managing appendicitis/performing appendectomies	USA, Brazil, Netherlands, Ethiopia, SA, India, Australia	Canada, Colombia, UK, Singapore	11
Managing abdominal wall defects/performing hernia repairs	USA, Canada, Brazil, Netherlands, Ethiopia, SA, India, Australia	Colombia, UK, Singapore	11
Managing the acute abdomen/performing laparotomies	USA, Canada, Brazil, Netherlands, Ethiopia, SA, India, Australia	Colombia, UK, Singapore	11
Managing benign and malignant colonic lesions/performing colectomies and anastomoses/stomas	USA, Netherlands, Ethiopia, SA, Australia	Canada, Colombia, UK, Singapore	10
Managing gallbladder disease/performing cholecystectomies	USA, Brazil, Netherlands, Ethiopia, SA, Australia	Canada, Colombia, UK, Singapore	10
Managing benign and malignant breast lesions/performing mastectomies or lumpectomies +/- SLNB or ALND	USA, Netherlands, Ethiopia, SA, India, Australia	Canada, Colombia, Singapore	9
Managing benign anorectal disease/performing hemorrhoidectomies, fistulotomies, or drainage of perianal abscesses	USA, Netherlands, Ethiopia, India, Australia	Canada, Colombia	7

Managing small bowel obstruction/performing small bowel resection	USA, Ethiopia, SA, Australia	Canada, Colombia, Singapore	7
Managing thyroid disease/performing thyroidectomies	USA, Ethiopia, India, Australia	Canada, Colombia, Singapore	7
Performing Upper GI Endoscopy	USA, Canada, SA, India, Australia	Singapore	6
Performing Lower GI Endoscopy	USA, Canada, SA, India, Australia	Singapore	6
Performing Minor Surgical Procedures	Netherlands, Brazil, Ethiopia, India	Canada	5
Performing vascular access procedures	USA, Brazil, Netherlands	Colombia	4
Managing soft tissue infections/performing soft tissue drainage or debridement	USA, Netherlands	Canada, Colombia	4
Managing skin and soft tissue malignancies	USA, Netherlands	Canada, Colombia	4
Performing amputations	Netherlands, Ethiopia, SA	Singapore	4
Managing parathyroid disease/performing parathyroidectomies	USA	Canada, Colombia	3
Performing tracheostomies/cricothyroidotomies	Ethiopia	Canada, Colombia	3
Performing CBD explorations	Ethiopia	Canada, Colombia	3
Performing partial or complete splenectomies	Ethiopia	Canada, Colombia	3
Managing varicose veins	Netherlands, India	Colombia	3
Surgical management of peptic ulcer disease	Ethiopia	Canada, Colombia	3
Performing gastrectomies	India	Canada, Colombia	3
Surgical management of rectal disease	Ethiopia	Canada, Colombia	3
Surgically Approaching Patients for Alternative Nutritional Route	Brazil	Canada, Colombia	3
Performing fundamental	Canada, India		2

skills/general procedures in General Surgery			
Performing procedures on the pancreas	India, Canada		2
Managing acute limb ischaemia	Netherlands	Colombia	2
Surgery for Obesity	Brazil	Canada	2
Managing acute pancreatitis	USA		1
Managing wounds	Netherlands		1
Managing fractures/performing immobilisation, prosthesis, osteosynthesis or K-wires	Netherlands		1
Performing tendon repairs	Netherlands		1
Performing Surgery for dorsal ganglia	Netherlands		1
Managing hand injuries	Netherlands		1
Managing Benign prostatic hyperplasia	Ethiopia		1
Performing procedures on the stomach and duodenum	Canada		1
Performing procedures on the appendix and colon	Canada		1
Performing procedures on the small bowel	Canada		1
<i>Performing procedures on the rectum and anus</i>	Canada		1
<i>Performing procedures on the spleen</i>	Canada		1
<i>Performing procedures on the breast</i>	Canada		1
Performing procedures on the hepatobiliary system	Canada		1
Performing procedures on the lymph nodes	Canada		1
Performing procedures on the skin and soft tissue	Canada		1

Performing the skills of minimally invasive surgery (MIS)	Canada		1
Performing procedures for patients with disorders of the thyroid and/or parathyroid glands	Canada		1
Surgically Approaching Patients with Digestive System Cancer	Brazil		1
Approaching the Patient for Catheterization and Probing	Brazil		1

Non-procedural EPAs:

<i>EPA title</i>	<i>Included as standalone EPA</i>	<i>Included in specifications of broader EPA</i>	<i>Number of countries</i>
Outpatient care related			
Managing patients in an outpatient clinic/service	Canada, Colombia, Netherlands, UK, SA, India, Australia, Singapore	USA, Brazil	10
Leading or participating in a MDT meeting	Netherlands, UK, Australia	USA, SA	5
Inpatient care related			
Managing ward rounds and the care of inpatients	Canada, Colombia, Netherlands, UK, Ethiopia, SA, Australia, Singapore	USA, Brazil, India	11
Managing acute admissions during an afterhours call/intake	Brazil, Colombia, Netherlands, UK, SA, Australia, Singapore	USA	8
Providing pre and postoperative care	USA, Canada, Brazil, Colombia, Ethiopia	Netherlands, UK, SA	8
Management of critically ill patients	USA, Brazil, Colombia, Netherlands, Ethiopia	UK, SA	7

Evaluation/initial management of trauma patients	USA, Canada, Colombia, Netherlands, Ethiopia, India		6
Providing a surgical consultation	USA, Canada, Netherlands	UK	4
Related to both in and outpatient care			
Ordering and interpreting investigations, and communicating the results	Ethiopia, India, Australia	Brazil, Netherlands, UK, Singapore	7
Obtaining informed consent	Ethiopia, India	Brazil, Netherlands, UK, Singapore	6
Documenting a clinical encounter	Ethiopia, India	Brazil, Netherlands, UK, Singapore	6
Performing a history and physical examination	Ethiopia, India	Brazil, Netherlands, UK, Singapore	6
Delivering bad news to patients and families	Ethiopia, Australia	Brazil, Netherlands, UK	5
Consulting other healthcare providers	Ethiopia	Brazil, Netherlands, UK, Singapore	5
Prioritising a differential diagnosis following a clinical encounter	India	Brazil, Netherlands, UK, Singapore	5
Collaborating as a member of an interprofessional team	India	Brazil, Netherlands, UK, Singapore	5
Giving or receiving a patient handover	India	Brazil, Netherlands UK, Singapore	5
Assessment and management of a simple General Surgery condition	Canada, Australia	Brazil	3
Entering and discussing orders and prescriptions	India	Brazil, UK	3
Discharge Planning for a Complex Patient	Australia		1
Arranging surgery for a Complex case	Australia		1
Research/teaching			
Teaching and supervision of students and juniors trainees	Canada, Netherlands, India, Australia		4
Conducting academic presentations	Canada, India, Australia,		4

	Netherlands		
Interpreting, conducting and disseminating research	Canada, India		2
Identifying system failures and contributing to a culture of safety and improvement	India	Brazil	2
Managing excellence in surgical care	Brazil		1
Performing the administrative, human resource and financial aspects of independent practice	Canada		1

Appendix C - List of procedures used in questionnaire (Chapter 6)

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

Appendix D1 - Registrar survey after implementation cycle 1 (Chapter 8)

This short survey is part of an HREC approved study (478/2022). All data will be de-identified, stored securely and confidentially. Participation is voluntary. By filling out the survey you are consenting to participate.

Initial and surname								
Contract type (please circle)	Local / International							
Year of training	1	2	3	4	5	6		
Number of Observations you had this rotation (estimate)	1	2	3	4	5	6	7	8

Perceptions regarding the **feasibility** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The WBA strategy seems easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems implementable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems possible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems doable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **acceptability** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
I like this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is appealing to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It meets my approval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I welcome this WBA initiative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **appropriateness** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
This WBA strategy seems fitting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems suitable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems applicable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems like a good match	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How do you feel about the current **list of activities for 'Observation'** (7 procedures, 1 inpt round, 1 acute intake round, 1 outpt clinic)?

Positives	
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Concerns/Suggestions	
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What do you think is a reasonable **number of Observations** required per 3 month rotation in our setting (current is 2, international norm is 8-12 per registrar per rotation)?

Has completing observations impacted the unit's clinical **workflow**, and if so, please give suggestions on how to minimise this?

Do you feel you need more **information/training** to give you a clear understanding of WBA?

Is the **digital (smartphone) system** easy to use? If not, what can be improved?

Is the observation **request process/form** clear and easy to complete? If not, how can it be improved?

Please describe any **obstacles to consultant completion** of Observation requests?

Did you always receive **face-to-face feedback** after an Observation and if not, how could this be better facilitated?

Final comments/suggestions?

Appendix D2 - Consultant survey after implementation cycle 1 (Chapter 8)

This short survey is part of an HREC approved study (478/2022). All data will be de-identified, stored securely and confidentially. Participation is voluntary. By filling out the survey you are consenting to participate.

Initial and surname								
Years post FCS qualification (please circle)	<3 years		≥3 years					
Number of Observations you completed this rotation (estimate)	1	2	3	4	5	6	7	8

Perceptions regarding the **feasibility** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
WBA system seems easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems implementable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems possible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems doable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **acceptability** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
I like this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is appealing to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It meets my approval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I welcome this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **appropriateness** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
This WBA strategy seems fitting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems suitable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems applicable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems like a good match	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How do you feel about the current **list of activities for 'Observation'** (7 procedures, 1 inpatient round, 1 acute intake round, 1 outpatient clinic)?

Positives	
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Concerns/ Suggestions	
--------------------------	--

What do you think is a reasonable **number of Observations** required per 3 month rotation in our setting (current is 2, international norm is 8-12 per registrar per rotation)?

Has completing observations impacted your unit's clinical **workflow**, and if so, please give suggestions on how to minimise this?

Do you feel you need more **information/training** to give you a clear understanding of WBA?

Please provide feedback on any of the 3 smartphone-based **Observation tools** you've used (procedure, inpatient/acute intake, outpatient), including suggestions on how they can be improved?

Please comment on the feasibility of the **24hr deadline** for completion of the report?

What is your perception of the Observation request and reminder **delivery methods** (currently an email and SMS at request and 24hrs)? Is it sufficient or should it be less/more, or using other methods?

Final comments/suggestions?

Appendix D3 - Registrar survey after implementation cycle 2 (Chapter 8)

This short survey is part of an HREC approved study (478/2022). All data will be de-identified, stored securely and confidentially. Participation is voluntary. By filling out the survey you are consenting to participate.

Surname						
Contract type (please circle)	Local / International					
Year of training	1	2	3	4	5	
Number of Observations you had in Jan-March rotation (estimate)	1	2	3	4	5	6

Perceptions regarding the **feasibility** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The WBA system seems easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems implementable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems possible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems doable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **acceptability** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
I like this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is appealing to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It meets my approval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I welcome this WBA initiative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **appropriateness** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
This WBA strategy seems fitting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems suitable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems applicable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems like a good match	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How do you feel about the current **list of activities for 'Observation'** (8 procedures, 1 inpt round, 1 acute intake round, 1 outpt clinic)?

Any that you feel don't work well in practice?	
Concerns/ Suggestions for other activities to add?	

In the previous rotation, both consultants and registrars suggested that the **ideal number of observations** should be around **five** per three-month rotation. Do you feel this is:

Too few		Just right		Too many	
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Did you always receive **face-to-face feedback** after an Observation?

Yes		No	
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If applicable, please describe any **obstacles you experienced to consultant/fellow/JC completion of** Observation requests?

--

Did the consultants/fellows in the unit **take this initiative seriously and engage** with it? If no, please describe why you think so.

--

Do you see Observations in the workplace primarily as a **tool to facilitate learning or a tool to test** you?

Educational tool		Assessment tool	
------------------	--	-----------------	--

Any improvements that can be made to the **digital (smartphone) system** and report emails?

--

Any improvements that can be made to the observation **request process/form**?

--

Do you feel you need more **information/training** to give you a clear understanding of the process?

--

Final comments/suggestions?

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Appendix D4 - Consultant survey after implementation cycle 2 (Chapter 8)

This short survey is part of an HREC approved study (478/2022). All data will be de-identified, stored securely and confidentially. Participation is voluntary. By filling out the survey you are consenting to participate.

Surname	
Years post FCS qualification (please circle)	<3 years ≥3 years
Number of registrar Observations you completed this rotation (estimate)	1 2 3 4 5 6

Perceptions regarding the **feasibility** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The WBA system seems easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems implementable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems possible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems doable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **acceptability** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
I like this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is appealing to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It meets my approval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I welcome this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **appropriateness** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
This WBA strategy seems fitting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems suitable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems applicable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems like a good match	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How do you feel about the current **list of activities for 'Observation'** (8 procedures, 1 inpt round, 1 acute intake round, 1 outpt clinic)?

Any that you feel don't work well in practice?	
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Concerns/ Suggestions for other core activities to add?	
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In the previous rotation, both consultants and registrars suggested that the **ideal number of observations** should be around **five** per three-month rotation. Do you feel this is:

Too few		Just right		Too many	
---------	--	------------	--	----------	--

If applicable, please describe any **obstacles you experienced to timely completion** of Observation requests?

The inpatient/acute intake and outpatient **forms were recently changed** from multiple MCQ-type questions to rate various specific components, to a simpler global rating type form. If you've completed both types, which do you prefer?

Old form (more MCQs)		New form (global rating)		Not applicable	
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Do you see Observations in the workplace primarily as a **tool to facilitate learning or a tool to test the registrar's ability?**

Educational tool		Assessment tool	
------------------	--	-----------------	--

Did you always give **face-to-face feedback** after an Observation?

Yes		No	
-----	--	----	--

Any improvements that can be made to the **digital (smartphone) system** and report emails, including the type and schedule of reminders to complete an Observation?

Do you feel you need more **information/training** to give you a clear understanding of the process?

Final comments/suggestions?

Appendix D5 - Registrar survey after implementation cycle 3 (Chapter 8)

This short survey is part of an HREC approved study (478/2022). All data will be de-identified, stored securely and confidentially. Participation is voluntary. By filling out the survey you are consenting to participate.

Surname							
Contract type (please circle)	Local / International						
Year of training	1	2	3	4	5		
Number of Observations you had in April-June rotation (estimate)	1	2	3	4	5	6	7

Perceptions regarding the **feasibility** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The WBA system seems easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems implementable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems possible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems doable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **acceptability** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
I like this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is appealing to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It meets my approval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I welcome this WBA initiative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **appropriateness** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
This WBA strategy seems fitting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems suitable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems applicable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems like a good match	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you had to tell a surgery registrar at another institution what the **main benefit** of Workplace Observations is, what would you say?

What is the main motivating factor for you to **request** an observation on any given day?

--

Do you feel that your ability to **self-assess** your performance of clinical activities has been improved by getting Workplace Observations?

Yes		No	
-----	--	----	--

Do you feel that the observation **reports** you received from supervisors were generally a reliable reflection of your performance for those activities?

Yes		No	
-----	--	----	--

Did you always receive **face-to-face feedback** after an Observation?

Yes		No	
-----	--	----	--

Please describe any factors, if any, that you think may limit the **sustained implementation** of Workplace Observations in this department?

--

Do you see Observations in the workplace **mainly** as a tool to **facilitate training** or a **tool to test** you?

Educational tool		Assessment tool	
------------------	--	-----------------	--

Are you ever worried about the implications of 'doing badly' in an activity you requested an observation for?

Yes		No	
-----	--	----	--

Any suggestions on what we can **change** to make Workplace Observations a more useful tool to enhance training in our department?

--

Appendix D6 - Consultant survey after implementation cycle 3 (Chapter 8)

This short survey is part of an HREC approved study (478/2022). All data will be de-identified, stored securely and confidentially. Participation is voluntary. By filling out the survey you are consenting to participate.

Surname	
Years post FCS qualification (please circle)	<3 years ≥3 years
Number of registrar Observations you completed Apr-Jun rotation (estimate)	1 2 3 4 5 6 7

Perceptions regarding the **feasibility** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
The WBA system seems easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems implementable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems possible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems doable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **acceptability** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
I like this WBA strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is appealing to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It meets my approval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I welcome this WBA initiative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Perceptions regarding the **appropriateness** of the current WBA strategy

	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
This WBA strategy seems fitting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems suitable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems applicable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems like a good match	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you had to tell a colleague at another institution what the **main benefit** of Workplace Observations is, what would you say?

How do you think Observations can be **integrated into the weekly rhythm** of your unit?

--

Do you feel that the trainees' ability to **self-assess** their performance of clinical activities has been improved by getting Workplace Observations?

Yes		No	
-----	--	----	--

Please describe any factors, if any, that you think may limit the **sustained implementation** of Workplace Observations in this department?

--

Do you feel that giving **face-to-face** feedback after every Observation is important?

Yes		No	
-----	--	----	--

What can we **change** to make Workplace Observations a more useful tool to *enhance training* and *continuously measure competence* in our team?

--

Appendix D7 - EPA assessment form (Chapter 8)

Note that the questions, as they appear in the online form, are shown in curly brackets.



Observation report

Registrar: {{Registrar name?}}

Context

- Rotation: {{Rotation?}}
- Date of observation: {{Date of observation?}}
- Supervisor: {{Supervisor name?}}
- Activity (EPA) observed: {{Activity observed?}}
- Description of activity (EPA): {{Description of activity?}}
- Difficulty rating: {{Compared to the average for the type of activity evaluated, this was (difficulty rating)?}}

Performance

- Description: {{Please describe the trainee's ability to perform the components of this activity independently?}}
- Supervision required for next time: {{Based on this observation, please provide an overall rating of how much supervision the trainee needs the next time he/she performs this activity?}}

Feedback

- Done well: {{Give at least 1 aspect of the activity done well?}}
- Could be done differently: {{Give at least 1 suggestion for something that could be done differently?}}

Appendix D8 - Competence committee guide (Chapter 8)

Purpose and principles

A Competence Committee allows for an *informed group decision-making process*, where patterns of performance can be collated to reveal a broad picture of a trainee's progression toward competence. To do this, the CC makes decisions and recommendations using data from multiple sources, primarily workplace-based observations. The CC decision-making model replaces the old method of high stakes decision-making (or lack thereof) by an individual, based on weak or no sources of evidence.

A regular review of each trainee's progress facilitates supporting the trainees' learning over time. In particular, the CC will identify registrars who are not meeting their educational targets, and can help to arrange support before the trainee gets too far off their trajectory. This support can mean, for example, assigning special mentors/educational supervisors, attending workshops, simulation programs or a remediation plan with modified or additional rotations. However, instead of a purely problem identification approach, the CC will emphasise a developmental approach, where *each* trainee's progress is assessed according to their own potential and ability.

Progression recommendations are made by the CC away from the individual teacher-learner interactions that occur during Workplace Observations, so that consultant observers can focus on feedback to help improve performance (i.e. using assessment FOR learning). Thus, the CC synthesises and reinterprets the data from many low-stakes observations for each trainee and makes recommendations related to progress. This is in contrast to the clinical supervisors (consultants) whose main role it is to provide training and formative feedback, which is documented as a low-stakes observation of the trainee's performance of specified Entrustable Professional Activities (EPAs).

The CC is expected to exercise judgement in making progress and status recommendations, i.e. they will use the defined EPAs and the expected number of observations as a guideline, but they are not bound to a specific number, context or type of observations or assessments. The key is that the committee must feel it has adequate information on the EPAs to make holistic judgments on the progress of the resident. The wisdom of the CC is considered the gold standard for progression recommendations. In addition to utilising EPAs, committee discussions will be based on all of the assessment tools and relevant evidence from the program as uploaded in the trainee's ePortfolio, e.g. End of Block Assessments. The CC should also consider official letters of complaint against specific trainees when making decisions.

In summary, the CC synthesises the results from multiple assessments and observations to make recommendations related to:

1. Progression of the trainee to the next stage of training;
2. Determining readiness to write the final exit College examination (when trainee is considered ready for independent practice);
3. Determining if a trainee is failing to progress within the program;
4. Interventions or strategies to improve the trainee's progress

5. Monitoring the outcome of any learning or improvement plan established for an individual trainee.

Operational details

- The CC will meet twice a year, where every trainee will be discussed that has been in the program for at least 12 months. Trainees who have completed the final exit examination, or are in their final year and already deemed competent and signed off to write the final exam, need not be discussed. Meetings will generally occur in June and November, prior to the Faculty Examination Committee meetings.
- The CC will include the members of the postgraduate education committee, who have been selected to this role based on interest, experience and expertise in training and education.
- Prior to the meeting, each member of the CC will review the portfolio data for a specific group of +/- 3-6 trainees.
- At the meeting, the primary reviewer for these trainees provides a succinct synthesis and impression of the trainee's progress. This includes their entrustment-supervision rating for each of the 5 broad EPAs, and the strength of the evidence to base these decisions on (guided by the number of observations per EPA). After discussion, the primary reviewer proposes a formal motion on that trainee's status going forward:
- If a trainee has completed 42 months of training (three and a half years), a recommendation regarding readiness to apply for the final certification examination, hosted by the CMSA, is also made (even though the exam is only written 6-12 months later).
- Committee members should attempt to avoid the introduction of hearsay into the deliberations. Discussions are informed only by the evidence available in the trainees ePortfolio eg workplace observations and end of block assessments.
- The CC, on an exceptional basis and after due process, has the responsibility to identify trainees who have met the predefined category of failure to progress, and may be requested to leave the program if remediation efforts have failed.
- Competence Committee decisions/recommendations and their associated rationales are documented within the program's ePortfolio system during the CC meeting.

Committee status recommendation procedure

- Each trainee is considered in turn, with the primary reviewer presenting their synthesis including competence in performing each EPA, as well as sharing important quotes from any observational comments about the trainee. The primary reviewer concludes by proposing a status for the trainee going forward in the program:
 - Ready for the exit examination
 - Progress to the next phase of training
 - Remain in current phase of training
 - Remediation required
 - Exit the program
- The Chair will ask if all agree with the assessment and recommendation.
- If there is a dispute, the Chair will call a vote on the proposed recommendation of the primary reviewer. If the recommendation of the primary reviewer is not seconded or the motion does not achieve a majority of votes, the Chair will then request another

motion regarding the trainee. This will continue until a majority of Competence Committee members supports a status motion.

- Status/progress recommendations can only be deferred if additional information is required. However, this deferred recommendation must be revisited within 4 weeks.
- A status recommendation is recorded in the trainee's ePortfolio and is ratified by the HoD and/or program convenor.
- If a learner's status is not progressing as expected, failing to progress or inactive (temporarily left the program for personal reasons), then the Specialist training committee (STC) and PG Dean needs to be aware.
- After the committee decision, the Program Convenor will discuss the decision of the CC with the trainee.
- If applicable, changes to the trainee's learning plan, assessments, or rotation schedule will be developed with the trainee and implemented as soon as feasible.

Example of CC report for a trainee

Trainee: John Smith (completed year 2)

A) Table to assess competence at performing key general surgery activities (EPAs)

Indicate current supervision required per EPA and number of observations available to make decision - leave blank if insufficient (<3-5) obs to decide

EPA	No. obs	Year 1*	Year 2	Year 3	Year 4	Year 5
Outpatient management	3	IS	NS	-	-	-
Inpatient management	5	IS	IS	-	-	-
Open procedures	7	IS	NS	-	-	-
Laparoscopic procedures	3	DS	IS	-	-	-
Endoscopic procedures	2	-	-	-	-	-

DS - Direct Supervision with consultant actively participating; IS - Indirect Supervision with consultant just present in room; **NS - No Supervision**, with consultant available to assist/advise only if called; SO - Supervise Others; *end of year of training

B) Progress status record/recommendation

Trainee	John Smith
Progress status	Progress as expected
Progress comments	Finished year 1 of cutting rotations after doing well in 1st year of junior rotation. Can do most open procedures independently but still needs supervision for lap procedures and scopes.
Recommendation decision	Progress next phase
Recommendations/actions	Development of lap skills in next 12 months of cutting rotations before starting subspecialist rotations. Try to arrange time in the sim lab especially in acute care surgery rotation.

Appendix E1 - Sample EPA (Chapter 9)

EPA 2: Managing general surgery inpatients

1. Title	Managing general surgery inpatients
2. Specifications and limitations	<p>Specifications:</p> <ul style="list-style-type: none"> ● Assessing, working up and managing 2 or more surgical inpatients, incl: <ul style="list-style-type: none"> ○ Pre- and post-operative cases ○ Patients admitted for non-operative management or investigation ○ Patients in the ICU/HCU ● The observation is based on the trainee's presentation of their assessment and plan for 1 or multiple cases seen for the morning consultant ward round (excluding new admissions which are presented by the post call trainee - see EPA 3). <p>Limitations:</p> <ul style="list-style-type: none"> ● Although subspecialist unit rounds are also included, trainees are expected to manage complex conditions at a generalist, non-subspecialist level i.e. recognition of complexity, initial workup and appropriate referral would be considered appropriate.
3. Potential risks in case of failure	Misdiagnosis, mismanagement and major in-hospital adverse events
4. Most relevant domains of competence	Healthcare practitioner; communicator; collaborator; leader & manager
5. Required experience, knowledge, skills, attitude, and behaviour	<p>Knowledge</p> <ul style="list-style-type: none"> ● Surgical pathology, appropriate investigations and management options <p>Skills</p> <ul style="list-style-type: none"> ● Focused history and examination ● Clinical reasoning to elicit a clear problem list for the day ● Assessment and succinct presentation to the team ● Counselling patients and their families on the diagnosis and treatment plan ● Accurate record keeping with thorough review of patient charts ● Time management of the round <p>Attitude</p> <ul style="list-style-type: none"> ● Professional behaviour towards patients (bedside manner) ● Professional behaviour towards members of the team including nursing staff, interns, students and allied professionals
6. Assessment information sources to assess progress and ground a summative entrustment decision	<ul style="list-style-type: none"> ● The list of potential pathologies and presentations is very broad. The trainee's performance may be judged on their management of a single patient/condition or for the entirety of the ward round. This is up to the trainee or supervisor's discretion. ● Assessment tool: COFFEE, which is completed by the supervisor within 72hrs after the round ● Number of observances to allow summative decision: 5 from at least 2 different observers ● Summative entrustment decision-making: made by the Competency Committee (CC) at 6 monthly review
7. Entrustment for which level of supervision is to be reached at which stage of training?	<p>The trainee is expected to be qualified to perform this EPA at NS (no supervision needed) by the end of year 3 of training.</p> <p>For a more detailed overview of the expected level of supervision required per year of training, see table 1 above.</p>

Appendix E2 - End of rotation assessment form (Chapter 9)



End of Block Assessment for {{Registrar name}}, {{Rotation}}

Registrar & rotation details

Name: {{Registrar name?}}

Year of training: {{Year of training?}}

Rotation period: {{Rotation period?}}

Consultants present for assessment: {{Consultant names?}}

Professional behaviours

Teamwork

{{Teamwork?}}

Communication

{{Communication?}}

Self-assessment

{{Self-assessment capacity?}}

Leadership

{{Leadership?}}

Work ethic

{{Work ethic?}}

End of block oral score: {{End of block oral score?}}

Final comments

Strength or aspect done well during the rotation? {{Please comment on a strength of this registrar or aspect that they did well during the rotation?}}

Suggestions to the registrar on how to address specific knowledge or skills gaps:
{{Suggestions to the registrar on how to address specific knowledge or skills gaps?}}

NB: Concluding comments (for Post Grad Education Committee)? {{Confidential concluding comments (for HOD and Post Grad Ed Committee)}}

The introduction of competency-based medical education for postgraduate training in South Africa

Specialist training has increasingly become the subject of public discourse, with greater demands for accountability from various stakeholders in safe delivery of healthcare. This includes the appropriate selection of specialist trainees, the assurance that these trainees are afforded suitable opportunity for achieving clearly outlined learning goals in appropriate contexts with adequate support, and the requirement that they are subjected to assessment that allows them to showcase their development over time.

The traditional approach to medical training and assessment has focused primarily on lists of knowledge objectives, but is now shifting towards an outcomes-based education (OBE) framework, where learning outcomes guide all curriculum and assessment decisions in a constructively aligned manner. Competency-based medical education (CBME), which can be considered a type of OBE, aims to ensure that all graduates attain the minimum standards for unsupervised practice (competence) in their field.¹¹ The five core components of CBME curricula are: outcome competencies; sequenced progression; tailored learning experiences; competency-focused instruction; and programmatic assessment (PA).¹² PA intends to build a system of assessment that is embedded in the entire learning cycle of registrar training, thereby addressing the current challenges in assessment inherited from our 20th-century models. PA, with a commitment to assessment for learning, includes a greater emphasis on: workplace-based assessment (WBA); the assessment of multiple domains of competence; the use of many raters and multiple assessment methods over time; and thereafter, valid summative decisions that are taken by a credible group (e.g. a competence committee), rather than an individual, using a collated set of assessments to provide a more holistic view of the learner's progress and achievement of defined competencies.¹³

CBME, proposed over 50 years ago, has taken centre stage over the last 20 years, owing to several forces and trends. The first is greater public accountability, which means that medical curricula must ensure that graduates are competent in all essential domains. The second is a greater emphasis on skills and attitudes, and their incorporation into observable competencies, rather than pure emphasis on knowledge objectives. The third is a de-emphasis on time-based training, recognising that learners progress at different rates and achieve threshold competencies at their own pace. Finally, CBME enhances learner-centredness by providing learners with a curriculum of competencies that delineate clear goals for them to achieve, with continual guidance on their progress and how to achieve those goals.¹⁴

The practical steps to implementation of CBME begin with identification of the abilities required by graduates in a specific context, which is followed by defining the required competencies and their components. In the last two decades, various competency frameworks have been described by a number of countries, and now form the basis of training for the majority of learners in these settings. In 2014, the Health Professions Council of South Africa published the list of South African (SA) competencies for medical professionals, dentists and clinical associates.¹⁵ These were adapted from the CanMEDS physician competency framework, and reflect the following:¹⁵

- (i) healthcare practitioner: the central, integrating clinical role requiring the contextual application of knowledge, skills and attitudes
- (ii) communicator: interacting with patients and patients' families

- (iii) collaborator: working effectively within a team to achieve optimal patient/client care
- (iv) leader and manager: contributing to the healthcare system, through cost-effective resource utilisation, improving efficiency and enhancing patient safety
- (v) health advocate: using expertise and influence in partnership with individuals, patient populations and communities to improve their health
- (vi) scholar: demonstrating a commitment to the creation, dissemination, application and translation of knowledge
- (vii) professional: ensuring ethical practice and high personal standards of behaviour.

Following identification of competencies, instructional methods and educational activities are selected, which will aid learners in achieving competence in the specified competency domains.

The next component of planning CBME curricula is the selection of assessment tools to measure learners' progress in achieving the required competencies.¹⁴ Unfortunately, competencies can feel somewhat detached from the clinical environment in which they are applied, making it difficult for them to be practically taught and assessed. Initial attempts to confirm attainment of the various competencies specified by these frameworks depended on directly assessing long lists of individual competencies.¹⁶

Entrustable professional activities (EPAs) were introduced to make the connection between competencies (characteristics/abilities of learners) and the professional activities to be entrusted to them on graduation.¹⁶ Ten Cate and Taylor¹⁷ define EPAs as 'units of professional practice (tasks or bundles of tasks) that can be fully entrusted to an individual, once they have demonstrated the necessary competence to execute them unsupervised'. Guidelines for the correct description and implementation of EPAs have been published, which include a description of the relevant competency domains, as well as knowledge, skills and attitudes required to execute that specific professional activity in a given context.¹⁷

For postgraduate medical training, EPAs represent the translation of daily specialist practice into units of practice that can be overseen, assessed, monitored and certified. Therefore, EPAs facilitate workplace-based assessment within a CBME context. By describing the specific skills proficiency, knowledge and higher-order abilities required to be entrusted to perform a specific activity, EPAs provide a framework for assessment tools to measure the degree to which a trainee can be entrusted to perform that activity unsupervised. Defining the units of practice that encompass a specialty also allows for redesign of the curriculum and re-evaluation of training methods, with emphasis on providing trainees with the knowledge and skills required to carry out these activities.¹⁷

The national conversation regarding mandatory WBA was initiated in 2017 and, while progress has been slow, there is a renewed commitment to achieving this goal by both the Colleges of Medicine of SA (CMSA) and the SA Committee of Medical Deans (SACOMD).¹⁸ The joint national WBA Steering Committee, with representatives of all specialist training platforms, has been launched in the last year in a collaborative effort between the CMSA and the SACOMD. The aim of the committee is the implementation of WBA for postgraduate medical training in SA. Following a series of

successful webinars in 2021, further roadshows and workshops are planned for the second half of 2022 to address the essential issues around WBA – what it is, why we need it, how we are going to design and implement it, who is responsible for it, and when all of this will take place. The current estimate of national implementation is the beginning of 2024. There is growing commitment to the groundwork needed to ensure that the SA implementation of WBA is not only educationally sound, but feasible and acceptable to our clinical teachers, who shoulder substantial service delivery burdens. We believe the inclusion of a carefully designed WBA process is not only feasible, but also promises to enhance clinical service delivery.

The SA clinical training platform, while unique, will benefit through the implementation of the various components of CBME. Our commitment to a transformed and decolonised curriculum demands that we translate the learnings from the Global North into systems and processes that recognise our inequitable contexts, while building a national framework for development. We are at a threshold at which our response to the calls for greater accountability will translate into modern curricula, which will deliver globally competent specialists and subspecialists who are fit for purpose in SA and beyond.

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Workplace-based assessment – a new era of surgical training competency assessment in South Africa

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Surgical training has traditionally been based on the Halstedian apprenticeship model.¹ In this model, certification is dependent on completing training under the guidance of a specialist surgeon and passing final written and oral examinations that primarily assess theoretical knowledge. In order to train specialists who are fit for purpose,² it is crucial that we move beyond the assessment of biomedical knowledge only and build capacity to test the full spectrum of competencies required for daily clinical practice, including surgical capability.³ In addition, changes to modern healthcare environments and greater numbers of trainees have resulted in the apprenticeship model no longer being a sustainable strategy for training surgeons. Furthermore, increasing pressures on operating room availability, ethical concerns of trainees training on patients, and escalation of litigation for medical errors require the integration of innovative strategies into training programmes and examining bodies to optimise training and trustworthy certification of competent surgeons.⁴

Competency-based medical education

An early attempt to measure competence, specifically the ability to perform procedures, was through the use of a logbook, which was introduced in the 1990s. However, as logbooks only record exposure and activity, rather than competence, they have limited content validity.¹ Being present at a procedure does not mean that a trainee is necessarily competent to perform that procedure or task independently.

Competency-based medical education (CBME), which came to the fore in the last 20 years, aims to ensure that graduates attain the minimum standards for unsupervised practice in their field.⁵ While traditional approaches to training and assessment focused on lists of knowledge objectives, in CBME outcomes guide all curriculum and assessment decisions. Furthermore, the primary method of confirming competence for unsupervised practice is through workplace-based assessment (WBA), which 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.”⁶ By providing the opportunity for direct assessment of what trainees actually do in the clinical environment, WBA has greater face validity than other assessment methods that

attempt to measure real-world competence. Evidence for its validity, acceptability and educational impact in surgery is growing, and it is increasingly being adopted globally.⁷

Rollout of assessment in the workplace is underpinned by a clear understanding of the entrustable professional activities (EPAs) of a discipline, the “units of professional practice (tasks or bundles of tasks)”⁸ that can be entrusted to an individual once they have demonstrated the necessary competence to execute them. EPAs, first described by Ten Cate almost 20 years ago,⁹ make use of rating scales anchored in entrustment rather than arbitrary numbers or percentages.¹⁰ A wide range of tools is currently being used to assess EPAs in the workplace, including the mini-clinical evaluation exercise (Mini-CEX), Ottawa clinic assessment tool (OCAT), case-based discussion (CBD), objective standardised assessment of technical skill (OSATS), and the Ottawa surgical competency in the operating room evaluation (O-SCORE).¹¹ Rather than being prescriptive of content, most of these tools provide flexible frameworks that can be populated according to the needs and realities of the healthcare systems within which training takes place. Furthermore, changes over time can be made to adapt training to contemporary healthcare requirements and changing realities and challenges in health systems.

An important aspect of WBA in the context of CBME is that the individual assessments, also termed observations, are low stakes and are primarily intended to be formative. Thus, assessment in the workplace is used for learning, and not just as an assessment of learning.^{12,13} Key to this formative strategy is the delivery of repeated and timely feedback to the trainee after observation of an activity by supervisors. High stakes decision making, such as to determine progression through training and eligibility to undertake specialist and subspecialist certification examinations offered by the Colleges of Medicine of South Africa (CMSA), is then assessed by a group of faculty surgeons, often referred to as a ‘competence committee’. Such committees typically meet 3–6 monthly and review trainees’ portfolios of learning, including WBA observations and other relevant documentation, to evaluate progression towards competence across the prescribed domains of surgical practice.


Workplace-based assessment in South Africa


The development and implementation of a WBA strategy for postgraduate training of specialists and subspecialists in South Africa, is being actioned by a national WBA steering committee, led by the South African Committee of Medical Deans and supported by the CMSA. This complex task includes defining appropriate and achievable EPAs for specialist training, the development of guidelines and adoption of suitable WBA observation tools, building capacity for implementation in individual training institutions, facilitating the integration of WBA into existing university-based training programmes, and identifying or developing a technology platform for national use. This generic approach will need customisation for each discipline.


The Steering Committee is aiming for a process of stepwise implementation of WBA across all specialties over a 12–24-month period. One of the early steps will require specialist colleges and departments to form working groups to determine lists of nationally agreed-upon EPAs for their discipline. This process requires consultation with a wide range of stakeholders including clinicians with educational expertise. Although the surgical colleges will agree on the list of EPAs, the development of WBA and institutional implementation will be the responsibility of the universities. It is anticipated that trainees undertaking specialist certification examinations offered by the CMSA will require institutional verification of competence for the specified EPAs of their discipline based on WBA.


WBA is not a fad, or an onerous addition to the already heavy workload shouldered by busy clinicians, but rather a catalyst that moves us beyond the realms of theoretical learning and assessment to achieving more well-rounded, empathetic and competent specialists. The fundamentals of WBA design in South Africa are being developed in an inclusive manner to ensure that the final outcome for implementation is acceptable, appropriate and feasible for all stakeholders, including trainees, trainers, training institutions and examining bodies. Change is not always comfortable or easy, but we urge the university surgical community at large to embrace this initiative which provides an invaluable opportunity for the implementation of modern assessment methods, thus reaffirming South African universities as training institutions of excellence, producing world-class clinicians. We are truly at the dawn of a new era of surgical training competency assessment in South Africa.

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Competency Assessment of General Surgery Trainees: A Perspective From the Global South, in a CBME-Naive Context



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OBJECTIVE: Before proceeding with local implementation of competency-based medical education-related assessment practices designed and evaluated in the Global North, we sought to challenge the assumption that this would be perceived as both necessary and acceptable in our context where training and assessment is based on a traditional, knowledge-focused approach. The aim of this study was to determine the perspectives of general surgery trainees and consultants towards the assessment of competence, how this has been achieved previously, and how it should be performed in the future at the University of Cape Town (UCT), South Africa.

DESIGN: Semi-structured interviews were conducted with consultants and trainees. Interviews were transcribed and then analyzed using a Reflexive Thematic Analysis approach.

SETTING AND PARTICIPANTS: Ten consultants (5 senior and 5 junior) and 10 trainees (5 South African and 5 international) from the Division of General Surgery at UCT in August 2022.

RESULTS: Five unique themes were developed: (1) Assessment of competence is essential, (2) competence includes multiple domains of practice, (3) a surgeon must be able to operate, (4) previously used methods were inadequate to assess competence, and (5) frequent

assessment with feedback is desired. The themes were considered in the context of Situated Learning Theory, particularly Communities of Practice and their role in the training for, and authentic assessment of, competence in general surgery trainees.

CONCLUSIONS: Participants described a need to develop and implement a new competency assessment program for general surgery training in this context, which is aligned with described competency-based medical education principles. Thoughtful integration of the formative and summative use of direct observation in the workplace, with a clear emphasis on procedural ability and the provision of high-quality feedback, may enhance the successful implementation of a strategy for competency-based assessment in general surgery training programs. (J Surg Ed 80:1462–1471. © 2023 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

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COMPETENCIES: Practice-Based Learning and Improvement

INTRODUCTION

During the 20th century, surgical training continued to be based on the Halstedian apprenticeship model, where

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learning occurs through prolonged, unstructured immersion of the trainee in a time-based system with constant exposure to expert surgeons.¹ In this traditional model, final certification depended on written and/or oral examinations which focused primarily on knowledge objectives, and were generally administered by an independent professional certification body.^{1,2} However, increasing pressures on operating room efficiency, ethical issues with training on patients, and escalating litigation rates for medical errors meant that training programs and examining bodies needed to develop robust new strategies to ensure and prove the clinical competence of graduating surgeons.²

Competency-based medical education (CBME), which aims to ensure that all medical graduates attain predetermined minimum standards for unsupervised practice in their field, has gained significant popularity over the last 20 years.³ The introduction of CBME curricula began with the description of the general abilities/competencies expected from all graduating clinicians.^{4,5} Apart from these 'outcome competencies', other core components of CBME evolved to include: sequenced progression through training, tailored learning experiences, competency-focused instruction, and programmatic assessment (PA).⁶ PA intends to address the many documented problems with the traditional approach to assessment and emphasizes the role of assessment *for* learning, especially through the use of direct observation of clinical performance in the workplace.⁷

In many countries, including South Africa, postgraduate training and assessment remains largely based on the traditional apprenticeship model. To be eligible to write the General Surgery final exit examination administered by the Colleges of Medicine of South Africa (CMSA), candidates need at least 4 years of approved time in General Surgery training. In addition, they need to submit a log-book of procedures performed, an overall report by the Department Chair which states the candidate's readiness to apply for certification, and a self-completed portfolio which describes participation in lectures and research.⁸ The exit examination consists of 2 Multiple Choice Question papers, an online structured oral examination which includes 4 clinical case-based discussions, 2 viva voce oral exams, and a computer-based OSCE.

Recently, there has been growing local interest in moving from the traditional knowledge-focused model to CBME, starting with the formation of a national steering committee which aims to facilitate the phased introduction of Workplace-Based Assessment (WBA) across all postgraduate specialist disciplines from 2024.⁹ However, despite growing local and established international enthusiasm for CBME and WBA, almost 2 decades of implementation has revealed mixed opinions regarding their utility.¹⁰⁻¹⁴ What starts off as an ideal approach in

theory may not necessarily translate to a strategy that is perceived to be acceptable and feasible by tired, busy trainees and supervisors. Before proceeding with local implementation of CBME-related assessment practices, which were designed and largely evaluated in the Global North, we sought to determine whether these would be perceived to be both necessary and acceptable to the trainees and supervisors in a resource-constrained setting, with significantly lower doctor-to-patient ratios than in the Global North.¹⁵ In addition, recognition of a shared mental model¹⁶ of competence and its assessment among trainees and supervisors, would greatly facilitate the design, implementation and uptake of any new assessment strategy within this 'community of practice'.¹⁷

MATERIALS AND METHODS

Study Design

We undertook a qualitative study, conducting semi-structured interviews with groups of professionals within General Surgery. The interview questions were designed to determine what consultants (also called supervisors) and trainees (i.e. registrars/residents) understood regarding the concept of 'competence', the importance of measuring it, if and how they felt it had been measured in our program before, and finally, how they felt it could best be assessed going forward. Thematic analysis was used to analyze the data. The study was performed within the interpretivist paradigm to emphasize the contexts that influenced individual assessment experiences, enabling a depth of understanding that was constructed through interactions between us as the researchers, the participants and the data.¹⁸

Setting and Participants

The Division of General Surgery at UCT includes consultants and trainees. Around 3 quarters of trainees are local South Africans and the remainder are international medical graduates who are usually funded by their home countries and are predominantly from elsewhere in Africa. Purposive sampling was used to select participants to maximize variation in terms of age, gender, local/international background and years of training/service. Five participants were selected from each of the following 4 groups: senior consultants, recently qualified/junior consultants, local trainees and international trainees (20 in total). Senior consultants were defined as being in full time service in the Division for at least 3 years. Recently qualified junior consultants include surgeons who had completed their training and fellowship certification examinations in the previous 3 years. Trainees needed to have completed at least 3 years of their

training in the Division and not yet undertaken the final fellowship certification examinations, to be eligible for inclusion. Eligible participants were contacted telephonically and asked if they were willing to participate in the study. Informed consent was obtained and documented prior to the commencement of an interview. Institutional review board approval was obtained (UCT HREC 242/2022).

Data Collection

Each participant was interviewed in person or using an online meeting platform if an in-person meeting was not practically possible. An initial set of non-directive questions was used. Probing questions were used to guide the interview process, with deviations or further questions allowed based on the judgment of the interviewer. A suitable set of questions could not be found in the literature, and so the researchers (DN and VB) designed the questions based on the primary and secondary objectives of the study. The questions were reviewed by LC and EJ and piloted on 2 trainees and 2 consultants to assess whether they were clear and elicited the information required. A sample of the initial and generic follow up questions is provided in Appendix A.

The spoken version of the interview was recorded using simple audio recording software on a mobile phone or Zoom (San Jose, CA.; Zoom Video Communications Inc) audio file, if conducted online. The interviewer made notes on non-verbal cues of the participants during the actual interview, as these were not video recorded. Transcription of recordings was performed using Otter.ai (Mountain View, CA: Otter.ai Inc). Transcripts were then de-identified, stored and analyzed using NVivo qualitative data analysis software (QSR International Pty Ltd. Version 12 Pro, 2022). All interviews were conducted by DN, a general surgeon and assistant program director for the postgraduate General Surgery training program at UCT. Interview transcriptions were compared to the audio files and corrected by MW, a trainee radiologist at a separate institution.

Data Analysis

Reflexive thematic analysis (RTA) was used with a predominantly inductive approach, such that data was

open-coded and participants' meanings were emphasized. However, a degree of deductive analysis was still used to ensure that the coding contributed to producing meaningful themes to answer the research question and objectives. The analysis was performed as per the 6 phases of RTA described by Braun and Clarke: familiarizing oneself with the data, generating codes, constructing themes, reviewing potential themes, defining and naming themes, and producing the report.¹⁸

Initial coding was performed by DN and MW, and then reviewed by LM, a qualitative researcher who acted as Educational Advisor to the project. In addition to being assistant program director, DN is part of a national steering committee tasked with postgraduate WBA implementation in South Africa, and thus made a conscious effort to critique, appraise, and evaluate how his subjectivity and professional context influenced the entire research processes, taking care to avoid introducing pre-conceived conclusions during the analytic process.¹⁹ A number of additional strategies were used to ensure trustworthiness of the data, including reflexive journaling, thorough documentation of the analytic process, consultation with MW and LM upon completion of each phase of the analysis, and finally, input from participants on the codes and themes developed.

RESULTS

Participant Characteristics

Twenty individuals participated: 5 senior consultants, 5 junior consultants, 5 local trainees and 5 international trainees (Table 1). All participants were faculty, currently training, or had recently completed training in the Division of General Surgery at UCT and had spent at least 3 years in the Division.

Theme Development

Initial coding of the entire dataset produced 118 preliminary codes, refined to 55 unique codes through 4 iterations. Nine candidate themes were then developed and refined to 5 final themes, which underwent multiple naming changes and re-allocation of relevant codes. Underlying codes were also reworded during this final

TABLE 1. Description of Participants

Participants	Median Age (range)	Male (n = 14)	Female (n = 6)	Code
Senior consultants	47 (42–58)	4	1	SC
Junior consultants	36 (34–42)	3	2	JC
Local trainees	33 (32–35)	4	1	LT
International trainees	34 (31–38)	3	2	IT

process, as greater understanding of concepts developed through repeated interactions with the dataset and discussion between the researchers.

Theme 1: Assessment of competence is essential

Both consultants and trainees felt that assessing competence during training was vital. As one junior consultant stated:

"I think it's more important than the actual [national college exit examination]. I think it's essential. It's the only way to know if someone is ready to be a surgeon" (JC2).

A few reasons were given why participants felt it was so important. First, and most alarming, there was a perception that previous assessment methods have allowed for the graduation of trainees who cannot function safely and independently as specialist surgeons:

"So I feel like there are people going through the same training program, but some people in the end were able to function as a surgeon and work safely as a general surgeon, and then there are some people that also graduate the same program that are not" (JC2).

The second reason, related to the aforementioned, was that current practices of primarily assessing theoretical knowledge, results in trainees giving up clinical learning experiences, especially performing procedures, to seek instruction focused on book knowledge:

"But for me, the focus has always been for the exam and if you ask the trainees, they would also say 'prepare me for the exam'" (SC1).

The third reason was that a lack of explicit competence assessment leaves trainees unsure of their clinical ability and progress. As one trainee said:

"I think I've never had an explicit thing [where a consultant said], you've done this, and this was done well, and this is where you need to improve" (LT4).

Therefore, in the perceived absence of explicit competency assessment feedback, trainees seem to infer competence from the level of autonomy provided. If a consultant allows a trainee to run a theater list, perform an operation, run an outpatient clinic, or do a ward round on their own, trainees felt that they were probably deemed competent to do that independently, even though it's not explicitly stated:

"I think a lot of the time, it's very informal. You kind of get a feeling of your competency from the way seniors allow you to do things" (LT5).

The final reason was that the training program carries the responsibility to ensure its graduates are ready for independent practice:

"Just because you've got book knowledge on a topic doesn't mean you can actually do the clinical work and you've got clinical acumen... we know we've got a big responsibility towards the trainees, but also the general public" (JC2).

Theme 2: Competence includes multiple domains of practice

The second theme was that competence, as a construct, included multiple different domains or roles. The most frequently mentioned were those competencies relating to the central, integrating role of "medical expert"/"healthcare practitioner" for example, possessing and applying theoretical knowledge, ability to assess patients and make diagnoses, clinical reasoning, making safe decisions, and instituting operative, perioperative and nonoperative management:

"You need to be able to manage the patient as a whole - not just the operation, but the perioperative side of things" (IT3).

A number of competencies relating to the "intrinsic roles" were also identified as important for surgical trainees to acquire: professionalism, communicating with patients and colleagues, working as part of a team, leadership, managing resources, teaching junior staff, performing basic research, recognizing your own limitations, and the ability to adapt to different contexts:

"You should be able to perform basic level of research and analyze research as well and... deal with the interpersonal aspects of your job... you must be able to have a skillset to communicate with patients and colleagues" (JC2).

In addition to describing which competencies a surgeon needed to possess, participants repeatedly set the benchmark for competence at *safe* practice, not necessarily mastery or excellence. As 2 participants succinctly stated:

"To me, competence is safety" (SC5)

and,

"You want to train people who will finish and be a safe surgeon" (LT3).

Participants explained this as being able to handle clinical situations safely, not harm the patient and seek more expert help when needed:

"I think that's also knowing your limits and within what scope you can work and when to take it to a colleague or another specialist" (JC3).

Theme 3: A surgeon must be able to operate

Despite the wide range of competencies that were mentioned that a general surgeon needed to possess, there was one that came through so strongly that it became a theme in itself: a surgeon must be able to perform general surgery procedures safely and independently. As one consultant emphatically stated:

"The essence of a surgeon is surgery! That's our core business... you should be able to identify the patient in need of an operation, and you must be able to do them well, and look after them well. To me, that's the essence of it" (SC4).

The ability to perform procedures was mentioned by every participant, emphasized repeatedly by many, and usually mentioned first when asked: "Which competencies do you feel are important for a general surgeon to possess?" As one trainee stated:

"It's a surgical hands-on speciality. You have to be technically competent" (LT4).

A reason given for the emphasis on technical capability, was that participants felt that performing procedures sets surgery apart from other specialties:

"The decision-making around managing your patients is not only limited to what you're doing in theater, but I think that's what separates us from physicians" (JC1).

Theme 4: Previously used methods were inadequate to assess competence

When questioned about which methods of in-training assessment of competence interviewees had participated in, all but one mentioned an End of Block Assessment (EoBA). This assessment occurred at the end of a 3-months rotation and was described as consisting of a 15 to 30 minutes unstructured oral examination, where clinical knowledge and reasoning was assessed. Some trainees reported occasionally being asked to describe how to perform an operation during this examination. A small number of trainees and supervisors mentioned participating in a single procedural assessment as part of the EoBA, where a trainee was observed performing an

operation. Supervisors recalled having to then write a simple narrative description of the trainee's performance, which was included in the EoBA report form and sent to the Head of Department:

"We also went through a phase where we wanted to have a supervised marked operation by a trainee towards the end of their block, or part of an operation, that would be a formal assessment of their surgical skills... it went through a phase and then people stopped doing it" (SC3).

Exploration of participants' perceptions regarding the ability of these previously used assessment methods to assess the competencies required of a general surgeon, revealed that all participants felt they were inadequate to do so. Several reasons were given for this, including that the EoBA was unstructured, lacked oversight, had no real consequences, did not provide feedback to trainees, was unreliable and subjective, and took place sporadically. As one recently graduated consultant stated:

"My entire [five years of training] time, I have had two formal assessments, one, which I thought was very random and very poorly done" (JC4).

Apart from its limited value in assessing competence, a major disadvantage was that the EoBA did not allow for any remediation during the block:

"One needs to identify those people early and give them extra support, and not right at the end when you see the wheels are coming off - that's a problem" (SC2).

In addition, the EoBA was described by some as a 'snapshot', a single point of assessment in time that was limited in its ability to cover the depth of topics related to the specialty participated in by the trainee for that 3 month rotation:

"So I think in terms of doing an end of block assessment and trying to get an understanding, I think the amount of knowledge that you can assess is a little bit thin" (LT1).

Despite the perception that the EoBA was not adequate to assess competence, participants felt it still had value. First, it helped prepare trainees for the national exit examination, which has a similar format. Second, it did encourage some trainees to put in extra hours of studying in the last week or 2 before the assessment, which they felt aided them in consolidating some of the knowledge gained during the rotation:

"Towards the end, when you knew it was coming, you sort of did a bit of extra work, crammed a bit in the last two weeks" (LT1).

The other method mentioned to measure competence was using a logbook of procedures performed, with 2 senior consultants expressing that one could infer some degree of competence from the number of cases performed. However, the trainees felt differently:

"When you go for your final exam, it's a verbal and written exam; there's almost no way to say, 'Hey, this guy can cut'... It might appear in your logbook that you've done this, this and this and, I suppose if you are incredibly terrible, someone will pick it up at some point" (LT4).

And

"I could pretty much put in there that I've done like six laparotomies and I don't think my application would get rejected. I don't think anybody looks at [the logbook]- it's a waste of time" (IT4).

Theme 5: Frequent assessment with feedback is desired

When asked to suggest better ways of in-training assessment of competence, both trainee and consultant participants felt that frequent, continuous assessments are needed:

"I do think that one has to change to kind of a continuous assessment throughout the block. How exactly you're going to do that I'm not certain, but it seems slightly more fair and representative of someone's performance" (SC1).

Many also felt that such a strategy of assessment would be preferable to a single point in-training or exit examinations:

"I think continuous assessment, and in-block assessment from people who are seeing you every day, has more substance to it and is closer to your real performance than having one exam" (JC4).

Participants felt that regular assessments would also allow for the early identification of gaps in clinical ability, allowing them to be addressed timeously. In addition to frequent assessment, participants felt that continuous provision of constructive feedback would be critical to enable these assessments to have a formative impact:

"I think what's missed is more the feedback to the individual to say, 'You're doing well, you're not doing well'... So there's a lot of informal assessments going on, but the feedback is definitely lacking" (JC3).

DISCUSSION

This study evaluated the perceptions of General Surgery supervisors and trainees regarding the meaning of competence and assessment thereof. An early finding was that a shared mental model¹⁶ already existed in terms of the definition of a competent surgeon, the importance of assessing competence, and that previously used assessment methods were inadequate.

There have been various definitions of a "competent surgeon" and, therefore, differences in how trainees are certified as having achieved this upon completion of residency.²⁰ A holistic definition of competence, which combines the key elements of knowledge, skills and attitudes of a surgeon, has been put forward as: "the demonstrated ability to safely care for patients thoughtfully and knowledgeably whilst maintaining acceptable standards of professional behavior".²¹ The participants of this study, despite having had no previous exposure to CBME, considered competence to include the various domains/roles already described by local and international competency frameworks, which form the foundation for CBME curricula.^{22,23} What was striking, however, was the significant emphasis placed on the ability to perform surgical procedures, which was unanimously considered the most important competency a surgeon needs to possess. Of course, participants still considered other competencies to be important, and clearly they are,²⁴ but designing an assessment strategy that does not focus on procedural ability may quickly be perceived as a box-ticking exercise.²⁵

The other important finding was that the benchmark for competence was clearly perceived as the ability to be "safe" when functioning as an independent surgeon, which correlates with the transition to competence as described by Miller Figure 1.²⁶ Thus, in the context of the participant responses in this particular study, a competent general surgeon can be defined as: "An individual who possesses the full range of required competencies to safely act as an independent surgeon, especially when performing procedures".

After establishing *what* participants defined as a competent surgeon, the next question was: *why* does competence need to be assessed? Both trainees and consultants felt that the assessment of in-training competence was important for both formative and summative purposes. The formative aspect was described by the

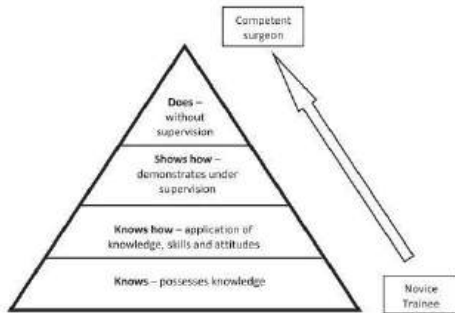


FIGURE 1. Miller's pyramid of clinical competence.⁷⁰

perception that a lack of explicit competence assessment and subsequent feedback leaves trainees unsure of their ability, deficiencies and progress towards becoming a surgeon. This can be considered in the context of situated learning theory, in particular 'Communities of Practice' as described by Wenger.¹⁷ There is no dedicated year of surgical internship in South Africa, thus, when a new doctor joins the program, they are automatically given the title of 'surgical trainee' and become a "legitimate peripheral participant" of the University's general surgery community.²⁷ Although some felt that they were being informally assessed by their supervisors and given autonomy accordingly, not getting explicit feedback from the very individuals who are already full members and judging entry into the general surgery community, was perceived as limiting their progress towards "having what it takes." As learning and assessment are inextricably linked,²⁸ the understanding that participants consider learning to become a surgeon takes place within this community of practice, suggests that assessment by the members of this community would also be perceived as having a high degree of authenticity.²⁹ Despite the formative emphasis, a summative value for competence assessment was also described. This was expressed in the disturbing perception that current summative assessment methods had allowed for the graduation of trainees who were considered by their peers to be unsafe to practice independently,

compromising the responsibility of the training institution and certifying body to ensure that this does not occur.

After establishing the *what* and *why*, the final question in this study was *how* should competence be assessed going forward? There was a clear perception that previously used methods to assess competence, primarily an end of block assessment (a type of In-Training Evaluation Report),³⁰ were inadequate. The reasons why these were not considered adequate can be used to improve the EoBA's implementation. Thus, it can still contribute meaningfully as a type of longitudinal measure of workplace competence if: it is overseen by the program director or department chair, has visible consequences and which are acted on, quality narrative feedback is provided to trainees, it has more structure, is performed by multiple consultants together (to enhance reliability) and takes place consistently.³⁰ However, such changes do not address the concerns regarding its validity of assessing workplace competence and limited formative value. Most participants indicated that continuous assessment through direct workplace observation from consultants, who are full members of the University's general surgery community of practice, would address these concerns. The finding of an existing shared mental model where trainees and consultants recognize the importance of learning and assessment within their community of practice, suggests that in this CBME-naïve population, workplace-based assessment may be welcomed by trainees and consultants alike.

As mentioned previously, WBA has had a mixed reception from the international surgical fraternity.¹⁴ The findings of our study suggest that the acceptability and successful implementation of a WBA strategy for general surgery, may be enhanced by application of the following design principles: 1) an emphasis on assessing procedures, 2) careful integration of summative and formative purposes 3) facilitation of quality, timely feedback to trainees after direct observations (Table 2).³¹ The latter could require a degree of faculty development, particularly in our context with no prior exposure to WBA/CBME and where a lack of quality feedback was already raised as a limitation of previous assessment practices.

TABLE 2. Summary of Themes and Recommended Design Principles for Competency Assessment of General Surgery Trainees

Themes	Recommended Design Principles
Assessment of competence is essential	Careful integration of summative and formative purposes
Competence includes multiple domains of practice	—
A surgeon must be able to operate	Emphasis on assessing procedures
Previously used methods were inadequate to assess competence	—
Frequent assessment with feedback is desired	Facilitation of quality, timely feedback to trainees after direct observations

In terms of summative/formative use of WBA, previous studies have raised the concern that attaching significant summative value to direct observations introduces a range of issues that limit their formative utility.⁵² This in turn may limit acceptability, especially to trainees, and hamper attempts at implementation. Therefore, this study supports the recommendation that WBA ought to be introduced as a component of a program of assessment, with individual observations being low stakes to maximize formative value, and summative decisions being made in a separate setting, for example through a 'competence committee' meeting, where the summation of multiple observations is reinterpreted to make high stakes decisions.^{7,35}

Limitations

This study reflects participants' perceptions in a specific context and thus may not be generalizable to other settings, particularly outside of general surgery. In addition, we acknowledge that other parts of the Global South are actively looking at the implementation of CBME/WBA. Therefore, we do not claim to offer a unique perspective that represents the Global South, but merely a perspective from our own context where CBME has not yet been implemented. Although CBME and WBA have not been formally introduced in South Africa, UCT frequently hosts elective students and academic visitors from countries that have established these in their curricula. Thus, participants may have had some exposure to visitors' experiences of CBME and WBA, which in turn may have influenced their own opinions and responses in this study. Finally, although the authors do not consider their own subjectivity as negatively affecting the study findings (and actually consider it to be beneficial within their chosen paradigm), DN found it challenging to truly question the assumption that WBA ought to be considered necessary, considering his role in the national WBA Steering Committee. Extensive further discussion between authors and participants aided in considering if the findings could be interpreted any differently to ensure that the conclusions drawn were a trustworthy representation of the data.¹⁹

CONCLUSIONS

Trainees and consultants, in this CBME-naive community of practice, perceive the continuous in-training assessment of competence to be important and necessary.

Thoughtful integration of the formative and summative use of direct observation in the workplace, with emphasis on procedural ability and the provision of high-quality feedback to trainees, may enhance successful implementation of an in-training assessment of

competence strategy. The knowledge of 20 years of international successes and failures, combined with the opportunity to design a strategy for a CBME-naive population, presents an exciting opportunity for the implementation of an educationally robust yet acceptable, feasible and sustainable method of measuring the competence of general surgery trainees.

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SUPPLEMENTARY INFORMATION

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Appendix F4 - Published manuscript (Chapter 5)

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Entrustable Professional Activities in postgraduate General Surgery training: a scoping review

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ABSTRACT

Objective

To provide an overview of the current use of Entrustable Professional Activities (EPAs) in postgraduate general surgery training internationally.

Background

Entrustable Professional Activities (EPAs) were introduced to connect clinical competencies and the professional activities to be entrusted to trainees on graduation. The popularity of EPAs as a framework for assessment is growing globally, including in general surgery. Anecdotally, there appears to be substantial variation in how they are implemented, yet a formal comparison of their use in postgraduate general surgery training is lacking.

Methods

A scoping review was performed, based on the original five-stage approach described by Arksey and O'Malley with the addition of protocol-specific items from the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols extension for scoping reviews (PRISMA-ScR).

Results

Twenty-nine published and grey literature sources were included in the review. Entrustable Professional Activity use in postgraduate general surgery training was identified in 11 unique contexts, including from North America, South America, Europe, Asia, Africa, and Australia.

There were substantial differences in the scope and number of EPAs, tools used for EPA assessment, and how EPAs were sequenced through training. Despite wide variation, eight distinct EPAs were common to the majority (>80%) of countries. Several articles described findings of EPA use in postgraduate general surgery training, allowing identification of multiple barriers and facilitators to integration.

Conclusions

This review provides guidance for certification and regulatory bodies, program directors, and institutions with ambitions to implement EPAs for assessment and curricular design. In settings where EPAs are already used, the data may facilitate refinement of programs and strategies.

Keywords: General Surgery; Medical education; Surgical education; Scoping review; Surgical training; Competency-Based Education, Entrustable Professional Activities

ACCEPTED

BACKGROUND

Competency-based medical education (CBME) aims to ensure that graduates attain the minimum standards for unsupervised practice in their field. Although CBME was proposed more than 50 years ago, it has only recently come to the fore, which can be attributed to several forces and trends.¹ With CBME, well-defined abilities to be achieved by graduates in a specific context are initially identified. This is followed by defining the required competencies, after which a program of assessment is implemented to measure learners' progress towards achieving these.¹ However, the practical teaching and assessment of competencies can be complicated, as they may be perceived as detached from the specific clinical environment in which they apply.²

Entrustable Professional Activities (EPAs) were introduced to facilitate the connection between learners' competencies (characteristics or abilities) and the professional activities entrusted to them on graduation/qualification.³ An EPA is defined as a unit of professional practice that can be fully entrusted to a trainee, once he or she has demonstrated the necessary competence to execute this activity unsupervised.² By describing the competencies, skills, knowledge and higher order abilities required to perform a specific professional activity, a postgraduate clinical specialty can be deconstructed into units of practice that can be overseen, assessed, monitored, and certified. Defining the units of practice that encompass a specialty also facilitates redesign and realignment of curricula, to provide trainees with the required content and learning experiences to carry out these defined core professional activities.²

The shift towards programmatic assessment and workplace-based assessment (WBA) is one of the most tangible areas where the implementation of CBME becomes apparent. Although several reviews on the use of WBA in general surgery have been published, none have focused solely on EPA-based strategies.⁴⁻¹¹ The use of EPAs has been described in the broader context of graduate medical education, but included few studies from surgical disciplines.¹²⁻¹⁴ As specialties differ in how best to use EPA assessment to establish competence, specialty-specific reviews are important.¹⁵ The aim of this study was to describe context or country dependent discrepancies in EPA selection, highlight common barriers and facilitators to their implementation, and explore areas for future research.

METHODS

This scoping review was based on the original approach described by Arksey and O'Malley complimented by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols extension for scoping reviews (PRISMA-ScR).^{16,17} The review process consisted of five stages: 1) Identifying the research questions, 2) Identifying relevant studies, 3) Study selection, 4) Charting the data and 5) Collating, summarizing and reporting results. The protocol was published previously and the study was registered on the Open Science Framework.^{18,19} A

waiver of ethics approval was obtained from the University of Cape Town Health Research Ethics Committee.

The primary research question was how EPAs have been selected and implemented in postgraduate general surgery training. Secondary objectives were to describe facilitators and barriers to EPA implementation and to identify aspects for further study. A systematic search was designed with the help of a faculty librarian with special competence in literature search strategies. The following databases were searched for published literature: Pubmed (Medline), Ebscohost (including CINAHL and Africa-Wide, PsycINFO and ERIC), Scopus, and Scielo (via Web of Science). In addition, an extensive grey literature search was performed, including published literature and grey literature databases, theses/dissertations, conference abstracts, regulatory body reports/guidelines, Internet search engines, targeted websites, consultation with experts, and snowballing of surgical educator contacts.

The search string included two main tiers of terms, related to "Entrustable Professional Activities" and "Surgery" (supplemental file 2, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>). Articles/sources were eligible for inclusion if they described the use of EPAs for curriculum design, teaching strategies, and/or assessment of competence in postgraduate general surgery training. Only sources that were created/published after January 2005, and were identifiable in English were considered. Sources that focused on non-general surgery specialties, undergraduate training, internship, or subspecialty/fellowship training were excluded. In contexts where general surgery training included one or two years of mandatory subspecialist/fellowship training prior to graduation, the EPAs related to the initial, non-subspecialist phases of training were included.

Two independent reviewers (DN and AN) screened article titles and abstracts; a third independent reviewer (EJ) reviewed and resolved discrepancies. Grey literature abstracts and document summaries were similarly screened. Assessment of full texts for inclusion in the review was then performed in the same manner. When required, Google translate was used for non-English grey literature. The search process was completed in August 2023. Extraction and charting were performed by DN and checked for accuracy against the source data by EJ prior to interpretation. An attempt was made to retrieve key missing data by contacting authors. For sources specifically describing EPA selection and use in assessment, the accuracy of the extracted information was confirmed by the authors or a local representative(s) in that setting. As per scoping review methodology guidelines, formal quality appraisal and risk of bias of included sources was not performed.

RESULTS

Following the screening and full text review process, 29 published and grey literature sources were included in the review (Fig. 1). The full list of included sources with details on authorship

and source characteristics is available (supplemental file 3, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>).

Assessed sources were divided into two distinct groups for charting. The first were primarily, but not exclusively, grey literature which described the lists of EPAs chosen in different institutions/countries, including number selected, tools used for assessment, sequencing of EPAs through training, and evidence of summative decision making through a Competence Committee (CC).²⁰⁻³⁰ The second group of published articles described findings related to EPA implementation.³¹⁻⁴⁸

EPAs selected in different settings

EPA use in postgraduate general surgery training was identified in 11 unique contexts, including in North America, South America, Europe, Asia, Africa, and Australia (Table 1). Most of the identified EPAs were selected as part of a national process, except for India, Brazil, and South Africa where they were from single institutions. Unlike Ethiopia and Colombia, where a Delphi process was used, EPAs were primarily selected and described by an expert panel or working group. The actual EPA titles for each of the 11 contexts, with links to the online source, were collated (supplemental file 4, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>).

In terms of surgical procedures, some made a clear distinction between non-procedural and procedural groups of EPAs (e.g. naming them 'Procedure Based Activities' or 'Key procedures'),^{24,29} some were standalone EPAs,²⁶ and others nested or simply included in the specifications of broad procedural or disease-specific EPAs (e.g. 'Performing elective surgical procedures', and 'Gallbladder disease').^{21,22,23,25,28,30} Progression in entrustment was described by sequencing EPAs through training, either by separation into different sets of EPAs for phases of training, or by setting expected entrustment levels required per EPA throughout the full training duration. Summative decision-making via a competence committee was described in seven of the 11 countries.

Discrepancies and similarities in EPAs

The list of EPAs selected differed greatly, with 53 unique procedural and 27 non-procedural EPAs identified across all contexts (supplemental file 5, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>). Eight EPAs were represented in at least nine out of eleven (80%) countries, as shown in Table 2.

Key findings of EPA implementation

Articles that describe findings of EPA implementation (supplemental file 1, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>), all originated from either the USA (n=14),

Australia (n=3), or Ethiopia (n=2). The use of an EPA framework for assessment was supported by articles confirming its validity, mainly inferred from the correlation between EPA ratings and concurrent milestone reviews.^{31,36} There was no gender difference in EPA assessments, however two articles raised concerns regarding participant perceptions of reliability, especially in the context of summative use for high-stakes decision making.^{38,41,42}

The use of EPAs in continuous workplace assessment was reported to be helpful in measuring and improving trainee self-assessment ability.^{33,45} The assessment of EPAs also allowed programs to monitor whether graduates were adequately prepared to carry out the core tasks in the specific context. Other benefits included improved feedback provision to trainees, and continuous information for program leadership on trainee progress towards competence.^{31,34,44,45,46} In addition, EPAs may have increased the autonomy given to trainees, improving their operative exposure.⁴⁸

Facilitators and barriers

Several articles described practical aspects of EPA implementation in postgraduate general surgery training programs. The key barriers and facilitators to EPA integration, described by these and other included studies, are shown in Table 3.

DISCUSSION

This study provides an overview of the current use of EPAs in postgraduate general surgery training. A scoping methodology was chosen due to the broad question, heterogeneity of sources and opportunity to identify gaps in the literature.

Contextual differences and similarities

The selection and sequencing of EPAs demonstrate the various ways postgraduate general surgery training is structured and the scope of a general surgeon's practice in different contexts. In many European countries, for example the Netherlands, the initial years of 'general' training is followed by a mandatory sub-specialization period before graduation.²⁴ Even in the USA where subspecialty training isn't mandatory, 80% of general surgery graduates pursue fellowship training.⁴⁹ This contrasts with a Global South context, for example Ethiopia, where specialist and subspecialist training is less prevalent. The difference in scope of practice is demonstrated by some of the standalone Ethiopian EPAs included e.g., 'Diagnosis and management of a patient with Benign Prostatic Hyperplasia'.²⁶ In high-income countries (HICs), this task would more typically be carried out by specialist urologists.

As EPAs reflect the core of the profession i.e., the minimum required task proficiency of each graduate, variation in the activities entrusted to a general surgeon according to context is expected. While these differences may have implications for the transferability of certification between nations, their existence is understandable and justifiable. The definition of EPAs by experts in a particular setting allows curricula to be aligned to train surgeons who are fit for purpose in that specific context.⁵⁰ For some countries, particularly from the Global South, this presents an opportunity to transform and decolonize their curricula through the process of EPA selection and implementation.⁵¹

Despite the wide differences in selected EPAs, eight were common to at least 80% of countries. This suggests that there are a core set of tasks performed by the majority of general surgeons across the globe. These tasks, defined as EPAs, come closest to providing a global definition of a general surgeon: a healthcare practitioner who provides inpatient, outpatient, and operative care for patients with appendicitis, abdominal wall defects, an acute abdomen, colonic lesions, gallbladder disease, and breast lesions. Countries or institutions who have not yet defined EPAs for postgraduate general surgery training may consider using these eight as a starting point, with context-specific modification as appropriate.

Selecting procedural EPAs

Caring for surgical in- and outpatients were included in nearly all EPA lists in some format and there were overall fewer unique non-procedural EPAs (supplemental file 5, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>). However, committing to a set of procedural EPAs within a specific context appears to be less straightforward as is evident by the large number of unique procedural EPAs.

Including a procedure as a standalone or nested EPA (small unit of professional practice meeting the EPA definition, being also part of a larger EPA to be entrusted later in training), especially in a national context, means agreeing to it being a core task required of all graduates. As institutions vary in educational resources and procedural volumes for trainees, this may be more difficult to achieve for some programs. In addition to the difficulty of ensuring adequate exposure to EPAs, programs would also need reasonable numbers of assessments to ensure adequate sampling and allow for reliable entrustment decision-making. A long list of required procedural EPAs may result in a high assessment burden, limiting the acceptability and feasibility of WBA using EPAs.⁵²

Therefore, most EPA lists described in this review included a sample of core/index procedures that could be assessed reliably to infer broader procedural competence (supplemental file 4, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>). This strategy ensures that procedural EPAs are both frequently performed and supervised in practice, which may facilitate implementation.⁵³ However, despite the empiric rationale for selecting a more limited set of “index” procedures, omitting certain procedures may have negative policy or political

consequences. One potential strategy to overcome this issue would be to include the option of 'elective EPAs' in addition to a nationally agreed upon set of required EPAs. These can be used selectively in training settings that do offer adequate exposure to such procedures.⁵⁴

It is also important to note that the EPAs in these sources were generated primarily through expert meetings or working groups, but also through more formal consensus methods like Delphi, which provide the opportunity for broader input. Thus, in addition to healthcare context, the method of EPA identification and selection may also have contributed to the wide range of procedural EPAs.

Validity

Concerns have been raised, especially from trainees, regarding the validity of EPA assessments for summative decision making.^{38,41} As can be seen from the list of included sources, EPAs for postgraduate general surgery training have only been widely implemented over the last 5 years (supplemental file 3, Supplemental Digital Content 1, <http://links.lww.com/SLA/F156>). In this time, some have specifically attempted to provide validity evidence by demonstrating the correlation between EPA ratings and year of training, case difficulty and semi-annual milestone evaluations.^{31,35} However, modern approaches to validity in health professions education look beyond isolated parameters, to compile a validity argument based on a number of sources. Messick's unified theory of validity includes the following five elements when considering a validity argument: content, response process, internal structure, relations to other variables, and consequences.⁵⁵

The use of EPA-based assessments can be considered as part of a large, complex system for making judgments of trainee performance and progression. Therefore, their use is subject to the same expectations for validity as any assessment process, requiring an analysis of the validity of the supporting data. This is challenging to do for EPAs in general surgery globally, as there is significant heterogeneity in the EPAs themselves, the tools used to assess them, and the methods of summative decision-making using individual data points. However, broad comments can be made regarding current validity evidence for their use, based on the sources included in this review.

In terms of content validity, EPAs are by definition more representative of the construct of interest, being the work performed by general surgeons in a specific context.^{35,40,44} In addition, the use of entrustment-supervision scales in EPA-based assessment tools, rather than the use of arbitrary numerical scores, make intuitive sense to surgeons when judging trainee performance.⁴⁶ However, this is based on opinion and not empiric evidence from within surgery. Although EPAs in general surgery were most frequently defined and elaborated by expert groups with health professions education expertise available, the use of the EQual rubric⁵⁶ to critically review the EPA descriptions and language used was not evident in any of the sources.

In terms of response process, it is clear that for EPA assessments to be valid, a shared mental model must be achieved through rigorous faculty and trainee development.^{40,44} When this is done, trainees' perceptions of their performance seem to align with faculty assessments.⁴⁵ Conversely, a lack of understanding of assessment criteria may account for discordant assessment ratings, especially when utilizing assessors who are not surgeons themselves.³³ Evidence for web-based development resources, including guidebooks, webinars, and videos were available in many of the contexts where EPAs are currently implemented in postgraduate general surgery training.^{20-22,24,25,29}

In terms of internal structure, it is difficult to comment on broadly. Although components such as inter-rater reliability have been investigated for some of the tools used to assess EPAs in surgery, a detailed discussion of these is beyond this text.³¹ No research has yet been done in surgery on assessing the reliability of summative decision-making events using EPAs, i.e. competence competency meetings.

In terms of relations with other variables, EPA assessments in surgery have been shown to correlate well with semi-annual milestone evaluations in the USA.^{31,36} In addition, EPA assessments have been shown to correlate with case difficulty and task complexity, as well as year of training and gains in clinical experience within training years.^{36,45} Although this evidence is from a single context only, it does add meaningfully to the validity argument for EPA use in surgery. There is currently no data on the impact of EPA assessments on patient outcomes in surgery.

Finally, in terms of consequences, EPAs appear to have a positive impact on learners' formative progress by providing more frequent and quality opportunities for feedback, allowing trainees to continuously improve their performance.^{31,34,47} In addition, EPAs may provide a graduated autonomy framework and improve trainees operative performance, especially in settings where this may be restricted due to medico-legal concerns.⁴⁸ EPAs may also lead to curricular redesign and have been described to catalyze a shift towards competence-based education in surgery.^{35,41}

Thus, although there is some evidence to make a validity argument for the use of EPAs, little empirical evidence is available from within surgery, especially from outside the USA. However, many other current assessments such as global end of rotation evaluations, ungrounded competence committee conversations, and summative attestations of competence by program director or head of department signature, all have the same if not more validity concerns. EPAs, while not convincingly validated in surgery as yet, do offer an opportunity for improvement over these assessments that are global, temporally remote from observed performance, and based in theoretical competency frameworks of limited practical relevance to faculty.

Reliability and assessment quotas

Reliability of WBAs is achieved through multiple assessments by multiple raters over time. The actual number of assessments required to demonstrate consistency across assessments is challenging to define and has been described to range from three to sixty, depending on the context, assessment tool and type of activity.⁵⁷⁻⁵⁹ In addition, reliability can also be influenced by faculty development, as the supervisors are in essence the assessment instrument.⁶⁰ Thus, training may lead to a decrease in variation from assessor to assessor and enhanced reliability of EPA assessments.

In recent years there has been a shift in thinking towards programs of assessment, with appreciation of the value of 'intersubjective' decision-making by a collective.⁶¹ Thus, a key part of high-stakes decision making based on EPAs, is reinterpretation of individual assessments by a group i.e. a competence committee. Thus, the number of assessments required per EPA may not necessarily be specified as a universal absolute number, but will depend on how many data points/'pixels' a CC in a given context requires to form a clear 'picture' of a trainee's ability to perform a task independently. For practical purposes, this may still require a threshold number to be decided upon in a particular context.

Areas for further study

Although the uptake of EPAs in postgraduate general surgery training is increasing, there remain several areas where further study is required. Almost all published and grey literature sources describe EPAs in the context of assessment. The impact of introducing EPAs into other aspects of curricula, particularly how content and learning experiences may need to be redesigned to align with EPA-defined assessment targets, warrants reporting. There are also obvious logistical issues around implementation, such as how to assess the broad scope of general surgery practice, yet do so in a feasible manner. Related to this is the dilemma of selecting the most appropriate procedures, either as standalone EPAs or nested within broader EPAs. As mentioned previously, the prevailing strategy is to select a set of core, frequently performed procedures that each need to be assessed a number of times to allow trustworthy entrustment decisions. However, the omission of more specialized procedures may exclude useful information on trainee ability and may also impact the desire to participate actively in procedures that are 'not on the list'. Innovative solutions to this dilemma are required. In addition to EPA selection, choosing the most appropriate EPA assessment tools from the wide range available is an additional challenge, with a lack in comparative studies to assess which has the greatest utility in general surgery.

Introducing EPAs into a single or national training curriculum is a major change management exercise. It would be beneficial to describe the most effective change models/frameworks to apply, best practices for faculty and trainee development, and the most effective methods to access intrinsic motivation and effect personal change in a surgical context. As is mentioned previously, there is limited validity evidence available and more studies from varied contexts,

utilizing modern approaches to validity, could greatly aid increasing trainee and faculty trust in this framework, enhancing its acceptability and implementation. Finally, most papers describing experiences with EPA implementation are from HICs. Studies from lower resourced countries may identify unique challenges and require innovative solutions to common but unique problems.

Limitations

Although the search was intended to be exhaustive, it may have missed non-English programs where EPAs are named differently.⁶² The review focused on EPAs, currently one of the most widely embraced and popular frameworks for competency assessment in postgraduate medical training. It is, however, not the only framework used for assessment and curricular design in graduate medical education and general surgery.⁶³ The findings may therefore be less applicable to settings where EPAs are not currently used, and where interest in the introduction of CBME is lacking.

Conclusion

In response to the increasing uptake of CBME in postgraduate education, surgical programs worldwide are refining their teaching and assessment programs. EPAs present a useful framework for evaluation, by operationalizing the assessment of competencies. EPAs may also facilitate curricular transformation, through alignment of teaching and learning with EPA-defined outcomes. This paper provides an overview of the current use of EPAs in general surgery, providing guidance for certification and regulatory bodies, program directors, and institutions with ambitions to implement CBME-related assessment practices. In addition, it could assist those who have already done so, to refine their strategies based on the thinking of, and lessons learned by colleagues in other settings.

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Table 1: EPA selection and description in different settings

Country	Number of EPAs	Tools	Sequenced	CC
USA ²⁰	18 (14 include separately assessed preop, intraop and postop phases)	Entrustment-supervision (ES) scale with narrative feedback	Described individually for each EPA	Yes
Canada ²¹	32 (5 foundations, 22 core, 5 transition to practice)	ES scale with narrative feedback, narrative observation	Divided into EPAs for foundations, core and transition phases	Yes
Brazil ²²	16	Direct observation, case-based evaluations, written tests	Per phases of training (1-3)	Yes
Colombia ²³	4 (with 117 procedures nested under a broad EPA)	Not reported (NR)	NR	NR
Netherlands ²⁴	17 (with 30 "key procedures" for first 4, pre-specialization years)	OSATS, CBD, CAT, MSF	Entrustment readiness expected per EPA in year 1 vs years 2-4	Yes
UK ²⁵	5 (surgery-specific EPAs termed "CIPs")	MCR with ES scale	Per phases of training (1-3)	Yes
Ethiopia ²⁶	29	NR	NR	NR
South Africa ²⁷	11	ES scale with narrative feedback	Described individually for each EPA	Yes
India ²⁸	26	Mini-CEX, MSF, ES scale	Per year of training 1-5	NR
Australia ²⁹	33 (16 non-procedural EPAs, 17 PBAs - "EPA subtype")	ES scale	Divided into EPAs/PBAs for years 1-3, years 4-5	NR
Singapore (draft) ³⁰	6 (with 13 specific procedures under 2)	Mini-CEX, MSF, EBD	Described individually for each EPA	NR

Table 2: EPAs with greater than 80% overlap between different countries

	EPA title	Included as standalone EPA	Included in specifications of broader EPA	Number of countries
1	Managing ward rounds and the care of inpatients	Canada, Colombia, Netherlands, UK, Ethiopia, SA, Australia, Singapore	USA, Brazil, India	11
2	Managing patients in an outpatient clinic/service	Canada, Colombia, Netherlands, UK, SA, India, Australia, Singapore	USA, Brazil	10
3	Managing appendicitis/performing appendectomies	USA, Brazil, Netherlands, Ethiopia, SA, India, Australia	Canada, Colombia, UK, Singapore	11
4	Managing abdominal wall defects/performing hernia repairs	USA, Canada, Brazil, Netherlands, Ethiopia, SA, India, Australia	Colombia, UK, Singapore	11
5	Managing the acute abdomen/performing laparotomies	USA, Canada, Brazil, Netherlands, Ethiopia, SA, India, Australia	Colombia, UK, Singapore	11
6	Managing benign and malignant colonic lesions/performing colectomies +/- anastomoses/stomas	USA, Netherlands, Ethiopia, SA, Australia	Canada, Colombia, UK, Singapore	10
7	Managing gallbladder disease/performing	USA, Brazil, Netherlands, Ethiopia,	Canada, Colombia,	10

	cholecystectomies	SA, Australia	UK, Singapore	
8	Managing benign and malignant breast lesions/performing mastectomies or lumpectomies +/- SLNBs or ALNDs	USA, Netherlands, Ethiopia, SA, India, Australia	Canada, Colombia, Singapore	9

SA – South Africa; SLNB – sentinel lymph node biopsy; ALND – axillary node dissection

ACCEPTED

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%), appendectomy (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 subspecialty 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).

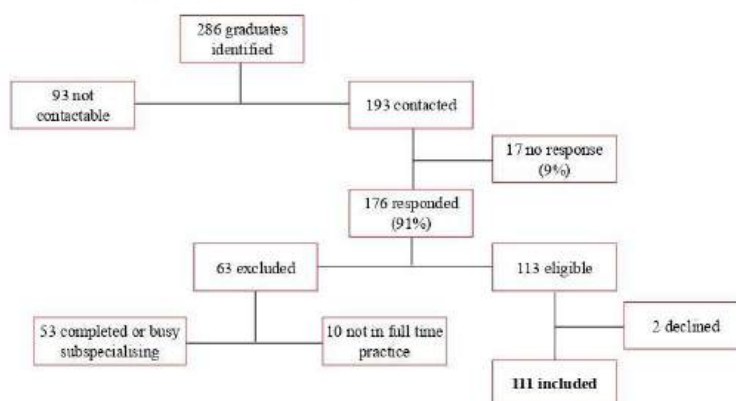


Figure 1: Flowchart of participant recruitment

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 enrolls 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.^{11,17-19} 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-assessment²⁰ 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 appendectomy (*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 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, appendectomy, 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

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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

CHAPTER 20

Addressing practical and conceptual challenges in workplace-based assessment

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Machelle Linsenmeyer

Abstract

Despite its recognized importance in ensuring clinical competence, implementing and sustaining workplace-based assessment (WBA) in EPA-based programs faces various obstacles, including validity concerns, time constraints, administrative burdens, and a perceived lack of formative value. To overcome these challenges, the chapter proposes several strategies. First, it emphasizes the role of EPAs and entrustment in streamlining the WBA process, making it more time-efficient and relevant to real-world clinical practice. Second, the chapter advocates for interprofessional collaboration in WBA, highlighting the importance of incorporating input from diverse health care professionals who regularly interact with trainees. Additionally, the chapter explores the tension between formative and summative assessment in WBA, emphasizing the importance of creating a safe environment for both trainees and supervisors. By shifting the focus from high-stakes assessments to continuous learning conversations, stakeholders can optimize each assessment situation for learning while supporting trainee autonomy. Furthermore, the chapter discusses the role of technology in addressing the perceived assessment burden associated with WBA. By leveraging mobile applications, e-portfolios, and data analytics, technology can provide efficient means for data collection, storage, analysis, and visualization, ultimately enhancing the effectiveness of WBA in health care education. Lastly, the chapter considers strategies for implementing WBA in low-resource settings, highlighting the importance of local feasibility and resource adaptation. By simplifying assessment tools, leveraging low-cost tech platforms, and col-

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laborating with colleagues from varying resource levels as well as different low-resource areas, low-resource settings can overcome barriers to WBA implementation and ensure the development of competent health care professionals tailored to their specific contexts.

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Introduction

Workplace-based assessment (WBA) is becoming increasingly crucial for ensuring and confirming clinical competence in trainees. However, a seemingly sound educational initiative does not always translate into something that is feasible in real-life practice. Perceptions of trainees and supervisors toward WBA have been mixed, with multiple conceptual and practical challenges identified that hinder its optimal implementation. The primary objective of this chapter is to offer a clearer perspective on overcoming these challenges and facilitating the realization of WBA. Special emphasis will be placed on how this process can be facilitated by entrustable professional activities (EPAs) and entrustment.

Limitations in the validity argument

A number of issues with the implementation of WBA are related to limitations in the validity argument. Although the validity argument for *entrustment decision-making* based on EPAs is discussed in more detail in Chapter 5, this chapter would be incomplete without mentioning some of the practical challenges and how they influence the validity argument of WBA. Table 20.1 summarizes some of the challenges that need to be addressed in WBA, in the context of Kane's validity model (for a deeper discussion, see Chapter 5).¹

In terms of scoring, supervisors are frequently confused about the high stakes/low stakes conundrum related to the dual-purpose use of WBA. In addition, many do not understand how to judge a trainee's performance using WBA tools or how to provide high-quality feedback, and often lack the time or the interest to be adequately trained (such as frame of reference and performance dimension training). In terms of generalization, although multiple EPA ratings should give a clearer picture of a trainee's competence, this may result in a high assessment quota that is required per trainee. With service pressures and the busyness of a clinical workspace, EPAs may not be observed frequently enough to enable trustworthy high-stakes decision-making. In terms of extrapolation, although workplace-based assessments are grounded in authentic clinical

Table 20.1: How the validity argument in WBA can be undermined by practical challenges: some examples.

Inferences in Kane's validity model ^{1,2}	Purpose of the inference	Examples of practical challenges to be solved
Scoring	Judgment and scoring of observed performance should reflect the quality of this performance	Observers (often clinicians as raters) who do not understand well how to judge and report trainee performance and have little time or interest to be trained; tools used are not construct-aligned to a discipline
Generalization	Multiple scores of similar EPAs should provide a fair picture of EPA required competence	High assessment quota required; however, EPAs are infrequently observed
Extrapolation	EPA required competence should hold across all possible or relevant contexts	EPAs are observed in one context or by one observer only
Implications (consequences)	The summative decision of entrustment is warranted, as associated risks are acceptable	Summative decisions are made in a too simplified manner, leading to substandard performance with little supervision; assessment burden on students, supervisors, and educational system

situations, if this occurs in one training or clinical context only, it may not necessarily translate to the practice situation or a different context a trainee may find themselves in. Finally, in terms of implications or consequences, summative decisions may be made in too simplified a manner under duress from service delivery pressures or due to inadequate or low-quality assessment data for proper high-stakes decision-making. In addition, there are also unintended consequences on the trainees, the faculty, and the educational system from an assessment that requires significant input and may add to the administrative burden for all concerned.

These unintended consequences can be considered more broadly in light of the consensus framework for good assessment, which include the following criteria: validity or coherence, reproducibility or consistency, equivalence, feasibility, educational effect, catalytic effect, and acceptability.³ The assessment burden introduced may limit the feasibility and acceptability of WBA. In addition, faculty and trainees often do not find that the perceived value of the assessment outweighs this burden, as the learning conversation or feedback may not be of sufficient value to overcome the requirements for completion. Potential solutions to address these and other practical concerns are discussed in the following sections.

Human resources in the clinical teaching environment

Critics of WBA often highlight its time-consuming nature, which translates into increased costs and adds to the administrative burden within an already-demanding work environment. Additionally, skeptics question the value of WBAs, citing a lack of demonstrated improvement in patient outcomes. This prompts the fundamental question: why invest time and resources into WBA? A succinct response to such skepticism echoes a quote often attributed to Abraham Lincoln: 'If you think education is expensive, try ignorance.' While this might seem clichéd, the underlying objective should be to cultivate competency efficiently, addressing the obstacles—money, time, administration—that hinder this process.

Despite the academic roots of medical professions, their real-world application unfolds in practical workplace settings. The pivotal task is to transfer theory into practice, emphasizing the importance of supervision and feedback in the workplace. Regularly employing WBAs within the structured framework of EPAs has proven to be remarkably time-efficient, averaging just three minutes per instance.⁴ This diminishes the argument of time constraints. Furthermore, the assessment workload can be distributed among various stakeholders, including patients, nurses, and student peers, provided they grasp their own role, that of the trainee, and the WBA concept. To facilitate this process, EPA-related entrustment–supervision scales for WBA articulate a concept familiar to all teachers, one they have implicitly used throughout their careers—entrustment, assigning the responsibility for doing something to someone.⁵ Emphasizing this point helps alleviate the common fear of something new and challenging. However, it is not necessarily straightforward for supervisors to explicitly elaborate an entrustment decision, and faculty development focusing on this process is important.⁶

In addition to assessor training, the increased emphasis on WBAs demands ongoing education for all involved parties to prevent assessment overload and subsequent stress. If trainees and supervisors do not perceive the benefits of WBA to outweigh the effort required, they may lose the motivation to participate. Establishing a cadre of 'champions' with dedicated time for introducing, teaching, and supervising the WBA process within an institution is crucial. These individuals must be well versed in the challenges of a feedback and assessment culture, addressing issues such as peer comparison, time pressures, overcontrol, and unrealistic expectations.⁷ In addition to developing a core team or champions, specific WBA meetings for all supervisors and trainees explicitly showing the benefits within an institution, especially the educational value, can facilitate the positive impact of WBAs and serve to increase buy-in.

Gathering interprofessional input

Working, learning, and collaborating in an interprofessional team are indispensable for achieving safe, effective, and sustainable health care.⁸ While multisource feedback (see Chapter 17 for more details) has demonstrated high reliability, validity, and feasibility in evaluating trainees,⁹ the incorporation of interprofessional direct observation for WBA remains uncommon.¹⁰ This discrepancy is particularly notable in postgraduate medical education, where trainees may have more frequent and intense interactions with nonphysician team members than with senior physician supervisors.¹¹ The reliance on a single assessor, typically a supervisor, may not be as defensible as incorporating input from diverse professional perspectives.¹²

Overcoming the scarcity of interprofessional WBA involves addressing practical and conceptual challenges. First, recognizing and highlighting the benefits and value of interprofessional input is crucial. This is especially pertinent when identifying and engaging a diverse range of assessors, including supervisors, nurses, physician assistants, dietitians, and other health care professionals that collaborate with the trainee on a regular basis. Furthermore, attending to the challenges associated with disparate professional perspectives, potential reluctance, and divergent opinions on competency is imperative.

To help establish a robust interprofessional assessment process, faculty development initiatives should extend beyond mono-professional supervisors to deliberately include all interprofessional stakeholders. Creating a standardized and seamless assessment process is pivotal, as is overcoming logistical hurdles such as ensuring access to digital platforms and addressing limited participant experience. In addition, legal considerations necessitate clear delineation of accountability and responsibility among the interprofessional team. For instance, how should the clinical competency committee (CCC), as the decision-making group responsible for evaluating trainees' progress in their specialty, value and utilize entrustment decisions made by interprofessional colleagues regarding their own trainees? Building trust and aligning expectations are essential in this context, requiring careful consideration to ensure a cohesive and effective decision-making process within the CCC. Finally, financial implications, particularly in regions linking remuneration to assessment outcomes, demand a balanced approach that ensures accuracy without compromising the assessment process's integrity.

By centering on interprofessional collaboration, WBA has the potential to become a more inclusive and effective tool in health professions education. This approach promotes a comprehensive and contextually relevant evaluation of trainee performance, contributing to the evolution of a more robust and holistic health care workforce.

The formative–summative tension

'Assessment drives learning'—well, not necessarily. When it comes to WBA there are some challenges to be aware of in order to optimize every assessment situation for learning. Collectively, a portfolio of WBAs can be used to make summative decisions regarding progress or promotion. However, on a spectrum from formative to summative, individual WBAs should be located in the formative corner. But, even if it is called 'formative,' from the trainee's perspective just using the term 'assessment' might create anxiety.¹³ In addition, if done infrequently, the assessment situation might feel like a summative test. As a result, trainees might only ask for a WBA if they are already proficient in a specific task (EPA); they fear getting a 'bad mark.' In a culture where each assessment is perceived as a high-stakes event, much of the trainee's energy goes into impression management instead of actual learning.¹⁴ On the supervisors' side, similar challenges exist as they might feel hesitant to use the lower spectrum of a performance scale because it might negatively impact a trainee's career or their relationship.¹⁵

In order to address these challenges in implementing WBA, the focus should shift to reducing stress and anxiety, and decreasing the perceived stakes as much as possible (for both trainees and supervisors). Every system of assessment needs to be absolutely transparent about the purpose of WBAs and how the data points are used to inform entrustment decisions of trainees. There is always some stake, even in formative assessment situations and especially if aggregated in an e-portfolio.¹⁶ Instead of using the terms 'formative' and 'summative,' terms such as 'low-stakes' and 'high-stakes' or a 'continuum of stakes' may be used, as is described in programmatic assessment.¹⁷ In addition, it may be recommended to avoid the term 'assessment' altogether, and instead call them 'observations' of performance in the workplace. Thus, rather than seeing it as an assessment, a workplace observation can be considered a perfect starting point for a 'learning conversation.' Trainees and supervisors should initiate frequent WBAs or 'observations' for facilitating learning from the first day of training until certification (and not just at the end). Using only the narrative descriptions of the entrustment-supervision scale in assessment tools (like 'direct supervision') emphasizes the clinical relevance of the rating, while using quantitative scales or levels at any point may still feel to the trainee like they are getting marked and that this should be avoided. In addition, no pass/fail decision or high-stakes decision should be made based on one single WBA.

If we succeed in our quest of decreasing trainee anxiety by carefully designing and communicating a system of assessment that is building on a growth mindset,¹⁸ we can, for trainees, truly optimize each assessment situation for learning. In addition, for supervisors, we can make our way toward autonomy-supportive teaching styles that fosters students' intrinsic motivation to learn.¹⁹

Ideal vs reality

Although multiple observations are required to provide a fair picture of a trainee's competence, there needs to be a practical sampling approach that provides sufficient evidence of progress and feedback opportunities, without becoming burdensome for both the trainee and the supervisor. Overambitious assessment requirements may lead to trainee and supervisor dissatisfaction and a 'tick-box' mentality, with WBA losing its formative and summative potential.²⁰ Insufficient opportunities for granting autonomy in training may also arise due to legal and regulatory constraints, coupled with concerns about patient safety.²¹ In particular, supervisors may not always trust the assessments of their colleagues, especially for higher-risk tasks like procedures.

Addressing these challenges may occur either in the context of establishing a new WBA strategy or refining an existing one. An essential starting point is gathering input from both supervisors and trainees to determine feasibility, including the number of required observations in a given time period and the selection of tasks or EPAs for assessment. Forming a stakeholder team, with or without surveys of the rest of the trainee and supervisor body, may facilitate this process, with feedback collection occurring iteratively during implementation. It is also valuable to examine what others have done and what principles they used to design their strategies, including barriers and facilitators identified to implementation and integration. However, it is essential to consider these insights in the light of the local context and adjust them based on local experience. In addition, the activities for assessment in the workplace (i.e., EPAs) should be mapped to curricular outcomes and the attributes of a successful graduate, as required by the relevant institution or regulatory body. Commencing with simplicity and gradual progression cannot be overemphasized. Starting with a few EPAs or a very low number of initial observations or both is advisable, and these can be progressively increased as feasibility is demonstrated and greater buy-in is achieved.

Multiple studies have defined minimum observation quotas for accurate assessments, but reliance on psychometrics should be balanced with subjective decision-making by a competence committee, emphasizing trust in trainees, supervisors, and in their high-stakes decision-making.²² In terms of autonomy, the use of prospective entrustment decisions are advised. Whereas retrospective scales report the actual supervision provided during an activity, prospective entrustment decisions require an estimation of the student's readiness for a specific level of supervision, focusing on future performance.²³ This means that they carry more weight and may have a greater influence on decisions regarding autonomy provision.²³ While entrustment decisions may not directly impact supervision levels in all contexts, they can lead to advancement within training, with senior roles carrying increased responsibility and autonomy. Though changing regulatory and legal frameworks is challenging, in some settings the trustworthiness of a competence committee's prospective entrustment decisions, based on multiple EPA observations from multiple supervisors, may enable trainees to legally assume more senior roles and thus experience greater autonomy in training.

Technology solutions to address practical challenges

WBA has challenges and limitations for which technological solutions could serve as a resource to overcome. Examples of challenges are: (a) competing clinical demands that interfere with the time available for faculty to complete assessments; (b) the need for the collection of multiple data points to support a decision regarding readiness; (c) the analysis and visualization of data points to support both self-reflection, progression decisions, and program evaluation; and (d) the security and confidentiality of data. In the past, assessment data has been collected in paper form. While the paper-based method of data collection has benefits (e.g., more comprehensive feedback), it makes the collection, storage, analysis, presentation, and security of a large number of data points cumulatively and across time less effective.²⁴

In looking to the future, it has been noted that technology such as mobile applications and dashboards or e-portfolios (if designed correctly) can provide efficient means to collect data immediately following a clinical interaction and allow instantaneous storage of data for analysis and further review in aggregate and across time. In addition to the efficiency in the collection, storage, and cumulation of data, technology also offers further ways for trainees and institutional entities (e.g., programs, directors, clinical competency committees, or institution administrators) to use the data. Trainees can benefit from seeing their progress across time and against other trainees, and from reviewing the feedback from each assessment as they consider their accomplishments and gaps toward unsupervised practice. Institutions can use the data more effectively for overall and longitudinal analysis. For example, CCCs, which are limited in their time to review trainee progress, can quickly see data displayed in multiple ways (e.g., individual data points, longitudinal progression, individual against aggregated group data) as they consider the next steps for a trainee. Regarding program evaluation, technology allows expansion from analysis of a trainee to broader perspectives of curriculum and the program (e.g., review of data by level of supervision for each EPA, looking at EPAs by program or specialty). Finally, it can provide a mechanism for digital 'badging' (electronically showing the qualifications for scope of practice of a trainee).²⁵

While technology certainly has benefits, it also has important considerations such as cost, design, security and data safety, Wi-Fi coverage and networks, legal and ethical issues, reporting, standardization, disinfecting or sanitizing devices, and training and support. These issues and considerations are extensively discussed in the literature by experts who have implemented technologies to support WBA.^{24,26,27}

Strategies in low-resource countries or areas

Although low-resource countries or regions encounter similar but often intensified challenges as those experienced in high-resource areas, some challenges are unique to resource-limited settings. In many low-resource environments, limited human resources and a high disease burden create service delivery pressure for clinicians, translating into less time for educational activities and fewer available human resources for initiatives like WBA.²⁸ Cultural dynamics as well as underdeveloped assessment systems and medical education departments may provide additional difficulties.²⁹ Further limiting factors include the cost of information technology platforms to make WBA user-friendly in the workplace, as well as the limited availability of Wi-Fi or cell phone data coverage. Low-resource settings may struggle to implement WBA strategies designed for high-income settings, with some concluding they lack the resources for WBA implementation altogether.³⁰

Addressing these challenges in low-resource settings requires a focus on feasibility within that specific context. This involves the lowest possible assessment burden for busy clinicians and the use of extremely simple tools, ensuring quick observation capture and minimal disruption to the clinical workflow. Local design of low-cost tech platforms for WBA, such as using Google packages, RedCap, or commercially available survey software, is possible. Paper-based systems, even in low-resource settings, are discouraged owing to their multiple limitations.²⁶ Implemented tech platforms should ideally have low data requirements or cache features for data syncing when data coverage is available. While guidance on EPA selection and description for WBA from other contexts is helpful, it is crucial for low-resource settings to ensure that EPA selection is appropriate and that the resultant assessment requirements are feasible to implement locally. Examples of strategies to improve feasibility include selecting a limited core group of EPAs (with or without 'elective' EPAs that are optional to be assessed) or opting for fewer, broader EPAs; both resulting in a lower assessment burden (see Chapter 9 for more details). In addition, the definition of EPAs by experts in a particular setting allows curricula to be aligned to train graduates who are fit for purpose in that specific context. For some countries, particularly from the Global South, this presents an opportunity to transform and decolonize their curricula through the process of EPA selection and implementation. To ensure greatest feasibility, including the perspective of the lowest-resourced area in a particular context is needed when selecting national EPAs. Low-resource settings can also seek assistance from colleagues in well-resourced environments with experience in WBA implementation, but must take care to ensure the advice is feasible. As local expertise grows, a community of practice within a low-resource setting may facilitate the exchange of ideas and strategies for overcoming resource restrictions. Finally, although collaboration between areas with varying resource levels holds significant value, collaboration among different low-resource areas is important, which may facilitate the sharing of potential solutions or even collectively addressing development costs.

Conclusion

Whether it is a new WBA strategy being implemented or an existing one being refined, challenges are inevitable. It is imperative for drivers of educational change to understand what they can do to limit the magnitude and shorten the duration of the initial period of disarray that inevitably follows the introduction of change. This chapter highlights many such strategies that can be used to create a more supportive external environment, as well as to address some of the cognitive and other internal barriers to WBA implementation (summarized in Table 20.2 below). In addition, we have discussed how EPAs and the concept of entrustment may assist in achieving this goal. We hope that this information empowers those who are embarking on an implementation journey or encourages those who feel that the challenges are too great to overcome.

Table 20.2: Practical and conceptual challenges to WBA and strategies to overcome them.

Challenge	Strategies
Assessment burden for busy clinicians	<ul style="list-style-type: none"> • Use EPA-based assessments with simple tools that include entrustment–supervision scales • Distribute the load through interprofessional involvement • Ensure continuous education of all involved parties • Establish ‘champions’ with dedicated time for introducing and supervising WBA process • Arrange WBA meetings for all supervisors and trainees showing local progress and stressing benefits to individuals and the team
Scarcity of interprofessional WBA	<ul style="list-style-type: none"> • Ensure faculty development initiatives include all interprofessional stakeholders • Create a standardized and seamless assessment process, including digital platform • Ensure clear delineation of accountability, legal responsibility, and remuneration
Tension between formative and summative purposes in WBA	<ul style="list-style-type: none"> • Avoid term ‘assessment’—instead use ‘observations’ of performance in the workplace/‘WBO’ • Use only narrative descriptions of the entrustment–supervision scale in assessment tools • Completely avoid numbers or ‘levels’ in rating scales • Ensure transparency about purpose of WBAs and how data points are used for high-stakes decision-making
Tension between educational ideals and reality of workplace environment	<ul style="list-style-type: none"> • Get local input from both supervisors and trainees to determine feasibility, especially regarding assessment quotas • Start with a few EPAs and/or a very low number of initial observations, then build up • Examine the literature to learn from the mistakes and successes of others • Continuously seek feedback from all participants during implementation and adjust as necessary
Logistics of continuous data collection in the workplace, and need to aggregate for later use	<ul style="list-style-type: none"> • Avoid paper-based system • Use mobile/smartphone-based applications to capture individual observations • Use e-portfolios for trainees to review own progress • Develop digital dashboards to aid competence committee view and analyze aggregated data points
Resource restrictions in lower-income countries/ contexts	<ul style="list-style-type: none"> • Ensure lowest possible assessment burden • Use of extremely simple tools • Local design of low-cost tech platforms • Incorporate low data requirements or cache features for data syncing when data coverage is available • Ensure EPA selection is appropriate and feasible locally

Competing interests

The authors declare that they have no competing interests.

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Appendix G1 - National WBA Steering Committee membership

Institution	Representative	Designation/Department
Nelson Mandela University	Dr Reno Morar	Director: Medical Programme
	Prof Yaseen Ally	Psychology
Sefako Makgatho University	Prof Dini Mawela	HOD: Paediatrics and Child Health
	Dr Abegail Dlova	Haematology
	Ms Gerda Botha	Health professions education
Stellenbosch University	Prof J du Toit	HOD: Orthopaedics
	Prof Jantjie Taljaard	Head: Division of Infectious Diseases
	Prof Louis Jenkins	HOU: Family and Emergency Medicine, George Regional Hospital
University of Cape Town	Prof Alan Horn	Neonatology
	Dr Tashneem Harris	Otorhinology
	Dr Daniel Nel	General Surgery
	Prof Tasleem Ras	Family Medicine
University of Free State	Prof Jacques Janse van Rensburg	HOD: Diagnostic Radiology
	Dr Anton van Aswegen	HOD: Neurosurgery
	Emeritus Prof Johan Diedericks	Anaesthesia
University of Kwazulu Natal	Prof Veena Singaram	Head: Health Professions Education Unit, College of Health Sciences
	Prof Kimesh Naidoo	HOU: Paediatrics
University of Limpopo	Prof Chris Sutton	HOU: Paediatrics
	Dr Thakadu Mamashela	HOD: Forensic Medicine and Forensic

University of Pretoria	Prof Vanessa Steenkamp	Deputy Dean: Teaching and Learning
	Prof Sumaiya Adam	HOU: Obstetrics
University of the Witwatersrand	Prof Maria Papathanasopoulos	Assistant Dean: Research and Postgraduate Support
	Prof Richard Cooke	HOD: Family Medicine and Primary Care
Walter Sisulu University	Dr Avumile Mankahla	HOU: Dermatology
College of Medicine of South Africa	Prof Eric Buch	CEO
	Prof Vanessa Burch	Executive Director: Education and Assessment

Appendix G2 - International Competence-Based Health Professions Education (ICBHPE) collaborative membership

Name	Surname	Location
Eusang	Ahn	University of Ottawa
Jonathan	Amiel	Columbia University
Dorothy	Andriole	Association of American Medical Colleges
Adelle	Atkinson	The Hospital for Sick Children
Michael	Barone	National Board of Medical Examiners
Farhan	Bhanji	Royal College of Physicians and Surgeons of Canada
Harold G.J.	Bok	Faculty of Veterinary Medicine, Utrecht University, The Netherlands
Christy K.	Boscardin	University of California, San Francisco
Jan	Breckwoldt	University Hospital Zurich
Monika	Brodmann Maeder	Bern University
Vanessa	Burch	Colleges of Medicine of South Africa
Ford	Burse	Memorial University of Newfoundland
Jamiu	Busari	Maastricht University
Holly	Caretta-Weyer	Stanford University
Olle	ten Cate	Netherlands
Kelly	Caverzagie	University of Nebraska Medical Center
Ming-Ka	Chan	University of Manitoba
Teresa	Chan	McMaster University
Kristin P.	Chaney	Texas A&M University
Aleda M. H.	Chen	Cedarville University, Cedarville, OH
H. Carrie	Chen	Georgetown University
Chien-Yu (Johnathan)	Chen	Taipei Medical University Hospital
Warren	Cheung	University of Ottawa

Fremen	Chou	China Medical Institution - Taiwan
John Patrick T.	Co	Massachusetts General Hospital
Tim	Dalseg	University of Toronto
Arvin	Damodaran	University of New South Wales, Sydney
Daniel	Dubois	University of Ottawa
David	Duong	Harvard Medical School
Laura	Egard	Accreditation Council for Graduate Medical Education
Robert	Englander	N/A
Jason	Frank	University of Ottawa
Brian	George	University of Michigan
Mary Ellen J	Goldhamer	Massachusetts General Hospital
Wade	Gofton	University of Ottawa
Larry	Gruppen	University of Michigan Medical School
Andrew	Hall	University of Ottawa
Deena	Hamza	University of Alberta
Marije	Hennus	University Medical Center Utrecht
Ronald	Harden	Association for Medical Education in Europe (AMEE)
Peter	Harris	University of New South Wales
Danielle	Hart	Hennepin County Medical Center & University of Minnesota Medical School
Karen	Hauer	University of California
Jennifer	Hodgson	VA-MD College of Veterinary Medicine
Eric	Holmboe	Accreditation Council for Graduate Medical Education
Susan	Humphty-Murto	University of Ottawa
Sören	Huwendiek	Institute for Medical Education
Ian	Incoll	University of Newcastle
Prashant	Jhala	University of New South Wales
Jolanta	Karpinski	Royal College of Physicians and Surgeons of Canada

Benjamin R.	Kinnear	Cincinnati Children's Hospital
Brenessa M.	Lindeman	University of Alabama at Birmingham
Kimberly	Lomis	The American Medical Association
Donlin M.	Long	Johns Hopkins University
Adi	Marty	University Hospital Zurich
Laura	Molgaard	University of Minnesota, Department of Veterinary Population Medicine
Eric	Nadel	Brigham and Women's Hospital
Viren	Naik	Royal College of Physicians and Surgeons of Canada
Daniel	Nel	University of Cape Town
Leila	Niemi-Murola	University of Helsinki
Markku T.	Nousiainen	Sunnybrook Health Sciences Centre
Ivy	Oandasan	College of Family Physicians of Canada
Anna	Oswald	University of Alberta
Yoon Soo	Park,	University of Illinois College of Medicine
Severin	Pinilla	University of Bern
Martin	Pusic	Boston's Children's Hospital
Denise H.	Rhoney	UNC Eshelman School of Pharmacy
Denyse L.	Richardson	Queen's University
Shelley	Ross	University of Alberta
Michael	Ryan	University of Virginia School of Medicine
Karen	Schultz	Queen's University
Daniel	Schumacher	Cincinnati Children's Hospital Medical Center
Jonathan	Sherbino	McMaster University
Linda Sara	Snell	McGill University
Pedro	Tanaka	Stanford University
Brent	Thoma	University of Saskatchewan
Claire	Touchie	University of Ottawa

David	Turner	American Board of Pediatrics
Teri	Turner	Texas Children's Hospital
Eric	Warm	University of Cincinnati College of Medicine
Debra F.	Weinstein	University of Michigan Medical School
Alison	Whelan	Association of American Medical Colleges
John Q.	Young	Donald and Barbara Zucker School of Medicine at Hofstra/Northwell