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REVIEW

Minimal access surgical research and training in South Africa – a scoping review

H Mangray,[1] S Madziba,[1] A Ngobese,[1] Y Govender,[1] DL Clarke[2,3]

[1] *Department of Paediatric Surgery, Greys Hospital, University of KwaZulu-Natal, South Africa*
[2] *Department of Surgery, Greys Hospital, University of KwaZulu-Natal, South Africa*
[3] *Department of Surgery, University of the Witwatersrand, South Africa*

Corresponding author, email: *mangrayh@ukzn.ac.za*

Background: Minimal access surgery (MAS) has been on the rise internationally; however, there seems to be limited information regarding research and training in the general and paediatric surgical (GPS) disciplines in South Africa (SA). We performed a scoping review to identify knowledge gaps that will assist us in developing strategies to improve the delivery and training of MAS within the GPS disciplines in SA.
Method: The method of the review – 2020 JBI guide and PRISMA for scoping reviews. We searched online databases and websites for publications from 1990 to 2022. Interviews were conducted with senior MAS trainers from training sites.
Results: Full texts of 194 articles were reviewed. Most publications were related to trauma, followed by laparoscopic appendicectomy and laparoscopic cholecystectomy. Paediatric MAS comprised 11.9% (21), and training was the focus in 4.5% (7) of all the publications. Published limitations regarding MAS included access to training and equipment.
Conclusion: This scoping review has summarised the current MAS research and training within the GPS disciplines in SA. We have highlighted the limitations that exist, which can direct the focus of research and training to improve the delivery of MAS within the GPS disciplines.
Keywords: laparoscopy, thoracoscopy, laparoscopic surgery, minimal invasive surgery, minimal access surgery, training, South Africa

Introduction

The rise of minimal access surgery (MAS) over the last three decades has been inexorable. The benefits in terms of reduced hospital stay and decreased pain are mostly related to the elimination of a surgical wound.[1] However, as an increasing number of procedures are performed laparoscopically, the need for training in MAS has expanded. Although MAS is ideally suited to surgical simulation-based training, establishing appropriate simulation training programmes is a costly exercise.[2] Access to surgical simulation across the globe is far from homogenous.

Just as the Lancet Commission highlighted the unequal global distribution in terms of access to surgical care, there is also an unequal distribution in terms of access to surgical simulation training.[3] South Africa (SA) is a middle-income country with considerable discrepancies in access to surgical care. The country tends to lag behind more developed countries in terms of uptake of new surgical technology, and this is especially the case in the state sector, where most surgical training takes place.[4] There is evidence to suggest that the uptake of MAS is not homogenous across the South African health landscape. In the private sector, MAS is ubiquitous, but across the state sector, this is not the case.[5]

Despite these difficulties, there has been a concerted effort to promote MAS in SA. The South African Society of Endoscopic Surgery (SASES) was established in 1991, and its role is to disseminate and promote MAS training in SA. As a result SASES offers MAS training fellowships in Germany, Holland, Belgium and Sweden.[6] Other trainees have visited centres such as IRCAD in France or IMMAST in India, which are well-equipped, and where live animal model training is available. The Basic and Essential Surgical Skills Training (BESST) course was developed in SA and is conducted in most medical universities in the country. The course includes MAS skills training and focuses on fine motor skills and hand-eye coordination. MAS training is available at some centres in SA, such as at the University of Cape Town (UCT) and the University of Witwatersrand (WU).

Considering the above, we set out to perform a scoping review of existing MAS research and current training opportunities in SA within the general and paediatric surgical (GPS) disciplines. The following research objectives were identified. What MAS training is available in SA for GPS trainees, and where is MAS research and training performed in SA? What types of procedures are being performed as described in the publications found during the scoping period? The review aimed to quantify the resources available for MAS training and identify publications where a MAS technique was used. A specific focus was placed on MAS training in KwaZulu-Natal (KZN).

It is hoped that this will identify knowledge gaps within the field of MAS and assist in developing strategies to improve the delivery and training of MAS within the GPS disciplines in SA.

Method

A scoping review using the 2020 updated Joanna Briggs Institute scoping review methodology was performed.[7] This included the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) checklist.[8] The biomedical and research ethical approval was BREC/00005035/2022.

We initially performed an online database and registry search. The other methods used were to look at specific websites, surgical organisations and citations.

An online database and registry search was undertaken using PubMed, EBSCOhost, Scopus, Sabinet, the SA Clinical Trials registry, and the South African Medical Research Council. The following search terms were used – laparoscopy, thoracoscopy, laparoscopic surgery, minimal invasive surgery, minimal access surgery, training and South Africa. We included all articles published from 1990 up to 2022 in all languages.

The second search was of websites related to South African medical and surgical journals and medical schools. We specifically looked for publications related to MAS on these sites. We reviewed the websites of surgical societies such as SASES and Association of Surgeons of South Africa (ASSA) and the Surgical Skills website for past and current MAS training courses offered. All citations in the reviewed articles which met the search criteria were included. This ensured we captured all publications on MAS and MAS training courses emanating from SA.

After the search, all identified citations were collated and uploaded into Zotero 6.0.35/2023 (Corporation for Digital Scholar). The articles were cross-referenced, and duplicates were excluded. In addition, animal studies, non-South African studies and medicolegal articles were excluded. Articles on gynaecology, adult urology, orthopaedics, and radiology were excluded. Articles were retrieved via the University of KwaZulu-Natal (UKZN) library. Abstracts were screened by two authors, and irrelevant articles were excluded. The articles were then reviewed, and the relevant data were collected and annotated.

In addition to this review of the literature, structured interviews with senior MAS trainers within the fields of GPS in SA were conducted. The information gathered was related to MAS training courses offered in SA at their specific institutions. We collected information on the resources available for MAS training, the duration, what MAS courses were offered, the duration for which they were offered and the costs.

Results

One hundred and seventy-one articles were identified in the initial online search. A further 143 articles were identified after manually searching specific websites and citations. A total of 120 articles were excluded after screening. Full texts of 194 articles were reviewed. Figure 1 shows the texts which were excluded and the reasons for exclusion. Most publications were retrospective reviews or case series. There were four surveys, three case reports and no randomised controlled trials.

There was a steady increase in the number of MAS research publications from 1990 until 2022, with most publications occurring after 2017 (Figure 2). Most publications from UKZN have appeared in the last decade. Most publications were related to trauma, followed by laparoscopic appendicectomy and laparoscopic cholecystectomy. A miscellaneous cohort focused on MAS for infective diseases, tumours, splenic conditions, and transplants. Paediatric MAS comprised 11.9% (21) of all the publications, of which two were case reports, two were surveys, and five were general MAS articles. The remaining 12 articles focused on specific paediatric MAS cohorts. Thoracoscopy publications

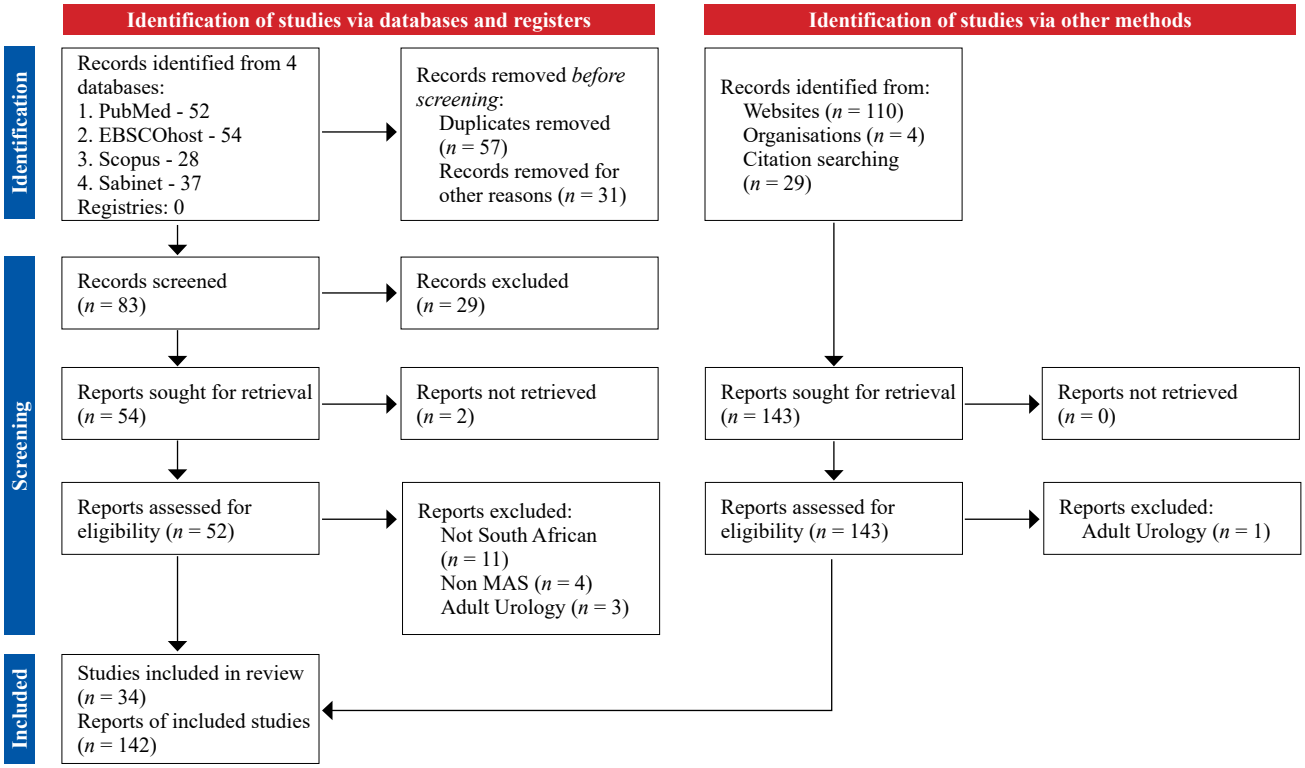

Figure 1: Flow diagram of studies' screening and selection

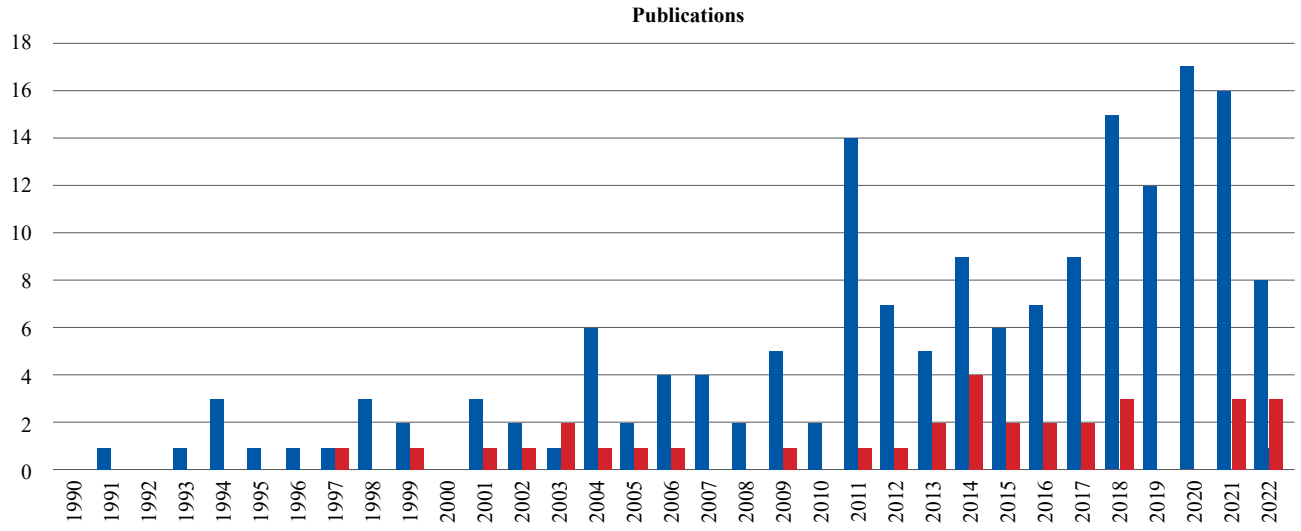

Figure 2: Number of minimal access surgery research publications per year comparing the University of KwaZulu-Natal to all other provinces

comprised 15.4% (27). Training was the focus in 4.5% (7) of the publications (Figure 3).

The UKZN cohort followed the national trend. There was no training and only a single paediatric publication (Figure 3). After excluding editorials and guidelines, we reviewed the number of MAS publications from each medical institution. Figure 4 shows the MAS publications per institution and correlates these publications with the establishment of formal surgical simulation training facilities. Eight articles elaborated on these limitations of MAS, as highlighted in Figure 5.[9-16] Limitations included the lack of a structured curriculum which should include a mix of lectures and literature, simulation-based practice, supervised clinical experience, and continuous assessment. The limitations in the UKZN studies highlighted the lack of MAS training and equipment (Figure 5).

The Internet and societal searches confirmed the existing international fellowships offered and advertised for the local MAS training courses.

The BESST course was developed at WU and is conducted in most medical universities in SA. In this course, MAS skills training is undertaken and focuses on fine motor skills and hand-eye coordination. MAS skills laboratories where regular MAS courses are conducted on synthetic and animal tissue are available at UCT and WU. The cost of setting up the WU skills laboratory was ZAR 22 million.[17] In Cape Town, regular suturing, appendicectomy and cholecystectomy courses are conducted under the auspices of the Red Cross War Memorial Children's Hospital. At WU, regular suturing, appendicectomy, cholecystectomy and Nissen fundoplication courses are conducted. The cost of the course ranges from between ZAR 3500–4250. At Sefako Makgatho Health Sciences University (SMU), a MAS fellowship for surgeons has been developed. This two-year programme covers all aspects of MAS and has run for the past 10 years.

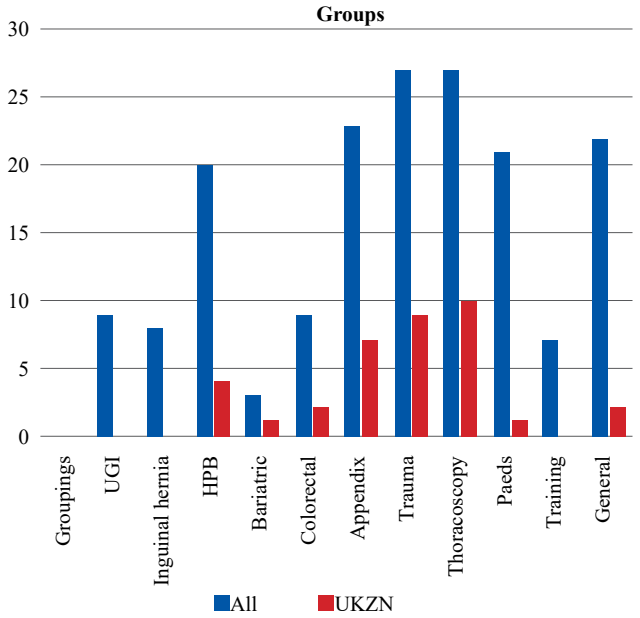

Figure 3: Number of minimal access surgery publications per group comparing the University of KwaZulu-Natal to all other provinces

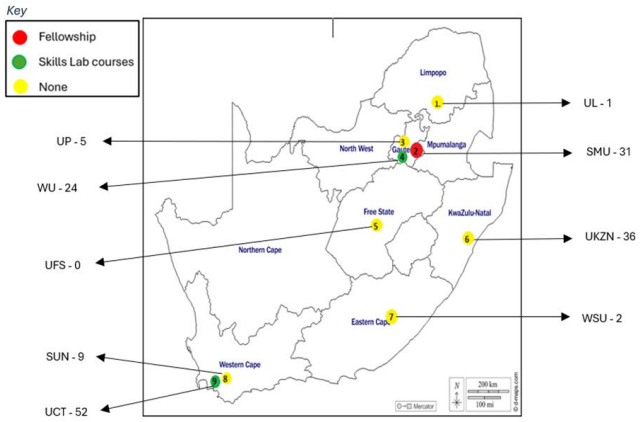

Figure 4: Map of South Africa showing the medical institutions, the minimal access surgery training offered and the number of minimal access surgery publications per medical institution

Discussion

This is the first scoping review on MAS research and training in SA within the GPS disciplines. This research has helped identify gaps within the field of MAS training and will assist

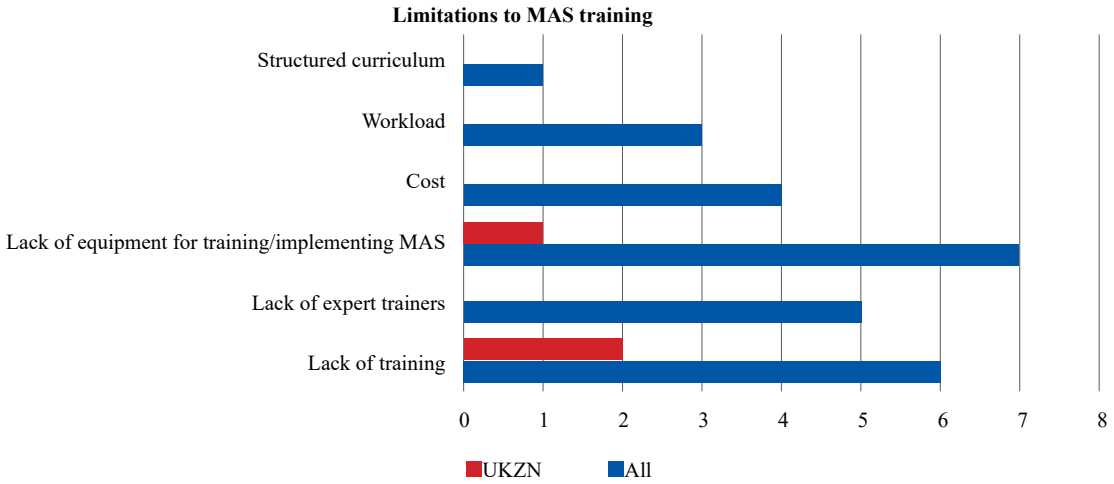

Figure 5: Number of publications highlighting limitations to minimal access surgery training

in developing strategies to improve the delivery and training of MAS within the GPS disciplines in SA.

Over the past three decades, MAS procedures have progressively superseded open surgical approaches. The increasing number of research publications on MAS reflects this. In SA, based on the number of publications in GPS where a MAS technique was used, the trend is similar. There has been a steady increase in publications over the past two decades, reflecting the increasing number of MAS procedures being performed in GPS. This increase is underpinned by improved access to training.

Despite numerous studies, the methodologies were mostly retrospective audits. With the increase in MAS training and practice, it is hoped that there will be more robust randomised controlled trials in the future.

There were no training courses in the country before 2011, and most training occurred abroad. This changed a decade ago when a MAS skills laboratory was established at the Red Cross Hospital in Cape Town, and a MAS fellowship training programme was initiated at SMU. In 2021, the WITS Advanced Surgical Skills Laboratory opened, hosting regular training courses covering intracorporeal suturing, appendicectomies, cholecystectomies, and Nissen fundoplication. These centres with skills laboratories also reported an increase in MAS-related publications.

In KZN, although there was no surgical simulation facility or MAS courses until recently, there was a sustained publication output focusing on MAS. The largest group of MAS publications focused on thoracoscopic sympathectomy, trauma-related MAS and laparoscopic appendicectomy. The only paediatric MAS publication was on thoracoscopic lung biopsies. There were no publications related to MAS training in UKZN; however, a few papers highlighted the lack of access to training and equipment. Limited access to MAS training locally necessitated trainees travelling to other provinces or abroad. The unequal distribution of MAS training in the developing world is well documented, and the reasons for this have been alluded to in the local literature. Cost remains a significant issue, and commercial and industry support is crucial in establishing a surgical simulation centre. This allows for a mutually beneficial relationship with support in setting up skills laboratories and exposing trainees to industry products.

Simulation has been shown to improve MAS skills; therefore, training should continue in skills laboratories until trainees are competent in specific tasks, such as suturing.[18] MAS trainers are essential for MAS training as they impart skills and technical knowledge. The need for appropriate trainers and mentors is a limitation highlighted by most MAS training publications. This deficit needs to be addressed. Training and upskilling a cohort of mentors requires a structured approach with a formal curriculum. Locally developed skills and simulation laboratories allow for ongoing skills training.

The workload within SA state hospitals is significant, and trainees often prioritise service delivery over training. Increased proficiency and familiarity with MAS should increase efficiency and improve workflow. This should allow for more complex cases to be performed using MAS procedures. These will hopefully include more laparoscopic liver resections, Whipple's procedures and abdominoperineal resections.[19-23]

This review has identified the resources available for MAS training in SA. Despite the limitations, several procedures are commonly undertaken in SA using MAS techniques and most institutions are involved in MAS training. There is a limited number of publications related to MAS training, and this is very apparent in terms of paediatric surgery. Within KZN, there is a clear need for a MAS training laboratory. There is also a need for training and paediatric MAS research within SA and KZN.

There are a few limitations to our study. Uptake of a MAS technique was based on publications and not on surgeon logbooks or national registries. The inherent limitation of our scoping review is that we provided breadth rather than depth of information on MAS training in the fields of GPS in SA. The second is the inability to access two of 196 full-text articles which could have contributed to answering the objectives. The risk of bias exists, and we therefore had two authors review the articles, and differences of opinion were addressed by involving a third author. Publication bias also exists as unpublished papers are often missed; however, we addressed this by searching the specific university websites for their research outputs related to the topic.

Conclusion

This scoping review has summarised the current MAS research and training within the GPS disciplines of SA. We are now aware of the resources available in SA and the sites where limited resources exist, such as KZN. This knowledge

allows for directed focus of resources, and future research and training to improve the delivery of MAS within the GPS disciplines.

Conflict of interest

The authors report no conflict of interest.

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Ethical approval

Ethical approval was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee (Ref: BREC/0000/5035/2022).

ORCID

H Mangray https://orcid.org/0000-0002-5204-3542
S Madziba https://orcid.org/0000-0003-4077-3465
A Ngobese https://orcid.org/0000-0002-1024-8478
Y Govender https://orcid.org/0000-0001-9187-0711
DL Clarke https://orcid.org/0000-0002-8467-1455

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