ORIGINAL REPORTS

Comparison of Operative Logbook Experience of Australian General Surgical Trainees With Surgeons Deployed on Humanitarian Missions: What Can Be Learnt for the Future?

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OBJECTIVE: General surgical training in Australia has undergone considerable change in recent years with less exposure to other areas of surgery. General surgeons from many high-income countries have played important roles in assisting with the provision of surgical care in low- and middle-income countries during sudden-onset disasters (SODs) as part of emergency medical teams (EMTs). It is not known if contemporary Australian general surgeons are receiving the broad surgical training required for work in EMTs.

DESIGN: Logbook data on the surgical procedures performed by Australian general surgical trainees were obtained from General Surgeons Australia (GSA) for the time period February 2008 to February 2017. Surgical procedures performed by *Médecins sans Frontières* (MSF) surgeons during 5 projects in 3 SODs (the 2010 Haiti earthquake, the 2013 Philippines typhoon and the 2015 Nepal earthquake) were obtained from previously published data for 6 months following each disaster.

SETTING AND PARTICIPANTS: This was carried out at the University of Sydney with input from MSF Operational Centre Brussels and GSA.

RESULTS: Australian general surgical trainees performed a mean of 2107 surgical procedures (excluding endoscopy) during their training (10 6-month rotations). Common procedures included abdominal wall hernia repairs (268, 12.7%), cholecystectomies (247, 11.8%), and specialist colorectal procedures (242, 11.5%). MSF surgeons performed a total of 3542 surgical procedures across the 5 projects analyzed. Common procedures included Caesarean sections (443, 12.5%), wound debridement (1115, 31.5%), and other trauma-related procedures (472, 13.3%).

CONCLUSIONS: Australian general surgical trainees receive exposure to both essential and advanced general surgery but lack exposure to specialty procedures including the obstetric and orthopedic procedures commonly performed by MSF surgeons after SODs. Further training in these areas would likely be beneficial for general surgeons prior to deployment with an EMT. (J Surg Ed 000:1−7. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: general surgery/education, surgical training, emergency medical teams

COMPETENCIES: Patient Care, Medical Knowledge, Systems-Based Practice, Practice-Based Learning and Improvement

INTRODUCTION

In Australia, a new, streamlined training scheme (Surgical Education and Training, SET) was introduced in 2008.[1]

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General surgical trainees spend 6-month rotations over a 5-year training scheme in a variety of general surgical subspecialties, but may have limited exposure to other areas of surgery. General surgeons from Australia and other high-income countries (HICs) have played important roles supplementing local health services in the provision of surgical care in sudden-onset disasters (SODs) as part of emergency medical teams (EMTs).[2,3] The purpose of this study is to compare the logbooks of Australian general surgical trainees with the case logs of surgeons in EMTs to assess whether trainees are receiving exposure to the surgical skills required for response to SODs, particularly in low and lower-middle income countries (LMICs), where baseline shortages of staffing and infrastructure [4] mean that health systems are particularly vulnerable to being overwhelmed.

METHODS

The prospectively recorded logbooks for all general surgical trainees in Australia from Rotation 1 in 2008 (beginning in February 2008) to Rotation 2 in 2016 (ending in February 2017) were requested from General Surgeons Australia (GSA), the provider of general surgical training in Australia. These data were provided in Excel (Microsoft, Redmond, California) spread sheets as logbooks for each individual 6-month rotation for each hospital involved in general surgical training in Australia. These logbooks were then amalgamated into a single spreadsheet. Endoscopic procedures were excluded from the dataset.

Operation logs of all procedures performed in *Médecins sans Frontières* (MSF) facilities during their recent responses to SODs were obtained from previously published data.[5-18] MSF is an international nongovernmental organization with significant experience in surgical responses to SODs.[6,11] Data were available for 5 projects in 3 disasters: the magnitude 7.0 earthquake in Haiti on January 12, 2010 (Cange, Chancerelles and Cité Soleil projects), the category 5 cyclonic storm that struck the Philippines in November 2013 (Guiuan project) and the magnitude 7.8 earthquake that occurred in Nepal on April 25, 2015 (Charikot project). Details were collected from when the teams were operational up to the first 6 months following the disaster.

As both data sets used different classification systems for their surgical procedures, these were amalgamated in order to enable comparison between data sets. The list of "essential" general surgery was derived from the Essential Surgery report.[19] Published in 2015 by the World Bank as part of the Disease Control Priorities, 3rd Edition, this report provides a list of surgical procedures that address a substantial proportion of the global burden of surgical disease. The full list of new categories, as well as the original GSA and MSF classifications, are described in Appendix A (supplementary information). Differences in the proportions of each procedure between the 2 groups were assessed for statistical significance using 2-proportions Z tests at a 5% level of significance (i.e. p value < 0.05).

Prior to commencement of the study, ethics approval was obtained from the Royal Australasian College of Surgeons Executive.

RESULTS

Australian general surgical trainees were involved in a mean of 2107 surgical procedures (including as both primary operator and assistant) during the average 5 years of training, after exclusion of endoscopic procedures. Common procedures included essential general surgical procedures such as abdominal wall hernia repairs (268, 12.7%), cholecystectomies (247, 11.8%), and appendicectomies (175, 8.3%). Advanced general surgery, such as colorectal procedures (242, 11.5%) and breast and axillary procedures (190, 9%), was also commonly performed. In contrast, specialist orthopedic, gynecological, obstetric, neurosurgical, and pediatric surgical procedures were infrequently performed. Some trauma surgical procedures, such as fasciotomy (1, 0.04%), tracheostomy (3, 0.1%), and thoracotomy (7, 0.3%) were very rarely performed.

MSF surgeons performed a total of 3542 surgical procedures across the 5 projects analyzed. Common procedures included Caesarean sections (443, 12.5%), wound debridement (1115, 31.5%), and other trauma-related procedures (472, 13.3%), which included chest drain insertion and removal and dressing changes under sedation. Very few advanced general surgical and other surgical specialty procedures were performed. There were also minimal numbers of thoracotomies (3, 0.1%), specialist vascular (3, 0.1%) and specialist plastic (2, 0.1%) procedures performed.

Australian general surgical trainees performed proportionately more essential general surgical procedures, including exploratory/diagnostic laparotomy (4.9% vs. 6.3%, $p < 0.05$), abdominal hernia repairs (3.9% vs. 12.7%, $p < 0.05$), cholecystectomies (0.2% vs. 11.8%, $p < 0.05$), and appendicectomies (0.3% vs. 8.3%, $p < 0.05$). They also performed proportionately more advanced general surgical procedures, such as specialist hepatopancreaticobiliary (0.03% vs. 1.8%, $p < 0.05$) and upper gastrointestinal (0.03% vs. 2.8%, $p < 0.05$) procedures. Furthermore, they were more likely to perform many nongeneral surgical specialty procedures, including urological (0.5% vs 3.6%, $p < 0.05$), pediatric surgical (0.2% vs. 0.5%, $p < 0.05$), and vascular procedures (0.1% vs. 4.8%, $p < 0.05$).

MSF surgeons performed proportionately more obstetric and gynecological procedures such as hysterectomies (4.2% vs. 0.1%, $p < 0.05$), procedures for ectopic pregnancy (0.7% vs. 0.01%, $p < 0.05$), and Caesarean section (12.5% vs. 0.01%, $p < 0.05$). They also performed proportionately more orthopedic procedures such as fracture repair (9.2% vs. 0.1%, $p < 0.05$) and major limb amputation (3.6% vs. 0.4%, $p < 0.05$). With regards to essential general surgery, they performed more wound debridement (31.5% vs. 6%, $p < 0.05$) than Australian general surgical trainees. A full list of surgical procedures is listed in Table 1. The proportions of each procedural group are demonstrated in Figure 1.

DISCUSSION

Australian general surgical trainees gain exposure to essential general surgical procedures, such as laparotomy, appendicectomy, and cholecystectomy, as well as advanced general surgery, including colorectal, hepatopancreatobiliary, breast/endocrine, and upper gastrointestinal procedures, but lack exposure to other surgical specialty procedures. Of note, there was minimal exposure to obstetric/gynecological procedures and orthopedic procedures. These surgical specialties made up a large proportion of the procedures performed by MSF surgeons in SODs. It has previously been demonstrated by other authors that obstetric and orthopedic

TABLE 1. Surgical Procedures Performed by Australian General Surgical Trainees During Training and by MSF Surgeons in SODs

Procedure	Australian General Surgical Trainees* (%)	MSF Surgeons (%)
Essential general surgery		
Exploratory/diagnostic laparotomy	132 (6.3%)	173 (4.9%)
Appendicectomy (open or laparoscopic)	175 (8.3%)	11 (0.3%)
Cholecystectomy	247 (11.8%)	6 (0.2%)
Abdominal wall hernia repair	268 (12.7%)	139 (3.9%)
Hemorrhoidectomy	25 (1.2%)	11 (0.3%)
Perianal abscess/fistula in ano	44 (2.1%)	5 (0.1%)
Skin graft	29 (1.4%)	201 (5.7%)
Minor soft tissue	204 (9.7%)	43 (1.2%)
Thoracotomy (all indications)	7 (0.3%)	3 (0.1%)
Wound debridement	125 (6%)	1115 (31.5%)
Tracheostomy	2 (0.1%)	6 (0.2%)
Other trauma-related procedures	2 (0.1%)	472 (13.3%)
Advanced general surgery		
Specialist breast and axillary procedures	190 (9%)	70 (2%)
Specialist colorectal	242 (11.5%)	9 (0.3%)
Specialist endocrine procedures	55 (2.6%)	11 (0.3%)
Specialist upper gastrointestinal	58 (2.8%)	1 (0.03%)
Specialist hepatopancreaticobiliary	39 (1.8%)	1 (0.03%)
Obstetrics/gynecology		
Hysterectomy	1 (0.1%)	150 (4.2%)
Procedure for ectopic pregnancy	0.2 (0.01%)	26 (0.7%)
Caesarean section	2 (0.1%)	443 (12.5%)
Other gynecological	2 (0.1%)	74 (2.1%)
Orthopedic surgery		
Fracture repair	2 (0.1%)	324 (9.2%)
Major limb amputation	7 (0.4%)	126 (3.6%)
Fasciotomy	1 (0.04%)	10 (0.3%)
Other major orthopedic	2 (0.1%)	61 (1.7%)
Other surgical subspecialties		
Specialist urology	77 (3.6%)	19 (0.5%)
Specialist vascular	101 (4.8%)	3 (0.1%)
Specialist neurosurgery	1 (0.1%)	2 (0.1%)
Specialist pediatric surgical	11 (0.5%)	7 (0.2%)
Specialist plastics	34 (1.6%)	2 (0.1%)
Other head and neck	22 (1.1%)	18 (0.5%)
Total	**2107 (100%)**	**3542 (100%)**

*Mean number of procedures per trainee for entire general surgical training (i.e., 10 6-month terms).

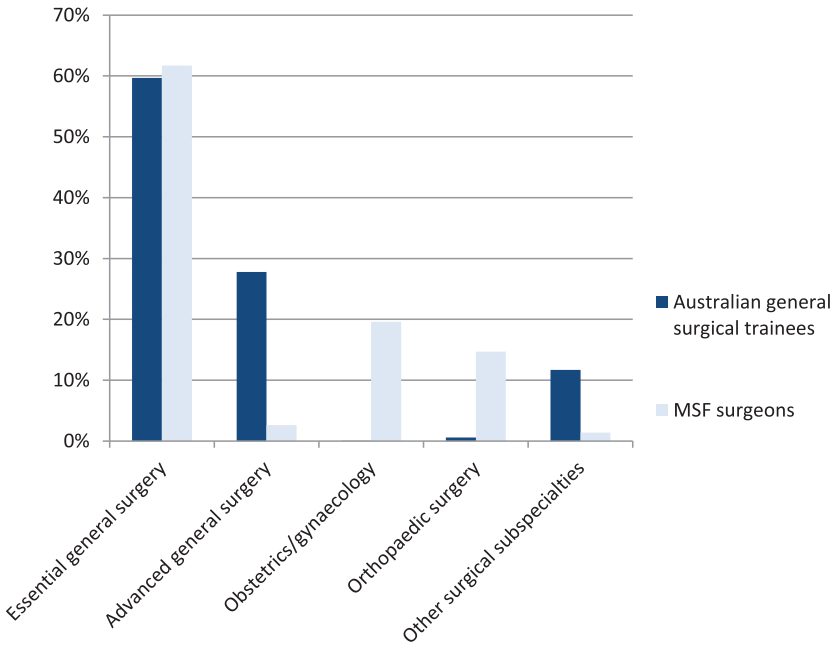

FIGURE 1. Proportions of surgical procedure categories performed by Australian general surgical trainees and MSF surgeons.

procedures make up a large proportion of the surgical caseload in humanitarian emergencies,[5,6,20] including in SODs.[3] Although trainee experience in urology, neurosurgery, and cardiothoracic were also minimal, these procedures were infrequently performed by MSF surgeons.

Wound debridement makes up a third of the MSF surgical workload, and the data from GSA would indicate that general surgical trainees do have moderate exposure to wound debridement and basic wound management. There appears to be variable exposure to procedures that are expected to be associated with major limb trauma, with few fasciotomies (1 per trainee) and major amputations (7 per trainee) performed, while there was some exposure to skin grafting (mean of 27 per trainee) and vascular procedures (100 per trainee). The learning curve has been described for a number of elective surgical procedures,[21-23] where it has been found to be variable between procedures and individuals.[23] Although the learning curve for wound debridement and skin grafts have not yet been described, it is likely that many general surgical trainees are getting sufficient exposure to have a basic proficiency in these areas but would likely find more advanced procedures challenging.

The findings regarding Australian general surgical trainees are consistent with findings from other HICs. Studies by Lin et al. and Trudeau et al. demonstrated that American general surgical trainees have limited exposure to pediatric, genitourinary, obstetrics/gynecology, and orthopaedics.[5,24] A comparative analyses of Dutch chief resident logbooks demonstrated limited genitourinary and pediatric surgical exposure.[25] Likewise, the cumulative caseload from MSF, while being from a single organization responding to a select few SODs, is consistent with other literature concerning the procedures performed in SODs, in particular the high proportion of obstetrics and procedures for fractures and soft tissue wounds.[3,5,7,26]

In the wake of increasing specialization in Australia, it is expected that general surgical trainees will have limited exposure to orthopedics, obstetrics, and gynecology. These findings suggest that such skills are commonly required by EMT surgeons and therefore would be particularly valuable in EMTs where orthopedic surgeons, and obstetricians/gynecologists are not included. While MSF surgeons performed only small numbers of specialist vascular, urological, and neurosurgical procedures, the general surgeon would be well placed to have experience in basic emergency procedures in these areas due to a lack of relevant specialists even in multiple-surgeon EMTs.[27] Having a pool of general surgeons with such broad surgical skills is not purely altruistic, as this would also be of use in domestic emergencies including terrorist attacks and SODs[28] and in rural and remote areas, where local population numbers may be insufficient to support resident specialists in all fields.[29]

In contrast to general surgeons in HICs, a recent survey of South African general surgeons and trainees by Chu et al. found that the majority had at least some obstetric, gynecological, and orthopedic experience

prior to commencement of their general surgical training.[30] General surgeons trained in South Africa and other upper-middle income countries (UMICs) may therefore be more suited to work in international EMTs, but HICs will still require broadly-trained general surgeons to staff their own national EMTs and would also be useful in ensuring that the resources of UMICs are not unfairly strained by carrying a disproportionate burden of EMT and other humanitarian commitments.

LIMITATIONS

This study has a number of limitations. It does not compare operative case mix and volumes for trainees against a historical control, and therefore cannot conclude whether exposure has changed significantly since the introduction of SET in 2008. Furthermore, there is the potential for reclassification errors given that the data were received from 2 differing coding systems. Some details were also not available, including technique (e.g. open vs. laparoscopic appendicectomy, mesh vs. sutured hernia repair). This is important as some surgical techniques, such as laparoscopy, are less suited to the austere environment and hence competency in basic open procedures is required. There is evidence of diminishing contemporary general surgical trainee experience in some open procedures in Australia,[31] as well as in other HICs.[32]

Patient age was also not reported in the datasets. Specialist pediatric surgical procedures were only performed in limited numbers by both Australian general surgical trainees (11, 0.5%) and MSF surgeons (7, 0.2%), with this category including procedures for Hirschprung's disease and for congenital abnormalities such as anorectal abnormalities. Conclusions regarding the need for competency in performing essential general surgical procedures (e.g., hernia repair and appendicectomy) on children could not be made. Given the young populations of many LMICs,[33] however, it is very likely that such competency would be required, as has been shown previously.[11,34]

Finally, this study only evaluated the experience of Australian general surgical trainees prior to completion of their fellowship training. Further study into the skillset of surgeons after completion of trauma and acute care surgery fellowships would also be very useful.

Implications and Recommendations

Despite these limitations, this study highlights requirements for EMT surgeons and the skill set of current general surgical trainees in Australia. Not only will this be of use to those responsible for recruiting general surgeons for EMTs, but it will also hopefully guide general surgeons who are interested in such work in their further training. Ideally, formal training pathways should be created to equip interested general surgeons with the required skillsets for practice in EMTs and other humanitarian surgical projects more broadly. Fader and Wolk demonstrate how such a model can be implemented in HICs, albeit on a small scale.[35] In the current absence of such formal pathways, interested surgeons would be advised to gain experience in obstetrics, gynecology and orthopedics, as well as working to maintain broad general surgical skills.

Completion of organization-specific predeparture courses (e.g., Australian Medical Assistance Team surgical course,[36] MSF surgical course[37]) and other trauma and low-resource surgery courses (Definitive Surgical Trauma Care[38] and the Surgery Training for Austere Environments course[39]) would also be advised. Outlines of additional recommendations have previously been made by the authors.[40] This study also demonstrates why maintaining a body of broadly trained general surgeons is still important in HICs.

CONCLUSION

When compared to the pooled experience of deployed MSF surgeons, Australian general surgical trainees are likely to receive sufficient exposure to both essential and advanced general surgical procedures. There is some exposure to wound debridement and skin grafting, but less experience with fasciotomy and major amputations. As anticipated, there is very limited exposure to obstetric, gynecological, and orthopedic procedures which constitute a significant proportion of procedures performed by MSF surgeons in response to SODs. As such, further dedicated training in these areas is likely to be useful, especially if deploying as part of an EMT without subspecialty surgical support.

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AUTHOR CONTRIBUTIONS

Dr Charles Coventry contributed to study design, data collection and analysis and the production of the manuscript. Prof. Andrew Holland, Dr David Read, and Prof Rebecca Ivers have provided significant input into study design, data interpretation and the writing of the discussion. Dr Lynette Dominguez and Dr Miguel Trelles

have provided valuable contributions to the data set and to data interpretation. Dr Maryam Montazerolghaem provided statistical analysis.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsurg.2019.08.010.