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ORIGINAL ARTICLE

Endoscopy training in Australia during COVID-19: Efficacy and knowledge assessment of gastroenterology and general surgery trainees

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Abstract

Background and Aim: During COVID-19, restrictions to elective endoscopy were introduced worldwide. A reduction in procedures may impact trainees' endoscopy learning. This study aims to assess Australian advanced gastroenterology and general surgery trainees' self-perceived efficacy and knowledge in endoscopy during the pandemic.

Methods: All Australian gastroenterology and general surgery trainees in their last 2 years of accredited training were invited to participate through email (2020–2021 and 2021–2022 training cycles). The primary outcome was to assess trainees' self-efficacy and knowledge regarding gastrointestinal endoscopy. Secondary outcomes included subgroup analysis between gastroenterology and general surgery trainees. Self-perceived efficacy was assessed with Likert-scale questions on 20 endoscopy procedures and knowledge was assessed through 21 endoscopy-related multiple choice questions.

Results: Eighty-one trainees responded to a self-efficacy questionnaire and 77 responded to the knowledge questionnaire. Over 90% of the trainees were confident or extremely confident in diagnostic endoscopy, but only half demonstrated similar efficacy for therapeutic endoscopy. The efficacy for basic endoscopy procedures was higher for gastroenterology trainees (64.0% *vs* 51.1%, $P < 0.001$). Last-year trainee achievement of conjoint committee requirements for upper gastrointestinal endoscopy was achieved in 95.8% of gastroenterology trainees *versus* 22.2% of surgical trainees ($P < 0.001$). The median score on the knowledge questionnaire was also higher for the gastroenterology subset (90.5% *vs* 71.4%, $P < 0.001$).

Conclusion: During COVID-19, endoscopy trainees' self-efficacy in endoscopic diagnostic procedures was achieved for most trainees. The differences in self-perceived efficacy and knowledge between gastroenterology and surgical trainees may be reflective of the different opportunities for learning between the two groups.

Introduction

As of March 2022, there have been over 500 million COVID-19 cases and almost 6.2 million related deaths worldwide.[1] The impact of COVID-19 on medical training has many direct and indirect consequences. The reduced number of endoscopy procedures performed has the potential of affecting logbook numbers required by trainees to achieve certification for independently performing endoscopy and their efficacy and knowledge in basic endoscopy procedures.

In Australia, the most important restrictions to endoscopy trainees' learning experience during the COVID-19 pandemic were: (i) a prolonged period of cessation for lower-priority procedures during a period focusing on "category 1" indications (clinically indicated to be done within 30 days as per the Australian Institute of Health and Welfare—AIHW); and (ii) cancellation of most face-to-face learning opportunities such as conferences, courses, and "hands-on" tutorials. The impact of restrictions on the number of endoscopy procedures being performed on trainees' endoscopy learning is unknown and its effect on trainees' preparedness to independently perform endoscopies once the training is complete is also unclear.

In order to perform endoscopies independently in Australia, a conjoint committee for recognition of training in gastrointestinal endoscopy (CCRTGE) has been created from the combined efforts of the Royal Australasian College of Physicians (RACP) and the Royal Australasian College of Surgeons (RACS). Since 1999, CCRTGE has only accepted prospective data entry for recognition of endoscopy training. Both general surgery trainees and gastroenterology trainees are expected to start performing endoscopy under supervision from the first year of their specialist training (i.e. SET1 and AT1), and not uncommonly have had exposure to such procedures even before then (while working as unaccredited registrars for instance). Nevertheless, exposure can vary from hospital to hospital and from rotation to rotation, and hence the importance of monitoring the number of endoscopy procedures during training has been introduced. Logbook evidence of a minimum number of completed colonoscopies and upper gastrointestinal (UGI) endoscopy (validated by a local supervisor) is required to be presented for trainees in general surgery to receive their fellowship from the RACS (minimum of 100 UGI endoscopies and 50 colonoscopies). This is not a requirement for physician trainees before their fellowship is granted by the RACP. The current minimum requirements for endoscopy training as per CCRTGE are outlined below.[2]

Upper gastrointestinal (UGI) endoscopy:

- Trainees are required to perform at least 200 unassisted and complete examinations independently under supervision.
- Examinations must include a minimum of 20 therapeutic procedures. Colonoscopy: Assessment for recognition of training in colonoscopy primarily involves assessment of the cecal intubation rate at the completion of training. Trainees are required to perform:

- A minimum of 200 large bowel endoscopic examinations that can include colonoscopy, flexible sigmoidoscopies, and colonoscopy via colostomy on patients with intact or non-intact colons.
- A minimum of 100 unassisted, supervised, complete colonoscopies to the cecum or the ileum in patients with intact or non-intact colons.
- Successful snare polypectomies on a minimum of 50 patients.
- Achieve at least a 90% cecal intubation rate by the completion of training. Procedures on patients with obstructing cancer and/or severe colitis must be recorded, but are excluded from the calculation of overall intubation rate. Evaluating trainees' self-perceived efficacy and knowledge relating to endoscopic procedures through semiquantitative surveys has been explored previously, prior to the global pandemic. Procedural efficacy is dependent upon number of procedures performed[3] and has been assessed through Likert-scale-style questions in the United States of America[4,5] and in Europe[6]; while knowledge levels were previously assessed through multiple choice questions in an Australian cohort.[7] The United Kingdom has regularly assessed endoscopy training for gastroenterology trainees via a national survey since 2008.[8,9] In 2020, surgical and gastroenterology trainees from United Kingdom were invited to participate in an online survey regarding their experience with endoscopy training, but the nationwide survey was cut short after only 2 months due to the COVID-19 pandemic.[10] Similarly to CCRTGE, the United Kingdom has a joint advisory group for certification in gastrointestinal endoscopy. In addition to hands-on apprentice style training, UK trainees have mandatory direct observation of procedure (DOPS) and direct observation of polypectomies (DOPys) forms for formal feedback.[10] Questionnaire based tools have been widely utilized to assess and report on training, knowledge, and efficacy of trainees and of staff working within endoscopy units.[11]

The impact of the COVID-19 pandemic on endoscopy training in the Australian setting has yet to be described, particularly in the context of the restrictions imposed on the type and number of endoscopic procedures that could be performed. This study aims to evaluate the reported procedural numbers, self-perceived efficacy, and knowledge of penultimate and final years' surgical education training (i.e. SET4 and SET5) trainees and gastroenterology advanced trainees (i.e. AT2 and AT3) in upper and lower endoscopy procedures.

Methods

This was a semiquantitative medical education cross-sectional study to assess trainees' self-perceived efficacy and knowledge in endoscopy, undertaken in Australia over two periods of time during the COVID-19 pandemic: November 2020 to January 2021 and September 2021 to January 2022.

Research ethics. This study was approved by the Austin Health Human Research Ethics Committee (HREC) as a low/negligible risk research project under the reference number: HREC/69542/Austin-2020. The HREC confirmed that the proposal meets the requirements of the National Statement on Ethical Conduct in Human Research (2007, updated 2018). This HREC is organized and operates in accordance with the National Health and Medical Research Council's (NHRMC) National Statement on Ethical Conduct in Human Research (2007, updated 2018), and all subsequent updates, and in accordance with the Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95), the Health Privacy Principles described in the Health Records Act 2001 (Vic) and Section 95A of the Privacy Act 1988 (and subsequent guidelines). A written explanation of the study was provided to trainees at the start of both the self-assessed efficacy form and the knowledge-based questionnaire. Contact details of investigators were available to all trainees to answer any questions. Completion of the survey by trainees was deemed a surrogate for consent to participate in the study.

Development of the trainee self-perception survey and knowledge questionnaire tools. Based on data from the current endoscopy guidelines and the requirements for accreditation stipulated by the CCRTGE and the Gastroenterological Society of Australia (GESA), a pilot electronic self-assessed efficacy survey form and knowledge-based questionnaire were designed through an iterative process by the authors including senior representatives from the fields of gastroenterology, surgery, and medical education. Knowledge questions were constructed incorporating the use of anonymous images from previous endoscopy procedures performed at our institution, with multiple choice answers.

The pilot form with 20 examples of endoscopy procedures for self-efficacy assessment, and the questionnaire (with 21 endoscopy-related clinical cases) were provided to five consultant gastroenterologists (Fellows of the RACP—FRACP) and six consultant surgeons (Fellows of the RACS—FRACS) to assess question validity and evaluate whether questions were pitched at an appropriate level for final year trainees/junior consultants. Feedback on each question was requested and was evaluated through later discussion by the study authors. Based on the feedback and discussion among authors, no content was removed from the original form or questionnaire. However, amendments were made to the body of the questions and responses to improve clarity.

After the feedback had been assimilated, the finalized self-assessed efficacy form and knowledge questionnaire were made available through Microsoft Forms links prior to the enrolment of the first participant (Appendices S1 and S2, respectively).

A second pilot training study, using the finalized knowledge questionnaire, was then undertaken to determine whether it could adequately differentiate junior (i.e. SET1/2/3 and AT1) and senior trainees (i.e. SET4/5 and AT2/3) to further benchmark that the knowledge-based questions were pitched at an appropriate level. Advanced gastroenterology and general surgery trainees at a tertiary metropolitan hospital (Austin Health, Victoria) were invited to answer the questionnaire. A difference in the average score on knowledge questionnaire of at least 10% between junior and senior trainees was deemed by the investigators to suggest an appropriate level. Whenever a smaller difference in knowledge levels is found, the questionnaire would be redesigned, and this pilot phase would be repeated. However, after an appropriate difference was found, the same questionnaire without any changes proceeded to be used in the study.

Every invitee received a unique identifier (e.g. VIC001) that was entered in both the self-assessed efficacy form and knowledge questionnaire. The link between the unique ID and individual was only known to the trainee-level investigators in order to discourage coercion for participating in the study or any concerns from trainees that a poor performance may be informed to their supervisors.

Recruitment strategy. After finalization of the study tools, through the process outlined above, all penultimate and final years' accredited advanced trainees in general surgery (i.e. SET 4/5) and gastroenterology (i.e. AT2/3) within Australia were invited by email to participate. The email address list was obtained from the training officers, committees, or representatives within each state for the 2020/2021 training year. The General Surgery Australia (GSA) association in the 2021/2022 training year assisted with the delivery of the emails to SET trainees. All trainees who had not responded within a month were contacted again through the same email after re-confirmation of the email address.

Sample size. In this study, due to the limited population (i.e. Australian senior gastroenterology and general surgery trainee cohort) and due to limited time (i.e. months/years affected by COVID restrictions on endoscopy procedures), having a standard power calculation would not be suitable as there is no room to reach more participants if required. Hence, convenience sampling was utilized.

The study aimed to invite all Australian penultimate and final year gastroenterology and general surgery trainees. The expected number of invitees per year (200) was based on the estimated number of SET4/5 (i.e. 150) and AT2/3 (i.e. 50) trainees in Australia in 2020. A completion rate of 50% was anticipated, leading to 100 completed questionnaires anticipated for the final analysis.

Outcome measures. Primary outcome: Evaluation of the percentage of participants that are self-perceived as "confident" or "extremely confident" in performing UGI endoscopy and colonoscopies, and their scores in the endoscopy knowledge questionnaire.

Secondary outcomes: Assessment and comparison of caseload between different trainee groups, achievement of CCRTGE requirements, differences in self-perceived efficacy, and knowledge scores between gastroenterology and general surgery trainees. The separation of procedures according to complexity was decided among the authors based on their own experience and on how much expertise would be needed to perform the given procedure proficiently. Subgroup analysis according to the complexity of endoscopy-related therapeutic procedures was done as follows:

- Basic therapeutic endoscopy-related procedures: Endoscopic dilatation with through-the-scope (TTS) balloon; dilatation with Savary bougie; endoscopic management for non-variceal bleeding with adrenaline injection/thermal therapy (e.g. gold probe)/mechanic therapy (e.g. clips)/hemostatic powder; endoscopic management for variceal bleeding with banding; endoscopic tattoo placement for colorectal malignancy marking; percutaneous gastrostomy (PEG); argon plasma coagulation (APC) for angioectasia; cold snare polypectomy; injection sclerotherapy of hemorrhoids; hemorrhoid banding; insertion of Sengstaken–Blakemore tube; gastroesophageal foreign body/food bolus removal
- Advanced therapeutic endoscopy-related procedures: Endoscopic mucosal resection (EMR) for UGI; endoscopic mucosal resection (EMR) for colorectum; insertion of a nasojejunal tube (NJT) under direct vision

CCRTGE requirements were deemed as achieved in UGI endoscopy if the self-reported volume was of at least 200 diagnostic and 20 therapeutic UGI endoscopies; and in colonoscopy, if the self-reported volume was of at least 200 diagnostic and 50 therapeutic colonoscopies (including but not restricted to polypectomies).

Statistical analyses. Data are presented as median (25th and 75th percentile) for continuous variables, and as frequency and percentages for categorical variables. For normal assessment, the Kolmogorov–Smirnov test was used. The Mann–Whitney nonparametric test was used once continuous data confirmed not to follow a normal distribution. Categorical data were compared with the Chi-square test of independence. A P value of <0.05 was considered significant. Statistical analyses were performed with SPSS statistical software (IBM Corp. 2020. IBM SPSS Statistics, Version 26.0. Armonk, NY, USA).

Results

The pilot phase was conducted between September and October 2020. An average difference in knowledge scores >10% between junior and senior advanced trainees was demonstrated. Subsequently, the same form and knowledge questionnaire, without modification other than wording for better clarification, were distributed through email among accredited senior gastroenterology (AT2/3) and general surgery (SET4/5) trainees throughout Australia (between November 2020 and January 2021). During the 2020/2021 clinical year, a total of 32 of 200 trainees responded to the form and 29 of 200 trainees responded to the quiz. The second round of recruitment took place between September 2021 and January 2022. During the 2021/2022 clinical year, a further 51 trainees responded to the form and 48 trainees responded to the quiz. In total, 81 completed forms and 77 knowledge questionnaires were available for statistical analyses. Overall, the response rate was 14% for all trainees, 5% for general surgery trainees, and 38.1% for gastroenterology trainees (based on the number of active senior accredited trainees in December 2021). The median age was higher as was the proportion of male gender in the surgical subset (Table 1).

The area of interest distribution for general surgery trainees was as follows: upper GI surgery 20.8% ($n = 5$), colorectal surgery 37.5% ($n = 9$), hepatobiliary surgery 12.5% ($n = 3$), breast/endocrine surgery 12.5% ($n = 3$), and no specific area of interest 16.7% ($n = 4$). The area of interest distribution for gastroenterology trainees was as follows: endoscopy 26.3% ($n = 15$), hepatology 35.1% ($n = 20$), inflammatory bowel disease 31.6% ($n = 18$), and no specific area of interest 7% ($n = 4$). Regarding the geographical location of the trainees on the year they have responded to the form: Australian Capital Territory 2.5% ($n = 2$), Western Australia 6.2% ($n = 5$), Victoria 39.5% ($n = 32$), South Australia 13.6% ($n = 11$), Queensland 23.5% ($n = 19$), New South Wales 13.6% ($n = 11$), and Europe 1.2% ($n = 1$).

When considered against the CCRTGE requirements for UGI endoscopy and colonoscopy, over 70% of the final year trainees had already completed the required overall numbers by the time of assessment, which was concordant with the trainee's perception of being "likely" or "extremely likely" to achieve the minimum numbers required by CCRTGE. However, the number of diagnostic and therapeutic endoscopic procedures was markedly different between gastroenterology and general surgery trainees (Table 2).

Assessment of knowledge relating to endoscopy showed no difference between the 2020/2021 and 2021/2022 cohorts but did demonstrate a statistically significant difference between gastroenterology and general surgery final year trainees, as shown in Table S1, Supporting information. The representation of final year trainees (i.e. AT3 and SET5) in our cohort was 42.1% for gastroenterology and 37.5% for general surgery ($P < 0.70$). When assessing knowledge score as per gender, females were found to achieve a better score compared with males overall (Table S1).

Significant differences in self-perceived efficacy for therapeutic endoscopy were demonstrated between gastroenterology and general surgery trainees, as illustrated in Table 3. When assessing gender subgroups, it was noted a numerical difference, but no statistical difference to the self-efficacy assessment. The basic and advanced self-efficacy was assessed as "confident" or "extremely confident" in 45.3% and 27.3% of male trainees, and in 57.2% and 25.3% of female trainees.

Sub-analyses for all outcomes excluding repeat responders (a total of nine RACP trainees were repeat responders) did not significantly affect the results. There were no significant differences regarding self-efficacy (for both basic and therapeutic procedures) nor pertaining knowledge test scores between the 2020–2021 and 2021–2022 cohorts.

Discussion

The COVID-19 pandemic has brought restrictions, introduced by the Department of Health, to the numbers of elective procedures being performed including gastrointestinal endoscopy (e.g. UGI endoscopies and colonoscopies) in Australia. In addition, during the stricter periods, only a single proceduralist was allowed in the room to mitigate possible contagion (i.e. solely the consultant would perform the procedure). In our institution, during the 2020–2021 and 2021–2022 training cycles, the total number of gastroscopies was 7005, and the number of colonoscopies was 8362. The same procedures for 2018–2019 and 2019–2020 training cycles were 7777 and 7910, respectively. Although the overall number of procedures did not markedly differ during the pandemic-affected training cycles, there was an unspoken perception that the pandemic could have affected the efficacy and knowledge in endoscopy of our endoscopy trainees, potentially more perceptive regarding UGI procedures, which seem to have been affected most.

Table 1 Cohort demographics

	Gastroenterology trainees	General Surgery trainees	*P* value	All trainees
Number of forms completed—*n* (%)	57 (70.4)	24 (29.6)	<0.001	81 (100)
Male—*n* (%)	30 (52.6)	18 (75)	0.06	48 (59.3)
Median age (IQR)	32 (30–33)*	33 (31–36)	<0.01	32 (30–34)

*One participant did not disclose age.

Table 2 Endoscopy volume at final years of training

Endoscopy volume	Gastroenterology trainees	General Surgery trainees	*P* value	All trainees
Median (IQR) of diagnostic UGI endoscopy procedures	340.5 (250 to 482.5)	160 (79 to 213.5)	<0.001	250 (189 to 400)
Median (IQR) of therapeutic UGI endoscopy procedures	60 (50 to 100)	15 (7.5 to 20.5)	<0.001	40 (20 to 80)
Median (IQR) of diagnostic colonoscopy procedures	220 (180 to 390)	200 (90 to 217.5)	0.02	200 (150 to 300)
Median (IQR) of therapeutic colonoscopy procedures	95 (50 to 150)	50 (12.5 to 78.5)	0.01	75 (42 to 150)
Last-year trainee achievement of CCRTGE requirements for UGI endoscopy—*n* (%)	23 (95.8)	2 (22.2)	<0.001	25 (75.8)
Last-year trainee achievement of CCRTGE requirements for colonoscopy—*n* (%)	20 (83.3)	6 (66.7)	0.31	26 (78.8)

CCRTGE, committee for recognition of training in gastrointestinal endoscopy; UGI, upper gastrointestinal.

Table 3 Trainees' ratings on efficacy for endoscopy procedures

	Gastroenterology trainees	General Surgery trainees	*P* value	All trainees
Perception that COVID-19 had a negative impact on endoscopy numbers during training ("likely" or "extremely likely")—*n* (%)	26 (45.6)	12 (50.0)	0.71	38 (46.9)
Likelihood of getting numbers for UGI endoscopy as per CCRTGE requirements by the end of training ("likely" or "extremely likely")—*n* (%)	53 (93.0)	12 (50.0)	<0.001	65 (80.2)
Likelihood of getting numbers for colonoscopy as per CCRTGE requirements by the end of training ("likely" or "extremely likely")—*n* (%)	54 (94.7)	17 (70.8)	0.003	71 (87.7)
Self-perceived efficacy in diagnostic endoscopy procedures ("confident" or "extremely confident")—*n* (%)[†]	110 (96.5)	45 (93.8)	0.44	155 (95.7)
Self-perceived efficacy in therapeutic endoscopy procedures ("confident" or "extremely confident")—*n* (%)[‡]	602 (58.7)	208 (48.1)	0.001	810 (55.6)
Self-perceived efficacy in basic therapeutic endoscopy procedures ("confident" or "extremely confident")—*n* (%)	547 (64.0)	184 (51.1)	0.001	731 (60.2)
Self-perceived efficacy in advanced therapeutic endoscopy procedures ("confident" or "extremely confident")—*n* (%)	55 (32.2)	24 (33.3)	0.86	79 (32.5)
Chi-squared test between basic and advanced therapeutic endoscopy procedures self-perceived efficacy ("confident" or "extremely confident")	<0.001	<0.01	NA	<0.001

[†]Pool of combined responses for both diagnostic UGI endoscopy and colonoscopy.
[‡]Pool of combined responses for all therapeutic endoscopy procedures mentioned in the form.
Description of basic and advanced therapeutic procedures can be found in the Section 2.
CCRTGE, committee for recognition of training in gastrointestinal endoscopy; UGI, upper gastrointestinal.

The impact of COVID restrictions to elective procedures had numerous effects on patients and procedural training. Due to the importance of hands-on training for achieving competence as per the CCRTGE, the effect of COVID-19 on logbook numbers and knowledge in gastrointestinal endoscopy for Australian trainees was hitherto unknown. Internationally, the vast majority of trainees have reported a reduction in procedural exposure, down 93.8% in the initial months of the pandemic.[11] UK pre-COVID data have been collected, but are not directly comparable; reporting more on the nature of training, where just over 50% of trainees were reported as having dedicated endoscopy lists each week.[10]

The results of this study suggest that despite the COVID-19 restrictions, over 90% of gastroenterology senior advanced trainees have achieved or are expected to achieve the minimum numbers for independent endoscopy practice as stipulated by CCRTGE. However, the percentage of senior general surgery trainees is much lower, with only half expecting to reach the minimum requirements for UGI endoscopy and 70% anticipating achieving the numbers for colonoscopy. Having a significant proportion of trainees achieving the minimum experience in endoscopy is reassuring for both trainees and their associated training colleges.

The results of over 90% of trainees having self-assessed as "confident" or "extremely confident" in performing diagnostic UGI endoscopy and colonoscopies are reassuring; conversely, only about half responded the same regarding therapeutic endoscopy (Table 3). In addition, there was a marked difference in

self-perceived efficacy for therapeutic procedures between gastroenterology and general surgery trainees. Having in mind the limitations of self-assessment, this is insightful toward what could be further developed in the endoscopy training program for gastroenterologist and general surgery trainees alike (i.e. more emphasis on therapeutic endoscopy during training).

The assessment of endoscopy-related knowledge in this cohort has shown an overall reasonable score (85.7% of correct answers among all trainees). However, a statistically significant difference was seen between gastroenterology and general surgery final year trainees (i.e. 90.5% *vs* 71.4%, $P < 0.001$). Although the difference in knowledge score was shown for gender and specialty subgroups, males and females within the same training specialty did not show statistical difference. Nevertheless, a numerical difference of 10% of the score is noted within the general surgery gender comparison as is likely not significant due to the limited number of participants.

Both differences, in confidence for therapeutic endoscopy and in the knowledge score, may relate to a different emphasis on endoscopy training within the RACP (gastroenterology) and RACS (general surgery) curricula. This is in keeping with the median number of procedures during training, which was significantly higher for gastroenterology trainees compared with general surgery trainees (Table 2). While technical training for gastroenterology trainees focuses mainly on endoscopic procedures, general surgery trainees are required to become proficient in a variety of complex operative procedures including the acquisition of knowledge and technical skills in endoscopy. This likely dilutes the focus on endoscopy training within the surgical curriculum in comparison to training in gastroenterology. In addition, differences in the types of procedures within medical and surgical lists could have further contributed to widening the gap in procedural volume and knowledge during the COVID-19 pandemic. In our institution, it is common for a higher proportion of screening or surveillance endoscopies in surgical lists compared with gastroenterology lists (commonly not Category 1 in urgency). Conversely, much of the therapeutic endoscopy including management of gastrointestinal bleeding and advanced endoscopy resection techniques are more common in gastroenterology lists. These facts allied to restrictions to elective procedures such as screening colonoscopies might have further contributed to the gap in volume we have found in our study.

A parallel can be traced between our findings and a recent study looking at how the adenoma detection rate (ADR), a quality metric for colonoscopy, behaved according to the specialty of the endoscopist. It may be as a result of this lower priority given by the general surgery curriculum to endoscopy during training, that a slightly lower ADR was achieved by surgeons in comparison to their gastroenterology colleagues in a previous study (37% *vs* 30%, $P < 0.0001$).[12] Nevertheless, it is important to highlight that even though a slightly higher ADR was found in the gastroenterology group, both gastroenterologists and surgeons achieved the minimum ADR threshold as recommended by CCRTGE in this previous study.

Further interrogation of the endoscopy training curriculum within the general surgery curriculum and gastroenterology AT might be of benefit to address these gaps in knowledge, efficacy, and performance. The difference found between gastroenterology and general surgery trainees seems likely related to differences in exposure, which could potentially be addressed with a single national training standard. This might be an important measure, given the necessity for practitioners from different training backgrounds to be able to achieve a shared minimum level of competence. Another important point to highlight is the standardization of novice endoscopists' training. Studies show that virtual reality,[13] especially when associated with a stepwise approach regarding the complexity of maneuvers through progressive learning-based curriculum,[14] can augment the learning process, and hence could be considered by the endoscopy training centers for future trainees.

The limitations of this study include the lack of pre-COVID data for comparison and the limited number of replies to the email invitations. The limited number of responses (14%) has the potential of introducing selection bias, potentially with the involvement of more motivated and perhaps more skilled trainees. This selection bias has the potential of being more pronounced in the general surgery trainee cohort (with a 5% response rate) compared with the gastroenterology trainee cohort (with 38.1% response rate). Nonetheless, our results need to be seen with caution regarding representativeness.

Although previously self-efficacy tools have been developed for assessing endoscopy trainees through a modified NASA-TLX instrument,[15] this was not used in our cohort as we attempted to grasp more specific information regarding basic and therapeutic gastroscopy and colonoscopy procedures. Likert-scale questions have been used before to assess specific questions, including procedural self-efficacy assessment.[4–6] In addition, trainee self-assessment of performance in endoscopy[16,17] and other procedural disciplines[18] have equivocal results, and hence the outcomes found in this study may not necessarily be related to pandemic-related factors.

As this was a prospective study conceived after the COVID-19 outbreak, prospective collection of such pre-pandemic data was unfeasible and as the participation of this study is voluntary, artificial retrospective data on all trainees was unlikely to be a reliable source for comparison due to the likelihood of recall biases. Additionally, there are complexities associated with the value of self-report measures of efficacy and what it means for clinical practice and competence.[19–21] As self-report efficacy and self-reported number of procedures are subjective, these need to be considered with caution.

Finally, after assessment by experts and using an arbitrary 10% difference threshold in scores, our newly conceived quiz was agreed among the investigators as appropriate for assessing endoscopy-related knowledge. However, as this has not been validated, the interpretation of our results may be limited.

In conclusion, despite COVID-19 restrictions, the majority of our cohort of Australian gastroenterology and general surgery trainees achieved or were likely to achieve the minimum numbers required for independent practice of upper and lower gastrointestinal endoscopy. However, the volume of procedures, endoscopy-related knowledge, and self-efficacy in therapeutic endoscopy was found to be higher for gastroenterology trainees compared with general surgery trainees. The data suggest that further development of endoscopy training curriculum, and creating a single national training standard, may be required to address this gap.

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Supporting information

Additional supporting information may be found in the online version of this article at the publisher's website:

Appendix S1. Endoscopy trainee self-efficacy form.

Appendix S2. Endoscopy trainee knowledge questionnaire.

Table S1. Endoscopy-related knowledge assessment.