



# Clinical activity and outcomes during Geelong's general surgery response to the coronavirus disease 2019 pandemic

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## Key words

cancer, coronavirus disease 2019, elective surgery, emergency surgery, surgical outcome, surgical training.

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## Abstract

**Background:** The response to the coronavirus disease 2019 pandemic has required conserving capacity and resources to avoid the health sector being overwhelmed. This paper describes Geelong's general surgical response, surgical activity, outcomes and the effect on surgical training.

**Methods:** Data collected from surgical audits; hospital databases and patient's medical records were used to compare the first 7 weeks of our new service delivery (30 March to 17 May 2020) to the corresponding 7 weeks in 2019 (1 April 2019 to 19 May 2019). All surgical cases, morbidity and mortality were discussed at weekly surgical audit meetings conducted by videoconference. Treatment performance indicators were tested by chi-squared test for proportions, and by Student's *t*-test or Mann–Whitney test for continuous variables.

**Results:** Elective general surgery decreased by 45.9% but an essential service was maintained by substantially increasing our public in private operating to perform 81 cases. Despite a 30% decrease in emergency department presentations, general surgery admissions decreased only 6.1% while emergency operations increased 13.9%. We used telehealth to conduct 81.3% of outpatient appointments and 61.8% of pre-operative anaesthetic reviews. No significant differences were found for overall surgical outcomes, including appendectomy (perforation rates) and laparotomy (length of stay and morbidity). Operative exposure for trainees was maintained.

**Conclusion:** Geelong was able to provide a safe and effective general surgery service during the first 7 weeks of the coronavirus disease 2019 pandemic. There are some valuable lessons which could be adopted elsewhere in the event of a surge or second wave of cases.

## Introduction

On 31 December 2019 the Wuhan Municipal Commission, China, reported a cluster of pneumonia cases which would be eventually identified and named as coronavirus disease 2019 (COVID-19).<sup>1</sup> From there the virus spread around the world, overwhelming many health systems, with mortality rates of a few percent, and high infection rates among health workers exceeding 10% of cases.

Australia reported its first case of COVID-19 on the 25 January 2020<sup>2</sup> and faced a similar situation to what was being reported from the Northern Hemisphere. On 11 March 2020, the World Health Organization belatedly declared COVID-19 a global pandemic,<sup>1</sup> the same day that the Greater Geelong region confirmed its first known case.<sup>3</sup>

Early decisive action in Australia resulted in flattening of the curve between March and May. This included the introduction of strict social distancing, closing the borders, contact tracing and isolation/quarantine of overseas travellers and known case contacts.

To reduce the number of patients attending hospitals, the Federal Government introduced 19 telehealth Medicare Benefits Scheme item numbers from 13 March.<sup>4</sup> To reserve emergency department, ward and intensive care unit capacity, as well as personal protective equipment, non-essential elective surgery was wound back from 26 March (1 April in private hospitals).<sup>5</sup> To create extra capacity, including for essential elective surgery, the government financially underwrote the private hospitals until 30 June. Only cases that were category 1 and urgent category 2 were done over the next

4–5 weeks. Elective surgery began to be restored in stages with a 25% increase allowed from 27 April 2020, 50% (18 May) and 75% (1 June).<sup>6</sup>

No other event in modern surgery has led to the need for such rapid, drastic changes in the delivery of a surgical service. This article describes Geelong's general surgical response to the COVID-19 pandemic and how practice and service delivery changed during the first 7 weeks (30 March to 17 May 2020).

## Methods

Barwon Health is the only public health service provider for the Greater Geelong Region serving a population of around 350 000.<sup>7</sup> Surgical services take place at University Hospital Geelong and two not-for-profit private hospitals, St John of God Hospital and the Epworth Hospital.

On 20 March 2020, the Barwon Health surgical directors agreed to form a State of Disaster Surgical Triage Team which met daily at 7 am from Monday 24 March. Ahead of the Federal Government's announcement, Barwon Health's State of Disaster Surgical Triage Team began cancelling category 3 and many category 2 elective general surgical patients similar to what was occurring at other tertiary institutions.<sup>8</sup> The workload of triaging and cancelling elective cases was spread among the specialties, with difficult cases discussed with an independent senior clinician.

Commencing on 30 March 2020, all public elective surgery was moved to the two private hospitals. To ensure teams were kept separate, and to distribute the work between the two private hospitals, the upper gastrointestinal and breast units went to St John of God, and the colorectal/endocrine unit to the Epworth Hospital. This involved 19 consultants, four fellows, six surgical education and training (SET) registrars and nine unaccredited registrars. A general surgical consultant meeting was held weekly online via Zoom to ensure good communication of the strategy.

The emergency surgical service was retained at University Hospital Geelong, but to isolate teams from each other (in case of an infected team member) we created a fourth unit as the acute general surgical unit. Two unaccredited registrars, two accredited SET registrars, a general surgical fellow and consultant were allocated to the unit, each rostered on for a week at a time. Both the general surgical fellow and supervising consultant were relieved of all other responsibilities for the 7-day period. Plans were in place to also move emergency surgery to the private sector, where the pandemic to overwhelm University Hospital Geelong's capacity.

Outpatient clinics changed to a largely telehealth-based service conducted over the phone. Patients were triaged by our surgical registrars who reviewed the referral letter and/or online medical record. Those not suitable for phone review were seen in person. Our perioperative team triaged patients, if appropriate, to a pre-operative phone review or review on the day of surgery.

Weekly surgical audits, multi-disciplinary meetings (MDMs), registrar teaching and department meetings were all conducted through an online videoconferencing platform Zoom.

To compare the service delivery and outcomes, we used the 7-week period (30 March to 17 May 2020) with the same 7 weeks in 2019 (1 April to 19 May 2019). The weekly audit data was

cross-referenced to Barwon Health's Data Warehouse. The individual medical records of patient's undergoing appendicectomies and laparotomies were reviewed to generate the outcomes of interest.

To measure the impact of COVID-19 on SET trainee operative exposure we compared the 7-week COVID period to the first 7 weeks of their current rotation (3 February 2020 to 22 March 2020), based on their Morbidity Audit and Logbook Tool. This enabled the same trainee in the same rotation to be compared between full and reduced activity.

Statistical analyses were performed with non-categorical data compared using a Student's *t*-test assuming homoscedasticity of data. Categorical data was compared between years using a chi-squared matrix. Differences were deemed statistically significant at the  $P < 0.05$  level. Statistical analyses were completed using MedCalc for Windows version 9.6 (MedCalc, Ostend, Belgium). Ethical approval was obtained from Barwon Health's Human Research and Ethics Committee.

## Results

There were 64 cases of COVID-19 in the Greater Geelong region between 11 March and 17 May 2020. During April there were only 10 new cases. By 17 May there were 1595 cases in Victoria and 7157 cases in Australia (Fig. 1).

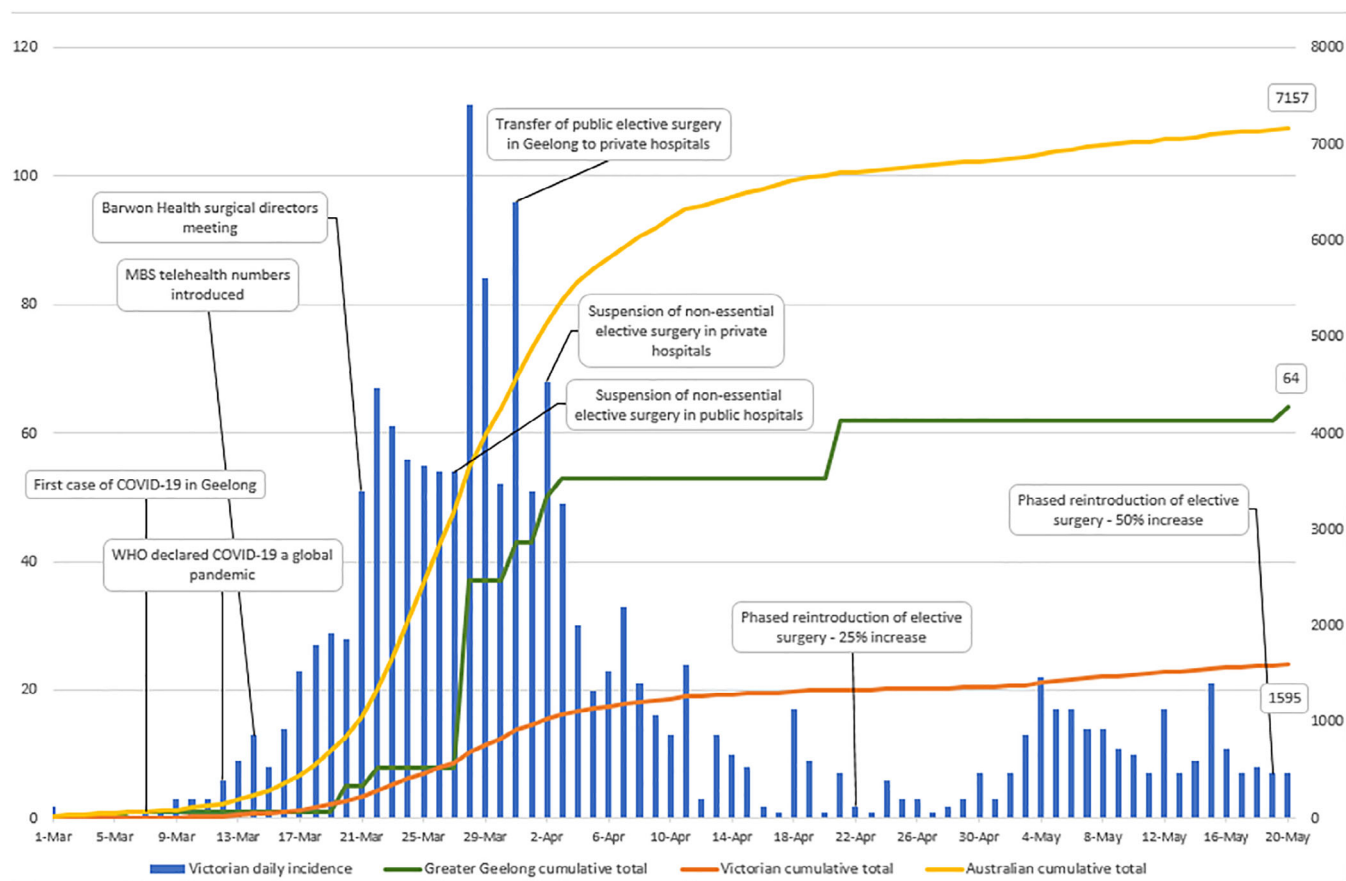
### Elective general surgery

From 30 March to 17 May 2020, general surgeons in Geelong performed 105 elective public elective operations (excluding endoscopy), a 45.9% reduction on 2019 activity (Table 1). Even category 1 cases were reduced by 30%. Eighty-one of these were performed in the private sector. Patients requiring surgery for cancer (44 patients) waited on average 3 days less (14.7 days compared with 11.7 days) during the COVID-19 period. One hundred and forty-two patients already on the waiting list with dates for surgery were cancelled by the hospital, the patient themselves or for a positive COVID-19 screen.

During the COVID-19 period we performed 198 public endoscopies in Geelong, representing a 58% reduction on the previous year, with category 1 endoscopies down 71% (Table 1). Seventy-six (38%) endoscopies continued were done at University Hospital Geelong, the rest in private hospitals. Five cancers were found, and the adenoma detection rate was 41%.

### Emergency general surgery

Despite a 30% drop in emergency presentations, emergency overnight general surgical admissions averaged 68 cases per week and only declined 6.1% (475 versus 506) compared with the same period in 2019 (Table 2). We conducted 205 emergency operations compared with 180 the previous year, an increase of 13.9%. There was an increase in the number of emergency laparoscopic cholecystectomies and emergency colonoscopies performed. There was no significant change in the indication for laparoscopic cholecystectomies (Table 3).



**Fig 1.** Timeline of coronavirus disease 2019 incidence in Greater Geelong, Victoria and Australia. (—) Victoria; (—) Greater Geelong total; (—) Victoria total; (—) Australia total.

**Table 1** Comparison of elective general surgery operations and endoscopy between 2019 and 2020

	1 April to 19 May 2019	30 March to 17 May 2020	% Change during COVID	P-value
<b>Elective operations</b>				
Total number of operations	194	105	-45.9%	—
Number of public operations performed in private sector	9	81 (77.1%)	800%	—
Category 1 operations	97 (50.0%)	68 (64.8%)	-29.9%	—
Category 2 operations	81 (41.8%)	37 (35.2%)	-54.3%	—
Category 3 operations	16 (8.2%)	0	—	—
Number of operations for cancer	51	44	-13.7%	—
Mean number of days on waiting list for cancer operations (all cancers)	14.7	11.7	-20.4%	0.104
Mean number of days on waiting list (colorectal cancers only)	15.4	13.6	-11.7%	0.562
Mean number of days from endoscopic diagnosis to operation (colorectal cancers only)	38.7	25.3	-34.6%	0.107
<b>Endoscopy</b>				
Total number of endoscopy procedures performed	474	198	-58.2%	—
Number of public cases performed in private sector	265 (55.9%)	122 (61.6%)	-54.0%	—
Colonoscopy	340	142	-58.2%	—
Gastroscopy	134	56	-58.2%	—
Category 1 endoscopies	315 (66.5%)	91 (46.0%)	-70.8%	—
Category 2 endoscopies	159 (33.5%)	106 (53.5%)	-33.3%	—
Number of cancers found	7	5	-28.6%	—
Adenoma detection rate	40%	41%	—	—

**Table 2** Comparison of emergency general surgery between 2019 and 2020

	1 April to 19 May 2019	30 March to 17 May 2020	% Change during COVID-19
Emergency department activity			
Total number of emergency department presentations	10 680	7475	-30.0%
Total number of overnight hospital admissions (all specialities)	4485	3616	-19.4%
Total number of overnight emergency surgical admissions (all specialities)	967	928	-4.0%
Total number of overnight emergency general surgical admissions	506	475	-6.1%
Emergency operations			
Total number of general surgical emergency operations	180	205	13.9%
Number of major operations	60 (33.3%)	80 (39%)	33.3%
Number of minor operations	120 (66.7%)	125 (61%)	4.2%
Common emergency operations performed			
Laparoscopic appendicectomy	50	48	-4.0%
Soft tissue infection	41	46	12.2%
Laparoscopic cholecystectomy	26	40	53.8%
Laparotomy	22	21	-4.5%
Hernia repair	8	7	-12.5%
Gastroscopy	16	5	-68.8%
Colonoscopy	7	13	85.7%
Endoscopic retrograde cholangiopancreatography	7	6	-14.3%

**Table 3** Comparison of morbidity and mortality measures

	1 April to 19 May 2019	30 March to 17 May 2020	P-value
Morbidity and mortality meetings			
Total number of complications discussed	9	10	—
Clavien–Dindo grade 1	1	0	—
Clavien–Dindo grade 2	3	4	—
Clavien–Dindo grade 3	3	3	—
Clavien–Dindo grade 4	1	2	—
Clavien–Dindo grade 5	1	1	—
Number of cases deemed to be non-preventable	0	0	—
Appendicectomies			
Total number of cases	50	48	—
Mean (SD) age of patients	33.3 (16.5)	30.1 (19.0)	0.382
Number of male patients	28	24	—
Perforation rate	18% (9/50)	14.58% (7/48)	0.854
Negative appendicectomy rate	18% (9/50)	18.75% (9/48)	0.869
Laparoscopic cholecystectomies			
Total number of cases	26	40	—
Mean (SD) age of patients	51.6 (17.7)	50.7 (18.3)	0.854
Number of male patients	10	16	—
Indication: biliary colic	9 (34.6%)	13 (32.5%)	—
Indication: acute cholecystitis	14 (53.8%)	20 (50%)	—
Indication: gallstone pancreatitis	3 (11.5%)	7 (17.5%)	—
Number of gallbladders with necrosis	3 (11.5%)	7 (17.5%)	0.858
Laparotomies			
Total number of cases	22	21	—
Mean (SD) age of patients	58.8 (20.9)	62.7 (23.6)	0.579
Number of male patients	9	9	—
Indication: bowel obstruction (benign disease)	11	10	—
Indication: bowel obstruction (malignant disease)	2	2	—
Indication: perforation of gastrointestinal tract	4	2	—
Indication: trauma	1	2	—
Indication: other	4	5	—
Mean (SD) Operative time (h)	2.94 (1.16)	2.71 (1.5)	0.590
Mean (SD) length of hospital stay (days)	14.3 (9.2)	10.7 (6.2)	0.204
Unplanned return to theatres	2	2	—
Unplanned readmission within 28 days	4	3	—
Death	1	1	—

SD, standard deviation.

## Morbidity and mortality

For the period 30 March–17 May 2020 there were 10 complications compared with nine in 2019. We included complications that occurred for patients initially treated during the respective time periods, which may or may not have been discussed within these dates. The Clavien–Dindo grade<sup>9</sup> for each complication was determined. In both periods, following peer review, the complications were deemed to be non-preventable. In 2020 none were considered related to changed environment due to COVID-19 or a reluctance to present to hospital.

Appendicectomy numbers were similar between the two time periods, particularly both the perforation rates and the negative appendicectomy rates. Indications for laparotomies were similar between the two time periods and there were no significant differences in numbers or outcomes for emergency laparotomies (Table 3).

## Non-admitted patient services

A radical restructuring of our outpatient clinic service led to a change from no scheduled telehealth consults in 2019 to 81.3% of all consults being conducted via telehealth. Similarly, no pre-operative anaesthetic reviews were conducted via telehealth in 2019 and this changed to 61.8% of all pre-operative consults in 2020 (Table 4).

## Multi-disciplinary meetings

At upper gastrointestinal, colorectal and breast MDMs we discussed an average of 9.1 patients per week (total = 64 patients) via the online platform. This is compared to 2019 when we discussed an average of 8.4 patients per week (total = 59 patients) in person.

## Surgical education and training

The SET trainee's operative exposure was similar comparing the first 7 weeks of the rotation with the seven during the COVID-19 response. However, gastroscopy was reduced by a third and colonoscopies by 14.3% (Table 5).

Prior to COVID-19, a weekly face-to-face tutorial for registrars was run by a rotating roster of general surgery consultants. During the COVID-19 service this tutorial continued, albeit delivered

through Zoom. While formal attendance numbers were not kept during 2019 for comparison, strong anecdotal evidence suggests a significant increase in the registrars participating in the tutorials when delivered online. A weekly meeting between the supervisor of general surgery training and trainees continued via online video-conference. Trainees within the training hub that were on rotation to other regional centres were invited to join these meetings online.

## Discussion

Almost every element of our general surgical service in Geelong was impacted by COVID-19. This was particularly so for elective surgery (down 45.9%) and endoscopy (down 58.2%). In addition to cancelling 142 patients already booked for surgery from 24 March, we did 89 fewer elective cases and 276 less endoscopies. The impact of not doing this surgery on the health of the population will only be learned over the coming 12–18 months. Of note, we did not change current best practice, despite some contrary advice from overseas<sup>10,11</sup> and consistent with General Surgeons Australia recommendations<sup>12</sup> we did not change our utilization of laparoscopic surgery. We would anticipate that we have around 90–100 patients per week not operated on in general surgery, which will equate to up to 1000 general surgical procedures (including endoscopies) before we are back to 100% given the staged re-introduction of elective surgery over 2 months. This represents a small fraction of the estimated 28 million elective surgeries cancelled worldwide due to COVID-19, or 400 000 for Australia.<sup>13</sup>

We expect there will be some delayed diagnosis of cancer, though the evidence from our maintenance of category 1 cancer surgery and the decision-making at our MDM's suggest we treated the 46 cancer patients we knew about appropriately. Our colorectal patients had a decreased time from endoscopic diagnosis to surgery (down 34.6% to a mean of 25.3 days) which shows we were able to maintain efficient and effective treatment pathways for known cancers. Additionally, all cancer patients had a decreased elective surgery wait list time (down 20.4% to 11.7 days,) demonstrating we maintained an effective essential service. A decrease in both these waiting times likely reflects increased access to theatre for category 1 patients.

With outpatient services being delivered via telehealth, our clinicians had greater flexibility to manage appointments and even undertook some of their outpatient commitments from home. We

**Table 4** Comparison of non-admitted patient services between 2019 and 2020

	1 April to 19 May 2019	30 March to 17 May 2020	% Change during COVID
General surgery outpatient clinics			
Total appointments	1472	1361	-7.5%
Total new patients	429	231	-46.2%
Total review patients	1043	1130	8.3%
Number of patients seen in person	1472	254	-82.7%
Number of telehealth patients	0	1107	—
Pre-operative anaesthetic reviews			
Total reviews	76	34	-55.3%
Number of patients seen in person	76	13	-82.9%
Number of telehealth patient (% of patients reviewed)	0	21 (61.8%)	—

**Table 5** Geelong's accredited surgical education and training trainee operative numbers during rotation one 2020

	3 February to 22 March 2020	30 March to 17 May 2020	% Change during COVID	<i>P</i> -value
Mean total number of cases	56	54	-3.6%	0.840
Mean number of major cases (primary operator %)	32 (45%)	35 (49%)	9.4%	0.436 (0.394)
Mean number of minor cases	24	19	-20.8%	0.470
Mean number of colonoscopies	21	18	-14.3%	0.636
Mean number of gastroscopies	6	4	-33.3%	0.530

retained half of our ability to assess new outpatient referrals and even increased the number of review patients by changing our model of care to involve telehealth in over 80% of consultations (Table 4). This is anticipated to be one of the major benefits of COVID-19,<sup>14</sup> and one we plan to utilize in the future.

General surgical emergency presentations were only slightly reduced during the COVID-19 response period. This was despite a 30% reduction in emergency department presentations and a 20% drop in all cause emergency admissions to hospital. This probably reflects the acute, obvious nature of general surgical emergencies, with our patients aware of the need to attend hospital.

We increased the number of emergency operations performed during COVID-19 by 13.9% despite a 6.1% decrease in overnight admissions. In particular there was an increase in the number of emergency laparoscopic cholecystectomies and colonoscopies performed. While there was no formal change in our departments approach to emergency surgery, this change in practice likely resulted from increased access to emergency theatre and a desire to perform urgent cases before a potential worsening of the pandemic.

Moving the general surgical electives to the private hospitals preserved capacity at University Hospital Geelong to respond to COVID-19. The key to being able to rapidly transfer our elective work to the private sector was Geelong's unique pre-existing public-private relationship.<sup>15</sup> This allowed rapid transfer of our units and a smooth transition to treat public patients in the private hospitals. Clinicians were also familiar with the clinical information systems, while credentialing, and financial processes were already in place. Only credentialing of junior medical staff was additionally required and, under the private hospital contracts, a system of private to public reimbursement for junior staff work.

Despite the potential for the community not presenting to the hospital for urgent care during the pandemic, our results do not reflect this. Our appendicectomy perforation rate, gallbladder necrosis rate and laparotomy lengths of stay were not significantly different.

While COVID-19 required a change in approach to pre-operative anaesthetic assessment there was no evidence that patient outcomes were affected. The number of pre-operative reviews decreased by 55.3%. Only 13 patients were reviewed in person compared to 76 during the corresponding period of time in 2019. Our concern was that patients would not receive the robust level of assessment compared to 2019, but in the end, none of our patients were cancelled on the day of surgery due to anaesthetic

issues. Similarly, our postoperative outcomes showed no significant change.

COVID-19 threatened to significantly impact surgical training.<sup>16</sup> We were very pleased with the comparative figures which showed that our SET trainees overall suffered no significant change in their operative exposure during the COVID-19 period. This figure also likely reflects our accredited trainees doing a greater proportion of procedures compared to our non-accredited trainees. Despite an overall reduction in the number of colonoscopies in Geelong performed by 58.2%, our trainees performed only 14.3% fewer colonoscopies. Combined with an increase in the mean primary operator rate, this highlights our department's ability to maintain exposure to operative surgery despite delivering a surgical service using different models of care.

We have found the use of online meetings a valuable tool for communication and maintaining morale in the face of social isolation. Despite restrictions in the delivery of some content, online meetings resulted in increased attendance of clinicians to our scheduled meetings. Increased attendance was likely due to the ability to access these meetings off-site, from either home or other workplaces while acknowledging that some clinicians did have a decreased clinical work load. Online meetings are likely to continue in the future.

Many lessons have also been learnt to better prepare ourselves, and other health service providers, for a similar situation in the future. Indeed, COVID-19 has been described a 'window of opportunity' for change.<sup>14</sup> Early, decisive and collaborative leadership without fear of making a wrong decision has underpinned our service changes. Furthermore, the flexibility of a pre-existing public-private partnership in Geelong has proved to be invaluable and is something that needs to be considered by other health service providers in the future.

We believe our response offers some valuable lessons which could be adopted by other health service providers.

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## Conflicts of interest

None declared.

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## Appendix I

### Geelong surgical COVID-19 response team members

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