


## ORIGINAL ARTICLE

# Impact of COVID-19 restrictions on pathology service utilisation

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**Key words**

pathology services, COVID-19, troponin.

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**Abstract**

**Background:** Isolation and social distancing restrictions due to COVID-19 have the potential to impact access to healthcare services.

**Aims:** To assess the use of pathology services during the COVID-19 pandemic initial restrictions.

**Methods:** Repeated cross-sectional study of pathology tests utilisation during a baseline time period early in 2020 compared with pre-lockdown and lockdown due to COVID-19 in South Australia. The outcome measure was changed in a number of pathology tests compared to baseline period, particularly change in the number of troponin tests to determine potential impacts of lockdown on urgent care presentations.

**Results:** In the community setting, the ratio of a number of pathology tests pre-lockdown and post-lockdown versus baseline period decreased from 1.02 to 0.53 respectively. The exception was microbiology molecular tests, where the number of tests was more than three times higher in the lockdown period. The number of troponin tests in emergency departments decreased in the lockdown period compared to the baseline time period; however, there was no evidence of an association between tests result (positive vs negative) and time period (odds ratio (OR) 1.09; 95% confidence interval (CI) 0.97–1.22). There was an inverse relationship between age and time period (OR 0.995; 95% CI 0.993–0.997), indicating that fewer troponin tests were conducted in older people during the lockdown compared with the baseline period.

**Conclusion:** COVID-19 restrictions had a significant impact on the use of pathology testing in both urgent and non-urgent care settings. Further studies are needed to investigate the effect on health outcomes as a result of the COVID-19 restrictions.

**Introduction**

Isolation and social distancing restrictions due to COVID-19 have the potential to affect access to healthcare. People may choose not to visit their doctor either for monitoring existing health conditions or for new conditions due to fear of catching the virus or burdening the health system.<sup>1–3</sup> Consequently, there may be a build-up of undiagnosed health conditions in the community resulting in unnecessary morbidity and mortality.<sup>4,5</sup> As an example of the impact of the COVID-19 pandemic on hospitalisations for a life-threatening condition, a decrease in incidence of hospitalisation for acute myocardial

infarction (AMI) has been reported in the USA and Italy.<sup>4,6</sup> Conversely during March 2020 there was an increase in Google searches for ‘chest pain’ which were correlated with the increase in number of COVID-19 cases in the USA, possibly due to patients self-triaging at home.<sup>7</sup> Another example on the impact on urgent care service utilisation is the reported decrease in number of aeromedical retrievals undertaken in Australia during the lockdown period.<sup>8</sup> However, there are also reports indicating a potential reduction of unnecessary care. A systematic review of healthcare utilisation during the COVID-19 pandemic compared with previous years found a greater reduction in users of healthcare services with mild illness compared with more severe illness.<sup>9</sup>

Changes in pathology testing can be considered a sentinel marker for changes in health service utilisation in

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general, thus mapping pathology test activity can provide information on the impact of COVID-19 restrictions on health service utilisation. A setting such as South Australia with very low COVID-19 incidence, but strong restrictive measures, is well placed to investigate the impact on initial COVID-19 restriction *per se*. Furthermore, mapping the impact on test type and the healthcare settings that have been affected can highlight issues and inform the need for subsequent targeted interventions.

In South Australia, restrictions on social movements were introduced in March 2020 concurrent with the introduction of national restrictions. Restrictions consisted of a ban on social gatherings (e.g. public gatherings with more than 500 people were cancelled on 15 March), social distancing rules (put in place 21 March), travel restrictions, quarantine requirements and lockdown of public places (e.g. restaurants and pubs closed 21 March). The objective of the study was to assess the impact of the first 4 weeks of COVID-19 restrictions on the utilisation of pathology testing services in South Australia compared to baseline periods in the same year and in the previous year (2019).

## Methods

This was a retrospective repeated cross-sectional study of the number of pathology tests performed during an 11-week time period (week 5–15 of 2020; i.e. 27 January to 12 April). We chose weeks 5–8 (27 January–23 February 2020) as the reference baseline period, weeks 9–11 (24 February–15 March 2020) as pre-lockdown and weeks 12–15 in 2020 (16 March–12 April 2020) as the lockdown period because Australia closed its borders in week 12 (20 March 2020) and the following week stay-at-home advice, restrictions on movement and social gatherings were imposed in South Australia. For comparison, pathology tests performed in the same 11-week period in 2019 (i.e. 28 January to 14 April 2019) were examined.

## Data sources

The SA Pathology service is the sole provider of public hospital pathology testing in South Australia and undertakes 35% of all community pathology tests requested by general practitioners (GP) and specialists with feed-in from every region of South Australia. Hence, the dataset constitutes all public hospital (including emergency department (ED)) pathology tests and approximately one-third of community tests.

In addition, data from patients who had angiogram for AMI, sourced from 14 hospitals in South Australia, were examined.

## Study cohort inclusion criteria

The study cohort consisted of people in South Australia who had pathology tests in the community and ED during the study period. Community tests included tests requested by GP and physicians outside the hospital setting and ED tests included tests conducted in public hospital ED. Troponin test impact analysis was limited to troponin requests from public hospital ED.

The SA Pathology tests were examined by the following discipline or sub-discipline groups: anatomical pathology specimen, blood bank, coagulation, endocrinology, general chemistry, haematology, immunology, non-molecular microbiology, molecular microbiology and serology. To determine potential negative effects of COVID-19-related restrictions on a health condition requiring urgent care, such as acute coronary syndrome (ACS), we investigated troponin test (belonging to general chemistry) requests in ED for adults aged 18–100 years.

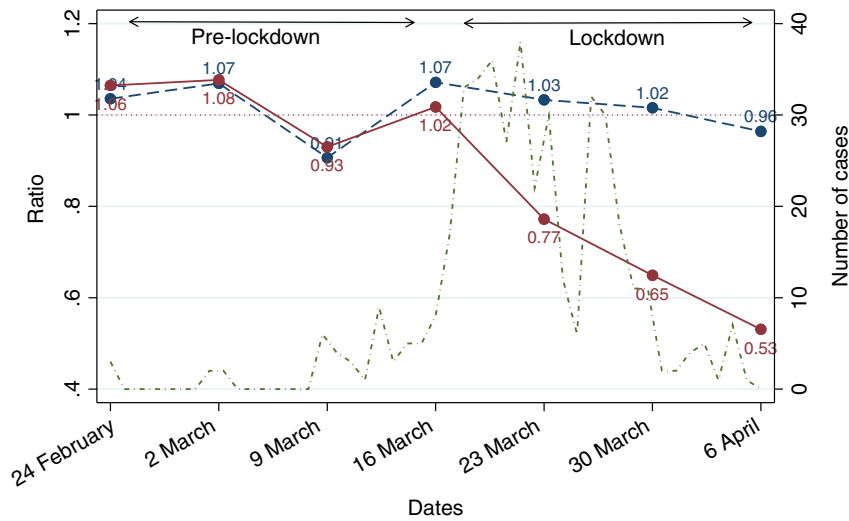
## Data analysis

To assess the changes in number of pathology tests conducted in the community and in public hospital ED, we compared the weekly number of SA Pathology tests in pre-lockdown and lockdown (weeks 9–15) to average weekly number of tests in baseline (weeks 5–8). For each discipline of SA Pathology tests ordered in the community, the ratio of number of tests in the 4-week baseline period was compared to the number of tests in the 4 weeks lockdown (i.e. weeks 12–15) and calculated for 2019 and 2020.

For the SA Pathology troponin tests, any tests recorded from a person within 1 day of the first test were counted as one test. The test was considered as positive if any of the tests taken within the time frame were equal to or greater than 30 ng/L. Logistic regression was undertaken to examine the relationship between time periods when the troponin tests were performed (lockdown vs baseline) and age of patients and troponin test result.

For patients undergoing angiogram for AMI in public hospitals the incidence rate (IR) per 100 000 person-weeks were calculated for two periods in 2020 (the baseline and lockdown period) and for the first 4 months of 2019 (1 January to 28 April).

We chose 0.05 as the alpha level for statistical significance. Stata/IC 16 (StataCorp LLC, College Station, TX, USA) was used for the analysis.



**Figure 1** Ratio of number of pathology tests per week compared with average number of weekly tests in the baseline period (weeks 5–8) in 2019 and 2020 ordered by physicians in the community setting superimposed on number of COVID-19 cases in South Australia over the same period. (–●–), Ratio2019; (–●–), ratio 2020; (– – –), number of COVID-19 cases.

Ethics approval for the study was obtained from Central Adelaide Local Health Network and University of South Australia Human Research Ethics Committees.

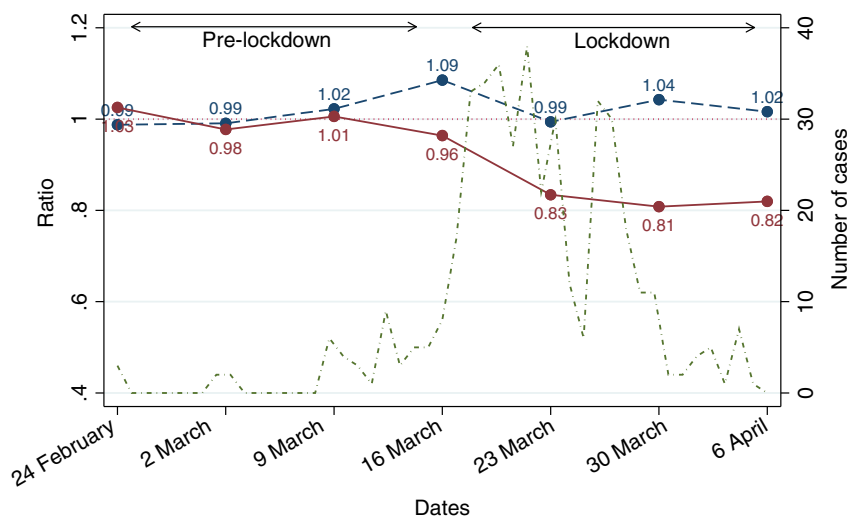
## Results

The number of SA Pathology tests per week in pre-lockdown and in lockdown compared with the average number of weekly tests in the baseline period is presented in Figures 1 and 2 for community and ED tests respectively. The figures indicate that in 2020 in both settings there was a decrease in the number of weekly tests performed during lockdown compared to the baseline period. The decrease in the number of tests was largest in the community setting, where the ratio decreased from 1.02 pre-lockdown to 0.53 lockdown. By

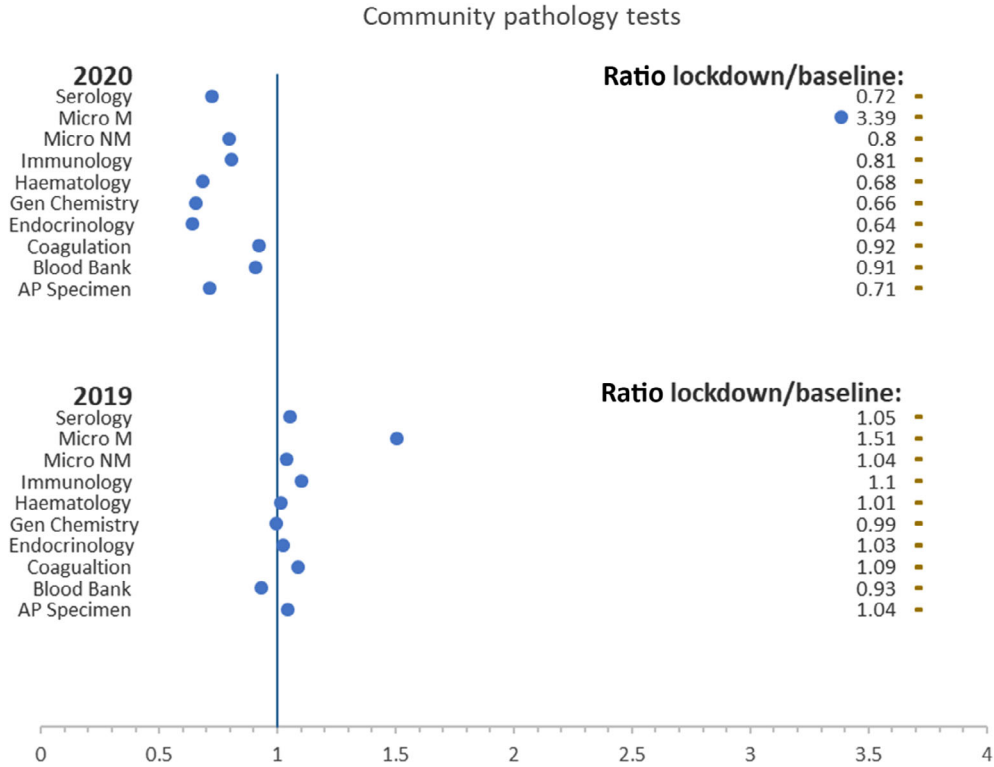
comparison, in both settings the weekly ratios were similar in 2019.

Figure 3 shows the ratios of number of tests performed in the community in the lockdown period compared to baseline for each sub-discipline in 2019 and in 2020. The number of tests in 2019 was generally similar between the two periods, whereas in 2020 there were fewer tests performed in the lockdown period than the baseline period. This was most pronounced for haematology, general chemistry and endocrinology tests. The exception was the molecular diagnostic group, which includes virology polymerase chain reaction (PCR), where the number of tests in lockdown was higher than in the baseline period both in 2019 (ratio: 1.51) and in 2020 (ratio: 3.39).

There were fewer troponin tests conducted during lockdown ( $n = 4208$ ) than during the baseline period



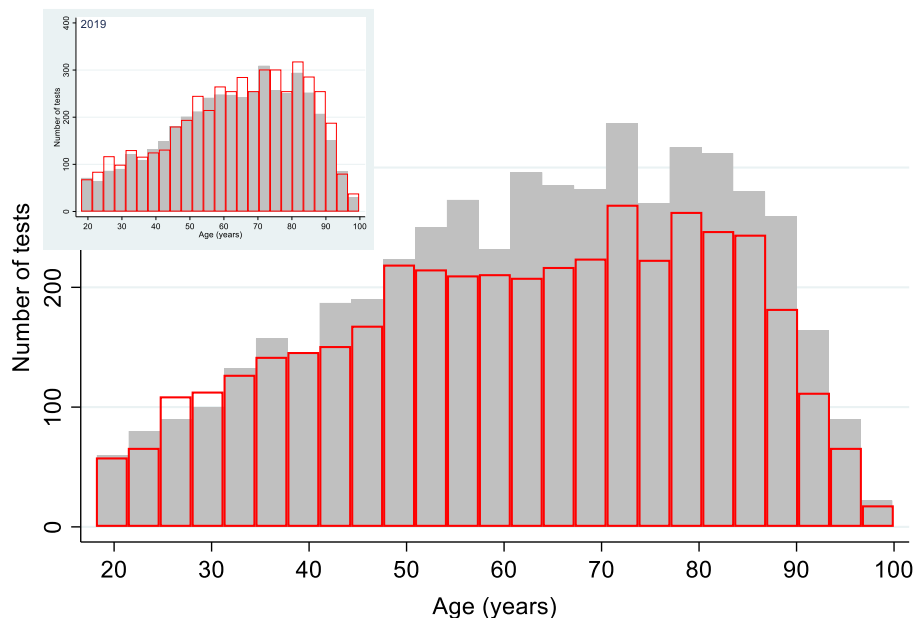
**Figure 2** Ratio of number of pathology tests per week compared to average number of weekly tests in the baseline period (weeks 5–8) in 2019 and 2020 ordered in ED superimposed on number of COVID-19 cases in South Australia over the same period. (–●–), Ratio2019; (–●–), ratio 2020; (– – –), number of COVID-19 cases.



**Figure 3** Ratio of number of tests performed in lockdown (i.e. weeks 12–15) to number of tests performed in the baseline period (i.e. weeks 5–8) in the community. AP, anatomical pathology; Micro M, microbiology molecular; Micro NM, microbiology non-molecular.

(*n* = 5032) in 2020. The number of positive tests (i.e. troponin  $\geq 30$  ng/L) was also lower; however, the percentage of tests that were positive was similar over

the two periods, 19% (*n* = 798) during lockdown and 18.9% (*n* = 953) during the baseline period. Conversely, in 2019 during the same two periods, there



**Figure 4** Age distribution of troponin tests in the (■) baseline period (weeks 5–8 2020: 27 January–23 February) compared with (□) lockdown (weeks 12–15 2020: 16 March–12 April) recorded by SA pathology. Inset: Same time periods in 2019.

**Table 1** Multivariable logistic regression: association between test period (odds of troponin tests in lockdown period (weeks 12–15) versus baseline (weeks 5–8)) and the variables age and troponin test result

Data	Variables	Odds ratio	95% CI	P-value
2020 SA pathology	Age	0.995	0.993–0.997	<0.001
	†Positive versus negative test	1.09	0.97–1.22	0.13
2019 SA pathology	Age	1.001	0.999–1.003	0.28
	†Positive versus negative test	1.03	0.93–1.15	0.58

†Positive troponin:  $\geq 30$  ng/L.

was a higher number of troponin tests in weeks 5–8 ( $n = 4485$ ) than in weeks 12–15 ( $n = 4786$ ), but as in 2020, the percentage of positive tests was similar over the two periods, 19.4% ( $n = 869$ ) versus 20.2% ( $n = 968$ ) respectively.

Figure 4 shows the age distribution of the number of troponin SA Pathology tests in the baseline period (weeks 5–8) compared with the lockdown period (weeks 12–15), suggesting that the decrease in number of troponin tests was most evident in the older age groups. This is consistent with the results from multivariable logistic regression of odds of troponin testing in the lockdown period compared to odds of tests in the baseline period (Table 1) where there was an inverse relationship between age and number of troponin tests performed during the lockdown period in 2020 compared with baseline (odds ratio (OR) 0.995, 95% confidence interval (CI) 0.993–0.997). Conversely, there was no evidence of an age effect observed in 2019 on number of troponin tests when comparing the two periods (OR 1.01; 95% CI 0.99–1.04). The age adjusted odds of positive test to negative tests were 1.09 (0.97–1.22) in 2020 and 1.03 (0.93–1.15) in 2019, indicating that there was no evidence that lockdown had an impact on the proportion of the tests that were positive or negative.

The IR of angiogram for AMI in public hospitals did not decrease over the two periods in 2020. During baseline in 2020, there were 142 angiograms for AMI consistent with an IR of 2.64 (95% CI 2.20–3.07) per 100 000 person weeks compared with 138 angiograms during lockdown with IR of 2.56 (95% CI 2.14–2.99). The IR in the beginning of 2019 was similar to the two periods in 2020, over the first 4 months there were 516 events corresponding to an IR of 2.26 (95% CI 2.03–2.48).

## Discussion

There was a decrease in the number of pathology tests requested in 2020 during the first South Australian COVID-19 lockdown both from the community and from the ED compared with earlier in the year. The exception was microbiology molecular tests, which include virology PCR testing, where the number of tests

was higher in both 2019 and 2020 in weeks 12–15 compared with weeks 5–8. The reason for this is likely due to the emergence of seasonal influenza during this period in 2019<sup>10</sup> and COVID-19 in 2020.

The number of troponin tests, as an indicator of urgent care, decreased in the lockdown period compared to the baseline period; however, there was no evidence for an association between tests result (positive vs negative) and lockdown. This may suggest either that there were fewer occurrences of ACS or that people with ACS did not present to ED during the lockdown period. The latter theory is supported by a report that during the peak COVID-19 outbreak in New York in the first half of 2020 there was a doubling of out of hospital deaths concurrent with a halving of ACS hospitalisations.<sup>11</sup> However, it has also been suggested that a more sedentary lifestyle, and less smoking may have led to a decrease in people who suffer ACS.<sup>12</sup> Our results showed an inverse association between patient age and numbers of troponin tests in lockdown, which may suggest that possible avoidance behaviour was more pronounced in older age groups who are at increased risk of suffering severe effects associated with COVID-19. The finding is supported by a nationwide Danish study that found that the largest decrease in ACS admissions was in those older than 60 years of age.<sup>13</sup> This is of concern as the incidence of ACS increases with age and if not treated promptly has a poor prognosis and is associated with increased cost to the health system.<sup>14</sup> However, although not representing the exact matching cohort, the IR of coronary angiograms undertaken for AMI across 14 public hospitals were similar over the baseline and lockdown period and to 2019, which could indicate that the rate of AMI did not change in those who were eligible for coronary angiogram. The reason for the discrepancy may be that the decrease in ED presentations for troponin tests consisted of elderly people that were too frail to undergo angiogram, for example people living in nursing homes where the potential risk associated with COVID-19 were considered too high to present at an ED. Additionally, the discrepancy could be explained by less presentations with non-MI related chest pain

with positive troponin, for example pericarditis, which did not require angiograms, hence all patients with AMI may have presented to hospital and received appropriate care.

The main limitation of this research is that although SA Pathology is the largest provider of pathology services, not all pathology tests conducted in the community in South Australia are included. However, because SA Pathology covers a broad range of services, it is likely that the sample is representative of the pathology tests conducted in South Australia during the period. Furthermore, by comparing number of tests conducted in the lockdown to baseline average number as well as number of tests in the previous year, the relative change could be assessed. The percentage of positive troponin tests is expected to be within 5–20% ACS of ED chest pain presentations,<sup>14</sup> but it was not possible to establish the proportion of patients with positive troponin tests who had ACS, because the pathology tests were not linked to ED diagnoses.

During COVID-19 pandemic, there have been reports about several conditions with a decrease in healthcare presentations. A study examining hospital presentation for stroke in Hong Kong suggested that there was reluctance to seek treatment for stroke symptoms during the pandemic.<sup>15</sup> Our findings are interesting because South Australia was one of the locations in the world with the lowest incidence of COVID-19 during the early phases of the pandemic. The first cases were reported late February, and by end of week 15 there had been 430 cases (Figs 1,2). Hence in South Australia, the healthcare

system was not overburdened by COVID-19 cases during the study period and as such did not represent a barrier to patient presentations at ED. The behaviour of not seeking treatment for urgent care conditions needs to be addressed in preparation for further possible COVID-19 restrictions and other pandemics. Conversely, overuse of pathology testing is a known issue in healthcare services and leads to increased risk of harm to patients and contributes to overspending in the health system.<sup>16</sup> A systematic review of published studies on inappropriate pathology testing found an overall rate of overutilisation of testing of more than 20%.<sup>17</sup> Hence, if the decrease in pathology testing during the COVID-19 pandemic signifies a reduction in unnecessary care, this may represent an opportunity for healthcare systems to reduce the prevalence of low-value healthcare.<sup>9</sup>

## Conclusion

COVID-19 restrictions had a significant impact on the utilisation of pathology services both in the community and in the ED. Consideration needs to be given to strategies aimed at minimising avoidance of health services during possible future community lockdowns particularly for urgent care conditions. The number of troponin tests decreased during the lockdown, mostly in the older age groups. Further studies are needed to investigate the potential effect on health outcome as a result of the COVID-19 restrictions and associated change in health seeking behaviour.

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