Effect of COVID-19 pandemic restrictions on chlamydia and gonorrhoea notifications and testing in Queensland, Australia: an interrupted time series analysis

Marguerite Dalmau 1,2, Robert Ware 3, Emma Field 2, Emma Sanguinetti 1, Damin Si 1, Stephen Lambert 1,4

ABSTRACT
Objective To investigate trends in testing and notifications of chlamydia and gonorrhoea during the COVID-19 pandemic in Queensland, Australia.
Methods Statewide disease notification and testing data between 1 January 2015 and 31 December 2021 were modelled using interrupted time series. A segmented regression model estimated the pre-pandemic trend and observed effect of the COVID-19 pandemic response on weekly chlamydia notifications, monthly gonorrhoea notifications and monthly testing figures. The intervention time point was 29 March 2020, when key COVID-19 public health restrictions were introduced.
Results There were 158,064 chlamydia and 33,404 gonorrhoea notifications and 2,107,057 combined chlamydia and gonorrhoea tests across the 72-month study period. All three studied outcomes were increasing prior to the COVID-19 pandemic. Immediate declines were observed for all studied outcomes. Directly after COVID-19 restrictions were introduced, declines were observed for all chlamydia notifications (mean decrease 48.4 notifications/week, 95% CI –77.1 to –19.6), gonorrhoea notifications among males (mean decrease 39.1 notifications/month, 95% CI –73.9 to –4.3) and combined testing (mean decrease 4,262 tests/month, 95% CI –6,646 to –1,877). The immediate decline was more pronounced among males for both conditions. By the end of the study period, only monthly gonorrhoea notifications showed a continuing decline (mean decrease 3.3 notifications/month, p<0.001).
Conclusion There is a difference between the immediate and sustained impact of the COVID-19 pandemic on reported chlamydia and gonorrhoea notifications and testing in Queensland, Australia. This prompts considerations for disease surveillance and management in future pandemics. Possible explanations for our findings are an interruption or change to healthcare services during the pandemic, reduced or changed sexual practices or changed disease transmission patterns due to international travel restrictions. As pandemic priorities shift, STIs remain an important public health priority to be addressed.

WHAT IS ALREADY KNOWN ON THIS TOPIC
⇒ Immediate declines in disease incidence are commonly reported in literature exploring the impact of the COVID-19 pandemic on STIs in 2020. Results of studies exploring longer term trends vary.

WHAT THIS STUDY ADDS
⇒ This study explores both the immediate and sustained impact of the COVID-19 pandemic restrictions on chlamydia and gonorrhoea in Queensland, Australia, across 2020 and 2021. An immediate decline in notifications and testing was observed for both conditions. Gonorrhoea notifications maintained a continued decline until the end of 2021, raising considerations for understanding local disease epidemiology.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY
⇒ The study findings highlight the need for renewed focus on STI surveillance. The study also prompts important considerations for how to maintain wider communicable disease surveillance and control during a public health emergency.
In addition to international border closures, restrictions on interstate movement and entry to Queensland were limited at different times. Following a national rollout of COVID-19 vaccines, most public health restrictions were gradually lifted, and a staged reopening of Australia’s international border took place from 1 November 2021.

Halting international travel, restricting social movements and increasing personal protective measures contributed to observed changes in communicable disease notifications in Australia. Notably, a severe disruption to most seasonal respiratory viruses in 2020 and 2021 has been reported.1–3 These changes are primarily captured in state and territory health department reports, with further analyses emerging. A preliminary analysis in the first 6 months of 2020 identified a reduction in disease notifications across nearly all nationally reported notifiable conditions when compared with the same period in 2019.4 The magnitude of reduction varied depending on the condition, its risk factors and transmission pathways.4 In the first 6 months of 2020, reported reductions in national notifications of STIs were 31% and 8% for chlamydia and gonorrhoea, respectively. Extended analyses on the sustained impact of the pandemic on STIs in Australia will help inform public health advice and control measures in future pandemic and communicable disease control responses.

In Australia, most STIs are treated in the primary health-care environment. In Queensland, approximately 80% of STI testing occurs in primary care settings, with the remaining 20% occurring in specialist sexual health services or public hospitals. Asymptomatic STI checks are recommended for anyone who requests testing, people with a new sexual partner, people living or travelling to areas of higher prevalence, people with a known exposure to an STI or people belonging to subpopulations deemed to be at higher risk of STIs.5 Specific testing recommendations differ depending on identified risk factors. Opportunistic STI testing is recommended for sexually active people aged 15–29 years. Specialist sexual health clinics are accessible for all Queensland residents, however, are predominately accessed by populations with an increased risk of STIs.

Australian national STI management guidelines provide advice on clinical presentations, testing, treatment and follow-up of patients diagnosed with STIs and their sexual contacts.6 In 2020, recommendations were developed to support clinicians in providing harm reduction advice for individuals engaging in casual sex during the COVID-19 pandemic.6 While the recommendations recognised the important social function of casual sex, they also advised that, where feasible, individuals limit their number of sexual partners.6 Furthermore, medical clinics adapted their services during the pandemic and pivoted to new models of care such as Telehealth. A survey of sexual health service directors (n=20) across Australia reported changed clinic practices during the pandemic across all facilities.7 Changed practices included reduced staffing due to pandemic priorities, suspended walk-in services and delayed or limited testing. During periods of lockdown, some clinics (9/17) did not offer consultations for asymptomatic patients who engage in heterosexual sex, whereas other clinics offered these consultations via telehealth platforms.

To better document changes in STI notifications and testing associated with pandemic interventions, we analysed notified cases and reported tests for gonorrhoea and chlamydia in Queensland, Australia. The primary study aim was to describe trends in notifications of these conditions, and testing data where available, during the COVID-19 pandemic, compared with the previous 5 years (2015–2019). By using 2020 and 2021 notification data, we were able to investigate the immediate and sustained effect of pandemic controls beyond their initial impact.

**METHODS**

We applied an interrupted time series (ITS) analysis to notification and reported testing data from Queensland, Australia.

**Study period**

We analysed data from 1 January 2015 to 31 December 2021, inclusive, resulting in a 5-year pre-pandemic comparison period. Queensland public health restrictions were introduced in March 2020 in line with national measures, and international arrivals were not permitted until January 2022.

**Study population and data sources**

We used disease surveillance data from the Queensland Notifiable Conditions System, a database storing case information for notifiable diseases detected in Queensland in accordance with the *Public Health Act 2005*.6 Episodes of chlamydia and gonorrhoea with notification dates within the study period were extracted. Extracted data included key demographic variables, unique person identifier codes and notifying laboratory information. Disease notifications for interstate or overseas residents and those with incomplete sex or date of birth fields were excluded. Notifications prior to 1 January 2018 represent infection site-specific positive results and may include more than one notification per individual. Duplicates based on combined fields of person ID, disease and notification date were therefore excluded.

We assessed Queensland testing trends for chlamydia and gonorrhoea using publicly available aggregated reports for Medicare Benefits Schedule (MBS) item numbers 69316, 69317 and 69319.7 These item numbers represent clinician requested tests for the detection of chlamydia by any method, combined with one or two other tests to detect a virus or microbial antigen or microbial nucleic acid. Most laboratories in Australia test for chlamydia and gonorrhoea concurrently using a dual nucleic acid amplification test.8 When one test is requested both are performed, and chlamydia testing can therefore be used to indicate gonorrhoea testing.8 The MBS reports represent clinician test requests funded by the Australian Government. The reports are more likely to represent tests conducted in primary care settings than tests that occur in public hospitals or public sexual health clinics.10 To calculate population-specific notification rates, we used annual second quarter population estimates for Queensland from the Australian Bureau of Statistics.11

**Statistical analysis**

We used descriptive statistics to report disease epidemiology and testing over the study period. Counts, proportions by sex and median age were calculated. Sex was categorised as a dichotomous variable of male or female due to data collection fields. Following an initial review of 5-year age categories, age groups were constructed according to disease trends. Age groups for MBS data were predetermined according to Medicare aggregated reporting. To describe pre-pandemic and post-pandemic trends, annual counts were compared with the preceding year as a ratio and percentage change. The pandemic years of 2020 and 2021 were also compared with a prepandemic 5-year mean (2015–2019). Annual age and sex-specific disease notification rates and monthly notification to MBS test ratios were calculated and visualised. The proportion of notifications made by private or public laboratories was calculated.
Informed by descriptive results, we undertook ITS analyses to estimate the effect of COVID-19 public health restrictions on chlamydia and gonorrhoea notifications in Queensland (outcome variable). We used a segmented regression model expressed as \( Y = \beta_0 + \beta_1 T + \beta_2 D + \beta_3 P + \varepsilon \) where \( \beta_0 \) estimates the baseline level of the outcome (the intercept or constant), \( \beta_1 \) estimates the preintervention slope (‘time before’), \( \beta_2 \) estimates the immediate change following the intervention (‘pandemic restrictions’) and \( \beta_3 \) is the difference of slope change between the pre-intervention and post-intervention time point (‘time since’).\(^{12}\) The sum of \( \beta_1 \) and \( \beta_3 \) is the post-intervention slope or sustained effect, that is, for each time unit that passed after the pandemic, notifications/tests increased/decreased by the calculated number. The intervention time point was 29 March 2020, the date key COVID-19 public health restrictions were introduced in Queensland. Monthly gonorrhoea and weekly chlamydia notifications, and monthly MBS testing figures, were modelled. Autocorrelation was assessed by plotting residuals (online supplemental figure 1). We divided the immediate level change (\( \beta_2 \)) by the number of reported tests/notifications per week/month pre-intervention to calculate the observed affect as a percentage change. All analyses were performed in the statistical software package R V4.0.0 (24 April 2020).

Ethical approval
This study was approved by the Prince Charles Hospital Human Research Ethics Committee (TPCH HREC Reference Number: 78992). Approval to release and use study data was assessed and granted according to the Queensland Public Health Act 2005.\(^{8}\)

### RESULTS

**Descriptive statistics: disease epidemiology**

Across the 7-year study period, there were 158,064 chlamydia and 33,404 gonorrhoea notifications after excluding records with missing sex (n=286) or date of birth (n=4) fields, duplicate records (n=3,513) and overseas (n=69) notifications. A combined 2,107,057 chlamydia and gonorrhoea MBS tests were reported. Females aged 20–24 years accounted for the highest proportion (n=33,990, 22%) of chlamydia notifications (online supplemental figure 2). The highest proportion of gonorrhoea notifications (n=4768, 22%) was observed among males aged 25–29 years. Females aged 25–34 years (n=53,124, 25%) were the most represented age group in MBS testing figures, followed by females aged 15–24 years (n=52,254, 25%).

**Descriptive statistics: trends**

In 2020, the annual number of notifications decreased for chlamydia (−8%) and increased for gonorrhoea (6%) when compared with 2019 (table 1). This trend reversed in 2021 when compared with 2020; chlamydia notifications stayed consistent (+2%), and gonorrhoea notifications decreased (−12%). Testing numbers declined (−7%) in 2020 and stayed consistent (+1%) in 2021 when compared with the preceding year. Age and sex-specific disease notifications rates varied by demographic group (figure 1). Chlamydia notifications among females aged 15–19 years have gradually declined from 2574 notifications per 100,000 population per year in 2015 to 2240 notifications per 100,000 population per year in 2021. Gonorrhoea notifications among males and females aged 30–39 years were on an increasing trend pre-pandemic. The notification to MBS test ratio increased for both diseases across April and May 2020, when compared with 2019 (online supplemental figure 2).

### Table 1

<table>
<thead>
<tr>
<th>Disease</th>
<th>Year</th>
<th>Notifications or tests (n)</th>
<th>Change from previous year (Ratio) (%)</th>
<th>Change from prepandemic 5-year mean (Ratio) (%)</th>
<th>Median age (years)</th>
<th>Male (n) (%)</th>
<th>Female (n) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia</td>
<td>2015</td>
<td>20812</td>
<td>–</td>
<td>–</td>
<td>23</td>
<td>8409</td>
<td>12,403</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>2255</td>
<td>1.07 7</td>
<td>–</td>
<td>23</td>
<td>9238</td>
<td>13,017</td>
</tr>
<tr>
<td></td>
<td>2017</td>
<td>23148</td>
<td>1.04 4</td>
<td>–</td>
<td>23</td>
<td>9902</td>
<td>13,246</td>
</tr>
<tr>
<td></td>
<td>2018</td>
<td>23460</td>
<td>1.01 1</td>
<td>–</td>
<td>23</td>
<td>10,199</td>
<td>13,261</td>
</tr>
<tr>
<td></td>
<td>2019</td>
<td>23869</td>
<td>1.02 2</td>
<td>–</td>
<td>24</td>
<td>10,536</td>
<td>13,333</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>22056</td>
<td>0.92 −8</td>
<td>0.97 −3</td>
<td>23</td>
<td>9487</td>
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</tr>
<tr>
<td></td>
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<td>22464</td>
<td>1.02 2</td>
<td>0.99 −1</td>
<td>23</td>
<td>9583</td>
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<tr>
<td>Gonorrhoea</td>
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<td>–</td>
<td>–</td>
<td>25</td>
<td>1837</td>
<td>913</td>
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<tr>
<td></td>
<td>2016</td>
<td>3624</td>
<td>1.32 32</td>
<td>–</td>
<td>27</td>
<td>2419</td>
<td>1205</td>
</tr>
<tr>
<td></td>
<td>2017</td>
<td>4503</td>
<td>1.24 24</td>
<td>–</td>
<td>27</td>
<td>3004</td>
<td>1499</td>
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<tr>
<td></td>
<td>2018</td>
<td>4851</td>
<td>1.08 8</td>
<td>–</td>
<td>28</td>
<td>3232</td>
<td>1619</td>
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<tr>
<td></td>
<td>2019</td>
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<td></td>
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<td>1.45 45</td>
<td>29</td>
<td>3800</td>
<td>2460</td>
</tr>
<tr>
<td></td>
<td>2021</td>
<td>5516</td>
<td>0.88 −12</td>
<td>1.28 28</td>
<td>28</td>
<td>3175</td>
<td>2341</td>
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<tr>
<td>MBS testing</td>
<td>2015</td>
<td>259201</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>72,385</td>
<td>186,816</td>
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<td></td>
<td>2016</td>
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<td>77,849</td>
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<td>–</td>
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<td>208,605</td>
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<tr>
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<td>312449</td>
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<td>–</td>
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<tr>
<td></td>
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<td>105,690</td>
<td>230,690</td>
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<tr>
<td></td>
<td>2020</td>
<td>313068</td>
<td>0.93 −7</td>
<td>1.06 6</td>
<td>–</td>
<td>92,531</td>
<td>220,537</td>
</tr>
<tr>
<td></td>
<td>2021</td>
<td>316974</td>
<td>1.01 1</td>
<td>1.07 7</td>
<td>–</td>
<td>93,119</td>
<td>223,855</td>
</tr>
</tbody>
</table>

MBS testing: Medicare Benefits Schedule (MBS) item numbers 69316, 69317 and 69319.
3). The increase was more prominent among males. Most chlamydia (77%) and gonorrhoea (59%) notifications between 2015 and 2021 were reported by private laboratories. This proportion remained stable across the study period for chlamydia. The proportion of gonorrhoea notifications notified by private laboratories increased from 54% in 2015 to 65% in 2021 (data not shown).

**ITS analysis**

The ITS results showed that, prior to COVID-19 related restrictions, chlamydia and gonorrhoea notifications and tests were increasing (figure 1). An increased trend in notifications was observed for chlamydia notifications (mean increase 0.19 notifications/week, 95%CI 0.10 to 0.28, p<0.001), gonorrhoea notifications (mean increase 5.5 notifications/month, 95%CI 4.8 to 6.2, p<0.001) and monthly combined testing (mean increase 130.6 tests/month, 95%CI 98.6 to 162.6, p<0.001) (table 2). Immediately following the introduction of COVID-19 restrictions, declines were observed for all chlamydia notifications (mean decrease 48.4 notifications/week, 95%CI −77.1 to −19.6, p<0.001), gonorrhoea notifications among males (mean decrease 39.1 notifications/month, 95%CI −73.9 to −4.3, p=0.03) and combined testing numbers (mean decrease 4262 tests/month, 95%CI −6646 to −1877, p<0.001). When compared with the average pre-pandemic chlamydia notifications per week (n=437), gonorrhoea notifications among males per month (n=246) and combined tests per month (n=24761), the immediate change accounted for 11%, 16% and 17% reductions, respectively. The immediate level change was more pronounced among males for both diseases (figure 2). The magnitude of decline in notifications and testing was not sustained to the end of 2021. By the end of 2021, a sustained decline was observed only for monthly gonorrhoea notifications (slope change −8.8, 95%CI −12.5 to −5.1, p<0.001) equating to an average decrease of 3.3 notifications per month. This was due to a sustained decline in monthly gonorrhoea notifications among males.

**DISCUSSION**

Our study examined notifications and testing of gonorrhoea and chlamydia across 2015–2021. After COVID-19 restrictions were introduced in Queensland, there was an immediate decline in chlamydia notifications and combined testing among both males and females. Gonorrhoea notifications were the only studied outcome with a sustained reduction in notifications to the end of 2021. We observed an immediate drop and continued decline for gonorrhoea notifications among males.

The immediate decline in testing and notifications on introduction of COVID-19 restrictions could be explained by a combination of factors. Changes to healthcare services availability or access, reduced or changed sexual practices, and reduced opportunities for introduction and acquisition from international travel are possible
explanations. While the immediate decline in gonorrhoea notifications is likely explained in line with this, the ongoing decrease in gonorrhoea notifications could also represent a persisting change in disease transmission. This should be interpreted in the context of increasing disease notification rates prepandemic, with the gonorrhoea notification to test ratio for males remaining below 2019 and 2020 levels by the end of the study period.

One plausible explanation for the immediate decline in chlamydia and gonorrhoea notifications and testing observed at the introduction of pandemic restrictions is an interruption to health-care services. From a survey of 1058 Australians younger than 30 years of age, 262 (24.8%) responded that they delayed seeking sexual or reproductive health services during the pandemic due to concerns about contracting COVID-19. Australian respondents of another online survey reported ‘difficulties connecting with clinics’ as a barrier to accessing sexual health services via telehealth during the pandemic. Most people will not experience symptoms with a chlamydia infection and the changed practices for asymptomatic testing likely contributed to the immediate decline in notifications and testing. The increased chlamydia notification to test ratio in April and May 2020 could also be explained by a shift in testing practices to symptomatic testing.

Alternatively, the immediate decline in disease notifications and testing observed may be because COVID-19 control measures interrupted disease transmission pathways. From 1828 serial cross-sectional surveys conducted in Victoria, Australia, 55% of participants reported recent partnered sex during periods of tight restrictions, increasing to 70% when control measures were eased. The earliest survey, conducted between April and May 2020, compared respondent sexual practices at the time with their sexual practices in 2019. Of the 965 completed surveys, 53.5% of participants reported less sex during lockdown than the year prior. The reduced sexual encounters could represent an actual reduced risk of disease transmission or could have reduced people’s health seeking practices if they perceived less risk.

In addition to reduced sexual activity, COVID-19 related travel restrictions are important to consider when hypothesising changing disease transmission pathways. This is supported by research exploring sexual behaviours when travelling. A meta-analysis of 49 articles exploring travel-related acquisition of STIs found a pooled prevalence of 35% of people engaging in casual sex when travelling and 17% not using condoms. Place of acquisition is not systematically collected for gonorrhoea surveillance data in Queensland, and the proportion of gonorrhoea infections acquired overseas is not known. A risk factor analysis for females attending a Melbourne sexual health clinic between 2008 and 2015 found sex with a person from a high prevalence country to be a risk factor for gonorrhoea infection. One explanation for the continued decline in gonorrhoea notifications could be due to the closed international border. Travel restrictions may have decreased the number, and ongoing transmission, of gonorrhoea cases imported by either returning travellers or visiting tourists to Australia.

Although there may have been an interruption to increasing rates of gonorrhoea, our study identified two important areas for future consideration. First, we identified an increased age distribution of gonorrhoea notifications. Clinical STI management guidelines currently recommend asymptomatic or opportunistic screening for people aged 15–29 years. Our results indicate that clinicians could consider extending this to include people aged 30–34 years. Second, our study identified an increased rate of notifications among females aged 30–39 years prepandemic. While the introduction of dual chlamydia and gonorrhoea testing in 2007 could have contributed to increased case finding, the increasing notifications in this demographic are important as they traditionally fall outside STI management guidelines. We also found increased rates in 2021 for females aged 15–24 years. This population may have perceived less risk from severe COVID-19 disease, resulting in earlier return to usual sexual practices. This group falls within STI management guidelines, and this study is an important reminder for clinicians to routinely offer opportunistic screening.

Our study should be interpreted within its limitations. One limitation of the ITS analysis is that the regression model cannot account for other changes that may have impacted the outcome at the same time point. However, no other significant changes in STI testing or treatment are known or reported to have occurred within the same period. The ITS outcome of chlamydia notifications returned a low R2, which could represent a poor goodness-of-fit for the model. In this context, the R2 would be very low and may not be meaningful.
interpreted as the proportion of observed notifications that can be explained by the ITS model’s inputs. The pre-pandemic trend and immediate level change are statistically significant, and the R² may therefore be explained by the nature of the study data. The MBS testing data do not include all chlamydia and gonorrhoea tests performed in Queensland during the study period. Tests requested in public hospitals and some public sexual health clinics do not bill to Medicare. While MBS may not capture all testing, it likely provides a reasonable representation of testing as the majority of disease notifications in the study period were

Figure 2  Impact of COVID-19 public health restrictions on weekly chlamydia and monthly gonorrhoea notifications, and monthly combined tests reported against Medicare Benefits Schedule in Queensland. The solid line shows estimates of the segmented regression model.
reported by private laboratories that always bill to Medicare for testing.

Acknowledging these limitations, our results are an important contribution to current knowledge on the impact of the COVID-19 pandemic on STIs. The immediate decline in chlamydia and gonorrhoea notifications and testing has been similarly observed in studies that assessed the early impact of lockdown or restrictions on STIs.\(^1\)\(^-\)\(^4\) The sustained impact has varied between countries. Following the immediate decline, Belgium found no overall changes in the positivity rate of chlamydia and gonorrhoea across 2020.\(^5\) Norway, Denmark and Sweden observed a relatively quick rebound of detected chlamydia cases, while Norway and Sweden observed longer lasting decreases in reported gonorrhoea cases in 2020.\(^6\)\(^-\)\(^8\) Interestingly, increases in gonorrhoea detection were reported in both Japan and Finland in 2021.\(^9\)\(^-\)\(^10\) Our findings demonstrate the importance of continued disease surveillance during and post-public health emergencies to understand the local epidemiology of diseases. Our findings align with another Queensland-based study exploring the effect of the pandemic on STI testing and test positivity from one sexual health service.\(^11\) This service has a priority focus for gay and bisexual men, representing more than 50% of all tests performed. Further studies to understand trends among priority subpopulations, and qualitative information to understand changes in behaviours, would enrich our findings.

As pandemic priorities shift, our study indicates that STIs are still an important public health priority to be addressed. We identified changing disease patterns in gonorrhoea notifications suggesting clinicians could consider populations that fall outside priority screening guidelines. Importantly, our study provides lessons for disease surveillance and management in future pandemics. We interpret our findings in a context of changed healthcare access and changed sexual practices, including likely limitations of travel-related importations. The immediate decline in notifications and testing highlight the importance of ensuring safeguards are in place to maintain sexual health services during public health emergencies. While the frequency may be reduced, people still engaged in casual sex, and it is therefore important to promote the validity of accessing sexual healthcare services where needed in a pandemic setting.

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**Contributors** MD, SL and EF conceptualised the study. MD designed the study, cleaned all data, performed statistical analyses and interpretation and prepared the manuscript. SL and EF supervised all stages of the study, with oversight of study design, interpretation and manuscript preparation. RW provided technical statistical analysis and interpretation and prepared the manuscript. ST and EF conceptualised the study. MD designed the study, cleaned all data, performed statistical analyses and interpretation and prepared the final manuscript and approved of the final version for submission. MD acts as guarantor for this article.

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**Disclaimer** We declare that the views expressed in this submitted article are our own and not an official position of our affiliated institutions.

**Competing interests** None declared.

**Patient consent for publication** Not applicable.

**Ethics approval** This study was approved by the Prince Charles Hospital Human Research Ethics Committee (TPCH HREC Reference Number: 78992). Approval to release and use study data was assessed and granted according to the Queensland Public Health Act 2005.\(^1\)

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data may be obtained from a third party and are not publicly available. Disease notification data are available on request from Queensland Health, following receipt of required ethics, governance and Public Health Act (2005) approvals.

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**REFERENCES**


Original research


Supplementary Files
The effect of COVID-19 pandemic restrictions on chlamydia and gonorrhoea notifications and testing in Queensland, Australia: an interrupted time series analysis

Supplementary Figure 1. Residual plots used to assess autocorrelation for A) weekly chlamydia notifications, B) monthly gonorrhoea notifications, and C) monthly MBS tests
MBS: Medicare Benefits Schedule test item numbers 69316, 69317, 69319
Supplementary Files
The effect of COVID-19 pandemic restrictions on chlamydia and gonorrhoea notifications and testing in Queensland, Australia: an interrupted time series analysis

Supplementary Figure 2. Age and sex distribution of gonorrhoea and chlamydia notifications and tests in Queensland 2015–2021
MBS: Medicare Benefits Schedule test item numbers 69316, 69317, 69319
MBS tests are publicly available aggregated reports. The age groups were unable to be adjusted
Supplementary Files

The effect of COVID-19 pandemic restrictions on chlamydia and gonorrhoea notifications and testing in Queensland, Australia: an interrupted time series analysis

Supplementary Figure 3. Chlamydia and gonorrhoea notification to MBS test ratio 2019–2021, Queensland

MBS: Medicare Benefits Schedule test item numbers 69316, 69317, 69319