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SHORT REPORT
https://doi.org/10.1071/SH21231

SEXUAL HEALTH

18 months on: an interrupted time series analysis investigating the effect of COVID-19 on chlamydia and gonorrhoea testing and test positivity at the Gold Coast, Australia

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Handling Editor:
Eric Chow

Received: 22 November 2021
Accepted: 17 March 2022
Published: 19 April 2022

Cite this:
Thng C *et al.* (2022)
Sexual Health, **19**(2), 127–131.
doi:10.1071/SH21231

ABSTRACT

Background. STI rates have been reported as reduced during the height of the COVID-19 pandemic. Our study evaluates the number of *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) infections recorded relative to the number of tests performed in 2017–2021, thus accurately depicting trends over time and evaluate the effect of COVID-19 restrictions since these were implemented in March 2020. **Methods.** Data was extracted from an electronic database of pathology and clinical records used at Gold Coast Sexual Health Service (GCSHS) in Queensland, Australia from January 2017 to October 2021. Poisson regression-based interrupted time series analyses were performed for number of tests performed and test positivity over the study period. The COVID-19 period was defined as starting from March 2020 when public health directives were implemented. **Results.** CT and NG testing dropped significantly in the month after COVID-19 restrictions were brought in, by 30% and 23% respectively. Over the 5 year study period, the proportion of positive CT tests has consistently decreased by approximately 0.33% points per year ($P \leq 0.001$). The instigation of COVID-19 restrictions had no effect on this trend. The proportion of NG positive tests remained steady prior to COVID-19 ($P = 0.96$) at approximately 3.5%, decreased immediately at the onset of COVID-19 restrictions to approximately 2.5% ($P < 0.001$) and has remained at this level post-COVID restrictions ($P = 0.54$). Testing at GCSHS continued to target gay and bisexual men, accounting for ≥50% of all tests performed. **Conclusion.** Our study suggests that there has been a sustained reduction in test positivity of NG infections in the 18 months since COVID-19 restrictions were implemented, and that this is not an artifact of reduced testing. It highlights the importance of maintaining health messaging including screening for sexually transmissible infections and maintaining access to services, which may include alternative models of care such as Telehealth, self-testing and collaboration between all sexual health service providers.

Keywords: chlamydia, COVID-19, gonorrhoea, infection, public health, sexual health services, STIs, testing.

Background

Several publications have investigated the effect of the COVID-19 pandemic on sexually transmissible infections (STIs). Most international studies have reported reductions in STI rates during the height of the pandemic, which may be explained by reduction in asymptomatic testing and reduced access to services.[1–6] In addition, social distancing measures have also reduced rates of partner change in gay and bisexual men (GBM).[7]

However, there is also evidence that prevalence of chlamydia and gonorrhoea remain unchanged in men who have sex with men[8] and concern remains that shorter periods of social distancing with prolonged periods of service disruption will lead to a rebound of rates of STIs.[9,10]

Gold Coast Sexual Health Service (GCSHS) in Queensland, Australia is a publicly funded sexual health service which provides testing, management and prevention of STIs.

The service is provided at no cost to patients and targets populations at high risk of STIs including GBM and young people.

This study describes trends in *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) infections diagnosed at GCSHS over 5 years from 2017 to 2021. It reports the monthly proportion of positive tests relative to the number of tests performed, thus accurately depicting trends in test positivity. This study also describes the effect of COVID-19 on CT and NG test positivity.

Methods

Gold Coast Hospital and Health Service Human Research Ethics Committee approved this study (LNR/2021/QGC/73873).

Data were extracted from an electronic database of clinical records used at GCSHS. A monthly aggregated report was generated recording the number of CT and NG polymerase chain reaction (PCR) tests performed, including the number of positive results from 1 January 2017 to 31 October 2021. Multiple tests from an individual patient were each counted individually. Duplicates in supplemental testing were excluded. Aggregated demographic data including mean patient age, gender and sex of partners within the past 12 months were also collected.

Poisson regression-based interrupted time series (ITS) analyses were performed for number of tests performed and proportion of positive tests each month over the study period. March 2020 was chosen as the start of the COVID-19 period because COVID-19-related health directives and re-deployment of Queensland Health staff occurred during this time. For proportion of positive tests, the Poisson regression of number of positive tests was offset by the number of tests performed. ITS analyses allowed the number of tests performed or proportion of positive tests observed to be modelled, taking into consideration time, immediate COVID-19-related changes, change in trajectory following COVID-19 (COVID-19 × time interaction), and seasonality. Seasonality was modelled by inclusion of one or more Fourier terms, which are sine and cosine functions of an annual time period. The Fourier transform process enabled any annually repeated pattern to be accurately modelled. Important predictors ($P < 0.05$) of the number of tests performed or proportion positive are reported in the results and the models shown graphically. Effects are reported as incidence rate ratios (IRR); that is, the ratio of the number of tests performed per month in, for example, the post-COVID-19 group to the pre-COVID-19 group once other variables in the model have been taken into consideration. For the proportion of positive tests analyses, the IRR reported are offset for the number of tests performed and are thus equivalent to a ratio of proportions. ITS analyses were performed in Stata 17 (StataCorp LLC) using the generalised linear model command with a Poisson distribution and log link.

Results

The annual number of CT and NG tests and the number of positive tests recorded for 2017–2021 is shown in Table 1. GBM demonstrated high rates of engagement for testing, making up 60% (5933 of 9885) of all CT tests and 64% (5587 of 8785) of all NG tests in 2021. This proportion has increased by nine percentage points since 2017 (6515 of 12 785 tests, 51%) for CT tests and by 14 percentage points (4451 of 9047 tests; 49%) for NG tests.

Results from ITS analyses are summarised in Figs 1 and 2.

Fig. 1*a* shows that CT testing has consistently increased (approximately four extra tests per month; $P = 0.018$) but dropped immediately following COVID-19 (IRR = 0.73, or approximately a 30% decrease in tests performed per month; $P < 0.001$). There is also evidence of a seasonal effect ($P = 0.008$). Over the 5 years, the proportion of positive CT tests has consistently decreased by approximately 0.33 percentage points per year (IRR = 0.995; $P < 0.001$)

Table 1. Annual CT and NG tests at Gold Coast Sexual Health Service.

Infection		2017	2018	2019	2020	2021 (to October 2021)
CT	Total tests	12 785	13 661	14 229	11 358	9885
	Positive tests	757	707	741	529	466
	Test positivity (%)	5.92	5.18	5.20	4.66	4.71
	Tests by GBM (%)	50.96	52.48	53.20	56.79	60.02
NG	Total tests	9047	9460	10 424	9928	8785
	Positive tests	283	355	365	255	205
	Test positivity (%)	3.13	3.75	3.50	2.5	2.33
	Tests by GBM (%)	49.20	51.70	54.55	64.13	63.60

CT, *Chlamydia trachomatis*; NG, *Neisseria gonorrhoeae*.

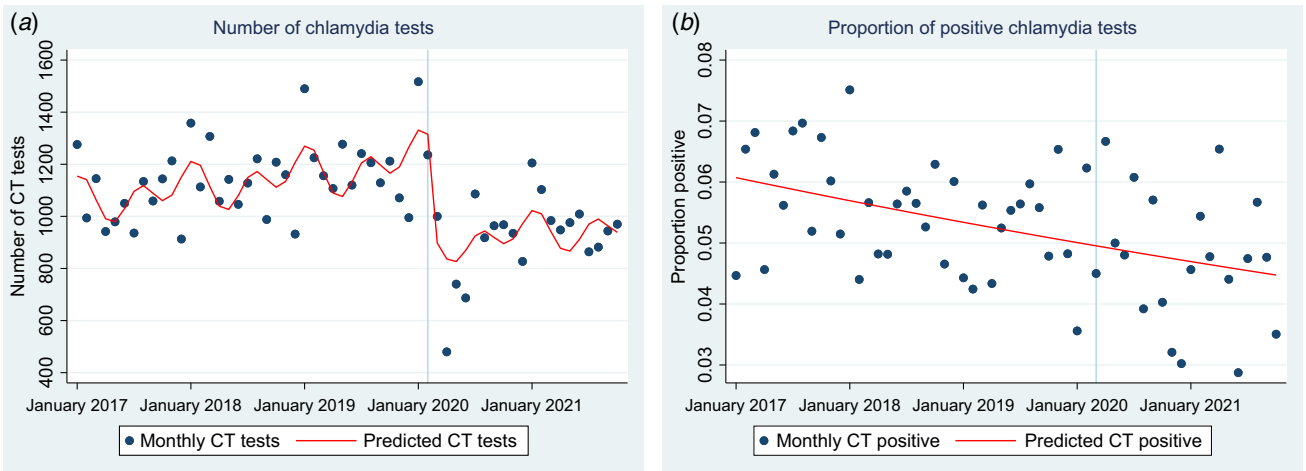

Fig. 1. *Chlamydia trachomatis* interrupted time series analysis. (*a*) Number of chlamydia tests performed, (*b*) proportion of positive chlamydia tests. Vertical blue line indicates initiation of COVID-19-related changes.

(Fig. 1*b*). The instigation of COVID-19 restrictions had no effect on this trend and there was no evidence of seasonality.

The trajectory of NG tests (Fig. 2*a*) is similar to that of the CT tests; increasing with time (approximately seven extra tests per month; $P < 0.001$), with an immediate drop after COVID-19 (IRR = 0.78, or approximately a 23% decrease in tests performed per month; $P < 0.001$), and seasonality ($P = 0.032$). Similar to CT testing, NG tests per month are still yet to reach pre-COVID-19 levels. Interestingly, unlike CT, the proportion of NG positive tests which had remained steady prior to COVID-19 at approximately 3.5% ($P = 0.96$) decreased immediately at the onset of COVID-19 to approximately 2.5% (IRR = 0.71, or by approximately 1.0 percentage point; $P < 0.001$) and has remained at this lower level post-COVID-19 ($P = 0.54$) (Fig. 2*b*).

Discussion

Australia, and particularly the state of Queensland, experienced extremely low numbers of COVID-19 cases in the community in 2020–2021.[11] In Queensland, social distancing and 'lockdown' under the *Movement and Gathering Direction* were imposed in March 2020 but eased to allow private gatherings of up to 100 people after only 3 months, and there were no further state-wide lockdowns for the rest of the pandemic. However, entry into Queensland remained restricted until January 2022.[12] At the height of the lockdown, service provisions at GCSHS were minimally effected with some reduction in staffing levels but only for 6 weeks and COVID-safe plans were implemented to allow safe access to STI services. In addition, the reduced demand and pivoting to new models

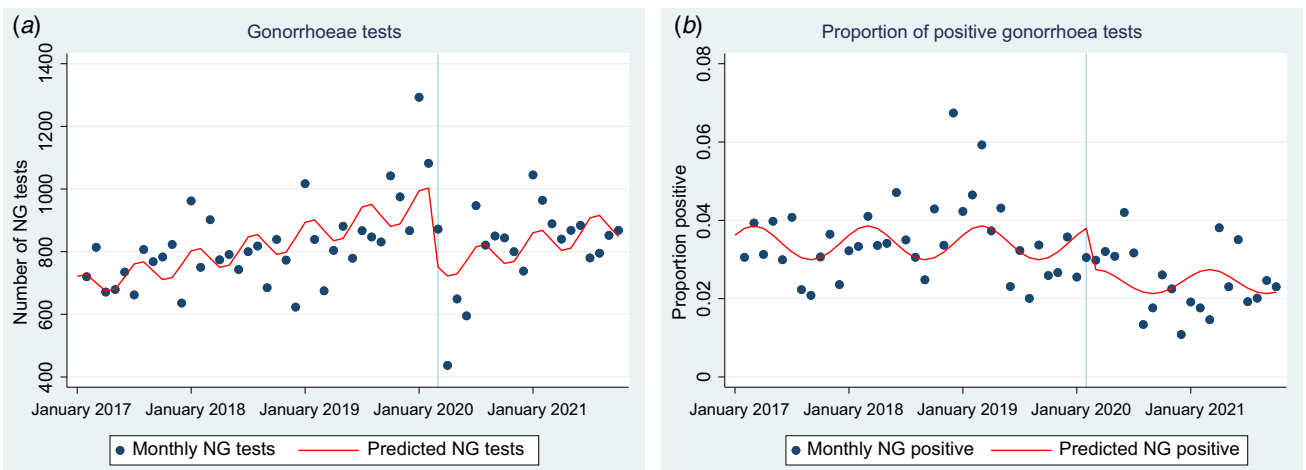

Fig. 2. *Neisseria gonorrhoeae* interrupted time series analysis. (*a*) Number of gonorrhoea tests performed, (*b*) proportion of positive gonorrhoea tests. Vertical blue line indicates initiation of COVID-19-related changes.

of care (e.g. Telehealth) during that period meant that contingency plans to reduce services due to staffing capacity did not have to be implemented, and all aspects of STI care (testing, treatment and prevention) could continue unrestricted.

Testing

Routine sexual health screening decreased during the COVID-19 pandemic worldwide.[13–16] In Australia, a study from Melbourne showed a 68% reduction in asymptomatic screening related to COVID.[16] In our study, CT and NG testing dropped by 30% and 23% respectively during COVID-19. At GCSHS, although testing capacity resumed quickly, demand for testing has not yet returned to that seen pre-COVID-19. Testing continues to target high-risk populations, and the proportion of tests by GBM continued to increase in 2020 and 2021. This may reflect successes in health promotion campaigns, which have led to familiarity and engagement with testing when accessing HIV pre-exposure prophylaxis (PrEP)[17] and current Australian guidelines, which recommend high frequency and multi-site testing for GBM.[18]

Infection

Trends in NG and CT test positivity were interestingly different. It was observed that CT test positivity seemed unaffected by the COVID-19 restrictions, continuing on a steadily declining trajectory while the proportion of positive NG tests, which had remained unchanged in 2017–2020, immediately decreased after the beginning of COVID-19 and has remained at this new lower level.

Due to this study measuring the number of NG infections against the number of tests, it is unlikely this decrease is fully attributed to reduced testing. NG test positivity dropped from 3.5% to 2.5% post-COVID. This lower positivity has been sustained over the past 18 months despite rates of testing increasing. Instead, the decreased NG test positivity may be due to a combination of (1) ongoing access to services including timely treatment of NG infections to reduce ongoing community transmission; (2) resumption of screening by high-risk populations e.g. GBM post-COVID-19; (3) a period of assumed reduced risk (reduced rate of partner change); and (4) reduced introduction of new infections as entry into Queensland remains restricted.

Local surveillance data (pers. comm.) shows no 'displacement' of patients from primary care to GCSHS or vice versa.

Jenness *et al.*[10] demonstrated that if disruption of services and sexual risk both occurred over an 18-month period, there would be net protective effect for infections. However, prolonged periods of service disruption with shorter periods of social distancing would lead to a large increase in STIs over 5 years.

Our study supports this modelling, with GCSHS placed in a fortunate circumstance of minimal and shorter periods of service disruption relative to longer periods of social distancing and even longer periods of border entry restrictions.

Our study is limited by using aggregated data and we are unable to identify the reason for the ongoing reduced testing post-COVID, or whether there is reduced testing in specific populations at risk of STIs (e.g. young people (aged <29 years) and GBM) or asymptomatic testing. Also, we did not measure changes in sexual risk in this study, although reduction in partner change during COVID-19 has been reported in the literature.[7]

Conclusion

Our study suggests that there has been a sustained reduction in test positivity for NG infections in the 18 months since COVID-19 restrictions were implemented in March 2020, and that this is not completely an artifact of reduced testing. Instead, this may be a result of minimal service disruption and rapid re-engagement of GBM into STI care in the context of longer periods of social distancing, border restrictions, and potentially sexual behaviour risk reduction in high-risk GBM, which may have resulted in a sustained decrease in NG infections. We now face further threats of disruption to health care with the emergence of the Delta and Omicron variants of COVID-19 while social distancing and travel restrictions continue to ease. Now, more than ever, support to maintain access to care particularly for our target populations, health promotion messaging to encourage testing, and engagement of high-risk populations in STI prevention will be crucial to mitigate the risk of a large rebound in STIs.

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Data availability. The data that support this study will be shared upon reasonable request to the corresponding author.

Conflicts of interest. The authors declare no conflicts of interest.

Declaration of funding. This research did not receive any specific funding.

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