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# Defining the peak: Point prevalence of SARS-CoV-2 using randomised sampling

Andre L Wattiaux, Fiona May, Terresa Allen, Tracy Bladen, Brielle Pery, Lisa McHugh, Vicki Slinko, Alice Sykes, Lashan DeSilva, Jay Bajra, Ross Andrews, Gulam Khandaker

## Abstract

Since Queensland eased border restrictions to the rest of Australia on 13 December 2021, notified cases of Coronavirus disease 2019 (COVID-19) dramatically increased, with the SARS-CoV-2 Omicron variant now the most widespread variant of concern: 145,881 cases and 13 deaths were recorded in Queensland in the month following the opening of the border. For an effective public health response to a highly transmissible disease, it is important to know the prevalence in the community, but the exponential increase in cases meant that many with symptoms had difficulty getting tested. We implemented a surveillance program on the Gold Coast that used a modified randomised household cluster survey method to estimate the point prevalence of individuals with SARS-CoV-2 detected by polymerase chain reaction (PCR). The estimated point prevalence of SARS-CoV-2 detected by PCR on self-collected swabs was 17.2% on the first visit to households (22 January 2022). This subsequently decreased to 5.2% (5 February 2022) and finally to 1.1% (19 February 2022). Out of 1,379 specimens tested over five weeks, 63 had detected SARS-CoV-2 and 35 (55.6%) were sequenced. All were SARS-CoV-2 variant: B.1.1.529 (i.e. Omicron). This surveillance program could be scaled up or reproduced in other jurisdictions to estimate the prevalence of COVID-19 in the community.

Keywords: SARS-CoV-2; prevalence; randomised survey

## Background and methods

Prior to 13 December 2021, Queensland had recorded 2,345 cases of COVID-19 and seven COVID-19 related deaths. With the global rise of the SARS-CoV-2 Omicron variant of concern, and the opening of the Queensland borders to southern states, 145,881 cases and 13 deaths were recorded in a single month (13 December to 14 January 2022).

In Queensland, case ascertainment relies on notifications of PCR confirmed cases of COVID-19 to public health authorities. However, as in other parts of the country where a rapid surge in cases was witnessed over a few weeks, the demand for testing exceeded testing capacity. Without rapid and reliable PCR testing, daily case notifications were not a reliable reflection of the true community burden of disease. There

has also been an increase in hospital and intensive care unit (ICU) admissions due to COVID-19 since the Queensland borders opened. Hospital/ICU admissions have been used as a surrogate measure to ascertain the actual population prevalence/burden of COVID-19 at a given time. However, no population point prevalence data have been reported in Australia to date.

Estimation of prevalence of a disease is a fundamental measure in the descriptive epidemiology of outbreaks and contributes to an effective public health response. We developed and implemented a surveillance program on the Gold Coast to provide information on the transmission dynamics of the virus. These results can then be matched against the pre-existing parameters of hospitalisations/ICU admissions.

We used a modified randomised household cluster survey method to estimate the point prevalence of individuals with SARS-CoV-2 detected on PCR.<sup>1</sup> Quantum Geographic Information System (QGIS v3.10.1) was used to randomise points within each Statistical Area Level 3 (SA3) of the Gold Coast City Council area (Appendix A, Table A.1). In one instance, an SA3 was divided in two in view of significant population growth since creation of the SA3 areas. The closest residential street address was found for each point. Trained workers attempted participant recruitment of persons who opened the door for that household, then every second household in a randomly selected direction from that address. Only one person per household was recruited for PCR testing with the aim of recruiting 400 participants. Consent was obtained from that person if they were over 18 years of age. Participants were observed self-collecting nasopharyngeal swabs for PCR testing. In addition, rapid antigen tests (RATs) were provided for household members to test themselves and report the results through an online form. New households were recruited every week for five weeks and existing participants with negative tests in the previous week were revisited to obtain a new sample. Only testing on the same person in subsequent weeks were included in the analysis. The surveillance program was conducted under the Queensland Public Health Act.

A detailed summary of results will be reported once final analysis is completed including correlation with hospital/ICU admissions.

## Results

Preliminary results for the five weeks of the program can be found in Table 1.

The median age distribution for all participants was 52 years old. The rate of households consenting ranged from 25.5% to 44.1% across the ten areas. The estimated point prevalence of people with SARS-CoV-2 detected on self-collected PCR tests was 17.2% on the first visit (22 January 2022) and subsequently decreased

to 5.8% (29 January 2022), 5.5% (5 February 2022), 2.4% (12 February 2022) and finally 1.1% (19 February 2022). Out of 1,379 specimens tested over five weeks, 63 (4.5%) were positive for SARS-CoV-2, 35 (55.6%) sequenced and all were Omicron variant.

## Discussion

This surveillance data showed a decrease in COVID-19 rates over the five weeks of the survey which is consistent with a decrease in rates of hospital/ICU admissions for COVID-19 on the Gold Coast. To our knowledge, this is the first time a modified randomised household cluster survey method has been used to describe the prevalence of SARS-CoV-2 in Australia. The design is derived from cluster survey methods used in low- and middle-income countries to estimate the prevalence of conditions or immunisation status.<sup>2</sup> Our experience is that this type of community surveillance can have a role in the provision of basic epidemiological data such as prevalence or incidence during a significant surge of cases. Also, the correlation of these findings with temporally related hospitalisation data may provide an estimate of the proportion of people infected with B.1.1.529 variant requiring hospital/ICU admission in the Australian context.

While possibly generalisable to the entire city, these results may not be representative of the pattern across the state or the rest of the country. There was an under-representation of people aged less than 40 years when compared with Gold Coast age distributions (data not shown). The survey was conducted on Saturdays; this may have contributed to an over-selection of older people, as younger people may be more likely to be out with activities. Gated communities were excluded for logistical reasons. The selection may also not be representative of the distribution of high- versus low-density accommodation on the Gold Coast.

**Table 1: Preliminary results for the five weeks of the surveillance program**

	22 January 2022	29 January 2022	5 February 2022	12 February 2022	19 February 2022
Total number of houses visited	463	555	776	901	987
Total number of houses who answered the door and consented to participate <sup>a</sup>	118 (25.5%)	244 (44.0%)	334 (43.0%)	397 (44.1%)	405 (41.0%)
Number of households that had been visited previously	—	97 (39.8%)	164 (49.1%)	262 (66.0%)	307 (75.8%)
Number of households tested by PCR	116	225	308	369	361
<b>Results by people PCR tested</b>					
Median age of people (with ranges) who were tested (in years)	52.5 (21–88)	53.0 (17–88)	53.0 (18–92)	53.0 (20–92)	56.0 (16–92)
Number of people positive	20	13	17	9	4
Point prevalence of individuals with a PCR test detected for SARS-CoV-2	17.2%	5.8%	5.5%	2.4%	1.1%
Number of people positive who previously tested positive (includes self-reported RATs)	3 (15.0%)	5 (38.5%)	10 (58.8%)	4 (44.4%)	1 (25.0%)
Number of people positive who were symptomatic on collection day: n (%)	4 (20.0%)	6 (46.2%)	5 (29.4%)	3 (33.3%)	1 (25.0%)
Number of people positive and unvaccinated: n (%) <sup>b</sup>	4 (20.0%)	1 (7.7%)	3 (17.6%)	0 (0.0%)	0 (0.0%)
Number of people tested who were tested in a previous week	—	77	144	311	265
Number of people positive among repeated swabs	—	1 (1.3%)	6 (4.2%)	4 (1.3%)	1 (4%)
<b>Results by household</b>					
Number of household with at least one positive test either on PCR or RAT: n (%)	22 (18.6%)	14 (5.7%)	20 (6.0%)	18 (4.5%)	7 (1.7%)
<b>Gold Coast case counts</b>					
Average number of cases of COVID-19 notified per day for that week in Gold Coast (PCR)	1,451	935	553	297	238
Average proportion of PCR positive tests among people who were tested that week	39.6	33.8	29.5	20.0	22.0

a These numbers include both newly recruited households and previously recruited households for each collection day.

b Regardless of previous result.

The role of symptoms in individuals is unpredictable in a willingness to participate. People may be concerned about having to isolate after a positive test (decrease in acceptance) or may want to confirm if their symptoms were due to COVID-19 (increase in acceptance). Observed self-collection of nasopharyngeal swabs for PCR has previously been shown to be a comparable alternative to healthcare worker collected samples.<sup>3</sup>

The prevalence reflects people with a positive test for SARS-CoV-2 and not whether these are active infectious cases. Some of these positive cases may be previous cases still shedding virus, as indicated by the people reporting previous positive tests, some weeks before their positive test during this program. Analysis of the PCR cycle threshold (CT) values may help in clarifying this.

With the decreasing rate of people presenting for PCR testing and the availability of rapid antigen tests,<sup>i</sup> it is unlikely that positive COVID-19 cases from PCR notifications will ever again be a reliable tool for case ascertainment. We have developed and implemented a surveillance program which could be scaled up or reproduced in other jurisdictions to estimate the point prevalence of SARS-CoV-2 in the community during or ahead of a significant surge in cases. This may have particular benefit during subsequent waves of the existing pandemic. This method could also be adapted to create a sentinel surveillance system with potential to monitor for a signal surge of cases of COVID-19 and forewarn of another wave of cases, providing health systems with additional preparation time.

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i Personal communication: EpiCOVID-19 Team, COVID Public Health Response Division, Queensland Health.

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## Appendix A

Table A.1: Included SA3 areas in Gold Coast region with population

SA3 name	Population
Mudgeeraba - Tallebudgera	36,681
Surfers Paradise	46,980
Robina	55,211
Coolangatta	58,850
Southport	63,967
Broadbeach - Burleigh	67,014
Gold Coast - North	72,214
Nerang	72,274
Ormeau - Oxenford	157,455