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Testing for COVID-19 in NZ to achieve the elimination goal

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In this blog we raise ideas for how New Zealand might optimise testing to both identify cases in the community as part of the COVID-19 elimination strategy, and to confirm when the virus has been completely eliminated from the country. These are urgent issues to clarify in order to minimise time spent under lockdown conditions and allow the economy and health system to return to more normal functioning. The priority is to continue testing symptomatic people, with the sensitivity of case detection expanded by steadily broadening the case definition and ensuring wide geographic and demographic coverage. After that, testing to assess the elimination goal could involve testing of higher-risk exposed groups, potentially using pooled specimens and serology, along with sewage testing.

Along with a few Asian countries, NZ has adopted an elimination strategy towards the COVID-19 pandemic (as some of us just recently detailed in a *NZ Medical Journal* Editorial [1]). We have been fortunate in having political leaders who made rapid decisions informed by scientific advice and modelling work [2]. While NZ had initially been relatively slow to scale up testing (partly due to access to test kits), this is now underway and, along with changes in the case definition, has allowed for a shift to testing more potential cases in the community. Given this background, this blog describes four broad testing approaches, each of which has a different sampling base and different relative contribution to case management, case finding, and assurance of elimination.

Critical characteristics of COVID-19 to first consider

There have been clusters of COVID-19 cases in the NZ community and some cases have had no links to other known cases or to overseas travel. But the true number of undetected cases in the community is quite possibly much higher as one international study estimated 5-10 undetected cases per detected case [3]. Furthermore, a majority of symptomatic cases appear to have relatively mild symptoms [4] and possibly around a half of infected people have no symptoms at all (based on: cruise ship data [5], and a report from Iceland [6]). These features mean that only a small fraction of cases of COVID-19 will come to medical attention in either primary care or as hospital admissions.

Additionally, cases may remain undiagnosed through incomplete test sensitivity eg, estimated at 70% for a RT-PCR test, as per one study [7]. Identifying COVID-19 cases will also become more difficult as we head into winter and other respiratory pathogens begin to cause an increasingly common background of patients with similar symptoms.

1) Testing of moderate and severe cases to ensure appropriate diagnosis and care

This is the population of people infected with COVID-19 who are sick enough to self-present to community-based assessment centres (CBACs) or directly to hospital, often following advice from Helpline. It seems likely that under 2% of COVID-19 cases are sufficiently ill to need hospital care (though the NZ experience to date of a very low proportion being hospitalised is biased due to most cases being in relatively healthy travellers). It is essential that diagnostic testing occurs for this group of sick people for determining the appropriate individual-level treatment and management. It is also especially important that these cases are appropriately diagnosed and managed so that the risk of them infecting healthcare workers is minimised. Identifying such cases should also trigger testing of their contacts.

2) Testing of symptomatic people as part of expanded case-finding to assist elimination

This is the population of people with COVID-19 symptoms who are not particularly ill. Some are already presenting to the 100 or so CBACs operating around NZ (with relatively good geographical spread), as well as testing in some general practices. The main purpose of testing this group is to support case-finding. This allows such cases to be isolated and for their contacts to be traced and placed into home quarantine. This population also provides a useful base for assessing achievement of the elimination goal. Both the case-finding goal and the achievement of elimination goal, could be supported by a series of extensions to this system. While the best approach will need to be determined by a team of surveillance-

orientated infectious disease epidemiologists, clinical microbiologists and experts in statistical sampling, we offer some initial ideas:

- This population could be expanded in a step-wise manner by widening the case definition and prioritisation of who should be tested, based on adjusting the Ministry of Health guidelines for providers [8]. The scope of testing could be made more representative by widening the geographic and demographic groups covered. For example, by using mobile CBACs that go into more deprived areas where household crowding is high and people may typically have barriers (such as access to transport) to attending other CBACs. There could also be targeted messaging to the public and engagement with community leaders in these areas to encourage attendance for testing.
- Very detailed analysis of testing results could be used to identify adjustments to all sampling dimensions (geographic, demographic, symptom profiles) to enhanced sensitivity.
- Other surveillance sources could be used to identify 'hot spots' of potential COVID-19 infection, notably the syndromic surveillance system FluTracking [9], which uses text-based reporting from almost 45,000 participants across New Zealand (https://info.flutracking.net/).
- The daily update of aggregated testing results could follow the high quality style used by Icelandic health authorities (https://www.covid.is/data).

3) Testing of asymptomatic people identified based on their elevated risk of exposure to assist elimination

This is testing of the population of people who are identified only through having a higher level of exposure to potentially infectious people than the wider population. Key groups could include: (1) asymptomatic contacts of cases; (2) healthcare workers; and (3) other essential workers who continue to have regular proximity to others during the lock-down (eg, supermarket workers, other retail outlet workers and transport operators). In these cases, testing could also specifically target younger essential workers on the assumption that they may be having higher levels of social mixing and be more readily exposed to the virus.

Here testing is moving more towards supporting the elimination assurance function, as the transmission potential of asymptomatic cases is currently still unclear [10]. There could be efficiency gains by using pooled sampling techniques for PCR testing which preserve reagents and involve only a modest reduction in sensitivity (as being done in Israel [11]). (Though with this pooled sampling there is still enough initial sample retained to allow individual cases to be identified if a positive result is obtained in the pooled sample.)

Testing for the presence of SARS-CoV-2 in these groups would be expected to have lower sensitivity and have very low yields (at least for the current NZ situation). Optimal testing approaches here require further careful deliberation.

4) Testing to confirm that the goal of elimination has been reached and is being sustained

A final level (but which could still start as soon as possible), would be testing to scientifically ascertain that elimination had been achieved. Possibly the most efficient way to do this would be via sewerage system sampling at a town and city level – if the favourable early work on this approach in the Netherlands, Sweden and the USA [12],

proves to be feasible for NZ. Fortunately, NZ scientists are experienced with this approach for detecting poliovirus in sewage [13]. Elsewhere, sewage has also been monitored to detect outbreaks of norovirus, antibiotic-resistant bacteria, and measles [12].

If the sewerage system sampling approach was not feasible, then larger samples of essential workers and other higher risk populations (as detailed above) may be required, along with further possible upgrades to the surveillance system. There would also need to be statistical and epidemiological advice on what level of confidence (eg, 95% or 99%) might be required for a DHB district, or region or large island level (North Island, South Island) to be declared “free of virus”, and so inform government decisions around lifting various restrictions.

At the same time, a separate set of testing approaches will be needed to support measures to keep COVID-19 out of NZ. These measures will be focussed on supporting the management (usually with quarantine) of arriving passengers and air crews to provide a high level of assurance that COVID-19 is being excluded at the borders. Testing to support these measures is beyond the scope of this blog.

Closer to the point of elimination of COVID-19, a phased removal of restrictions on economic activity will start, a process that may last many months. It will be essential during that period to have in place the means to provide public confidence in government’s capacity to ensure that if any isolated cases arise (eg, from border control failures) are not a reversal of elimination. Managing the oversight of COVID-19 risk as well as the public’s welfare during the very essential recovery brings difficult political choices, and building confidence in these needs to be founded on trustworthy statistics based on measurement processes that have to be more frequent and timely than we are used to.

Conclusions

The surveillance approaches described above have the potential to contribute to both achieving COVID-19 elimination in NZ and then ongoing assurance that elimination has been maintained. The exact mix of approaches used requires further careful expert deliberation, and will change as we move towards, and then hopefully achieve, elimination.

Successful, sustained elimination of COVID-19 also depends on border controls and systems for rapid case and contact follow-up operating at very high levels of performance. Such systems need to be supported by effective use of digital technologies, including mobile phones [14]. These critical activities also have their own sets of surveillance indicators that need to be operating and reporting, just as much as the systems of testing described here, before New Zealand can consider moving out of lock-down.

Disclaimer: This blog represents the views of the authors in their independent or university capacity only. This includes those two authors who also have roles advising the Ministry of Health (AK and MB).

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