MINISTRY OF HEALTH
MANATŪ HAUORA

Briefing

Update on current COVID-19 surveillance tests and tools

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To:	Hon Chris Hipkins, Minister for COVID-19 Response		
CC:	Hon Dr Ayesha Verrall, Associate Minister of Health		

Contact for telephone discussion

Name	Position	Telephone
Ian Town	Chief Science Advisor	s 9(2)(a)
Gill Hall	General Manager, Science & Insights COVID-19 Health System Response	s 9(2)(a)
Sue Gordon	Deputy Chief Executive, COVID-19 Health System Response	s 9(2)(a)

Action for Private Secretaries

N/A

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Update on current COVID-19 surveillance tools

Purpose

1. This report responds to your request for an update on the Surveillance Strategy and Testing Plan in the context of the increased global prevalence of COVID-19, new variants, the rapidly emerging scientific evidence and our experience to date.

2. This report will also inform the COVID-19 testing strategy over the coming months, as vaccination is rolled out and trans-Tasman and Pacific travel increases. Each of the main testing technologies to detect COVID-19 is described and evaluated in terms of how it can enhance New Zealand's Surveillance Strategy (Ref. 20202029), which was approved by Cabinet in December 2020.

3. We also report on the development of surveillance tools, including the recently implemented mapping system that the Ministry and DHBs can use to rank the need for testing in each region, based on the likelihood of undetected cases, the potential for exposure and transmission, and the potential consequences of an outbreak in each community.

Background

Testing sits at the foundation of the Elimination Strategy

4. All pillars of the Elimination Strategy rely on testing to inform the surveillance and detection needed to minimise the effects of COVID-19 on New Zealand.

    a. "Keep it out" border controls rely on surveillance testing in countries of departure; pre-departure testing of travellers; and case detection at the air and sea borders and through Managed Isolation and Quarantine Facilities (MIQF)

    b. The "Prepare for it" pillar relies on detection and surveillance to ensure cases are detected and transmission is controlled.

    c. "Stamp it out" identification and stopping of each transmission chain relies on case detection testing, then on surveillance testing of contacts and asymptomatic individuals in the community. It now also uses genomic sequencing and wastewater testing for case detection and surveillance, and serology (blood) testing to confirm infection status in suspected cases.

5. As New Zealand's vaccination programme proceeds, we should increase the use of some testing types and potentially reduce our reliance on others.

6. Annex One and Two of this report describe the 'toolbox' of tests and strategies that are now available for us to choose from in the months ahead. Annex Three describes a new tool that ranks regions across New Zealand by their priority for testing.

Surveillance tools get the right information to the right people

7. Public health surveillance is the systematic ongoing collection, management, analysis and interpretation of data followed by the timely dissemination of that data to inform public health action.

8. The Ministry of Health working with ESR, DHB Public Health Units, and other agencies is constantly reviewing, upgrading and adding to the suite of testing and surveillance tools.

9. Surveillance tools include identification of new data sources; the development of models to interpret that data and inform operational decisions (such as travel restrictions); and new and improved ways to present information to decision-makers and the general public.

Testing strategies need to adapt to vaccination, viral variants, and increasing international travel

10. The "toolbox" of test settings is summarised in Table 1; test technologies are summarised in Table 2. The report's Annexes One and Two expand on each test setting and technology, giving their current use, strengths and limitations, and future utility.

11. To date, New Zealand has relied on **PCR testing of nasopharyngeal swabs** (NPS) as the main test for case detection and pre-departure testing. **Whole genomic sequencing** is used to understand and track transmission chains. **Serology testing** has had limited use, as a follow-up for diagnosis of cases suspected to be historical. **Wastewater testing** has recently been added to give assurance that outbreaks are being contained.

12. As international travel increases, there will be demand for methods that enable test results to be returned closer to the time of departure, such as **point-of-care testing** despite the risk of lower quality standards. Technology options for point-of-care testing are discussed more below.

13. Vaccination will likely increase the demand for less invasive testing of border workers and other regularly tested populations. It may be appropriate to supplement nasopharyngeal swabs with **PCR testing of saliva**, and to start **point-of-care testing** in those groups.

14. **Serology testing** of blood samples, including finger-prick samples, may also be acceptable for pre-departure testing in vaccinated travellers. Planning for **seroprevalence surveys** may be helpful, in case they are needed to understand outbreaks of existing or new variants in a partly or fully-vaccinated population or region.

15. In addition to its current role of detecting new cases in a region, wastewater testing could be used in the long-term to detect infections in a vaccinated, low risk country. It can also monitor any circulation of viral variants.

16. Other **emerging test technologies** are reviewed in this report. As they are evolving so rapidly, it is important that we keep a watching brief on international and local developments and consider when and if each technology should be deployed.

Table 1: Key points on test settings

Setting	Usage, key points, and status
Managed isolation testing	- current NPS testing of guests at Days 0/1, 3 and 12 - regular testing of facility staff, saliva tests being integrated - genome sequencing of positives to study transmission & origin
Pre-Departure testing	- implemented in early 2021 for all NZ arrivals - may limit the most infectious people from boarding planes - does not replace the need for border control using NZ-based tests and isolation
Asymptomatic testing	- used primarily at border to detect asymptomatic COVID-19 cases in workers and guests - used to test contacts of cases during community outbreaks - may be used more once population is mostly vaccinated
Point-of-care (POC) testing	- rapid testing speeds up response(s), performance will suffer - increasingly used at hospitals & airports (antigen, PCR, LAMP) - may have some utility in screening workers and goods rapidly
Wastewater testing	- ESR has established sampling protocols and know-how - 18 NZ-wide wastewater monitoring sites have been piloted - capacity exists to support community outbreak investigations
Environmental swabbing	- has been used in a targeted manner during outbreak investigations - may be used for screening export goods if required by other countries - could be used more to understand MIQ transmission routes - under review by Ministry for Primary Industries

Table 2: Key points on test technologies

Technology	Usage, key points, and status
PCR testing – Nasopharyngeal	- gold standard test, most sensitive, easy to automate & scale - will continue to be the mainstay of NZ testing capability - poorly taken samples can result in false negatives.
PCR testing – Saliva	- easy collection, less invasive than NPS but difficult to process - virus typically detected in saliva later than NPS. - will be increasingly used as supplementary test to NPS.
Symptomatic testing	- NPS testing of symptomatic people is vital to NZ response - presents best chance of detecting COVID-19 early - the need is widely understood by public and in workplaces
Serology testing	- currently used to detect historical cases - can determine the presence of antibodies, can be quantitative - will increasingly be used to determine correlates of protection

Technology	Usage, key points, and status
Genomic testing	- a vital tool in determining transmission chains and source - part of global effort to identify and track viral variants - will be used to monitor escape mutations in vaccinated NZ.
Antigen testing	- can rapidly detect viral proteins but assays can lack sensitivity - false positive/negative rates are uncertain - NZ is looking to regulate the import of these rapid tests
LAMP testing (isothermal)	- a test for viral RNA but occurs at low (or room) temperatures - can be rapid and sensitive but underperforms c.f. NPS-PCR - Likely to be increasing used as a POC test in a variety of settings

Principles for choosing when and where to use each kind of test and strategy

17. There are principles in epidemiology that guide decision making on our approach to testing in different epidemiological contexts. Table 3 outlines the risk-based approach to testing in three broadly different epidemiological contexts.

18. While it is possible to find commonalities in the surveillance and testing approach that will apply to all clusters, each community outbreak in New Zealand has required a different suite of testing and surveillance tools based on the specific epidemiologic patterns and risk assessment. For example, the recent Papatoetoe High School cluster with hundreds of students required a different response than previous clusters.

Table 3 Prioritisation of populations for testing in different epidemiological contexts

▲ = work underway or required	**1: No transmission in the community** *Cases being detected only in returned travellers in MIQ*	**2: Community Transmission** *Sporadic cases & clusters, through to wide-spread community transmission, with laboratory testing and public health capacity meeting testing demand*	**3: Community Transmission placing burden on response capacity** *Widespread community transmission, with testing demand exceeding laboratory, public health and health system capacity*
People with COVID-19 compatible symptoms	High Priority for testing - particularly people presenting to hospital and primary care with pneumonia or acute respiratory infection.	High Priority for testing – particularly in areas where there is concern about potentially undetected chains of transmission, either because of known cases or low rates of testing ▲ *Mapping ranks areas for testing priority*	High Priority for testing - particularly in areas where there is concern about potentially undetected chains of transmission, either because of known cases or low rates of testing ▲ *Mapping ranks areas for testing priority*
People with known recent exposure to SARS-CoV-2 (asymptomatic)	High Priority for testing e.g. exposed staff and those within the same family bubble in an MIQ facility	Close and 'Casual plus' contacts tested regardless of symptoms as part of contact tracing. Source investigation	May be rationalised to protect laboratory capacity. Maintaining rapid turnaround time for test results is critical. Labs to prioritise turn around for people who are at higher risk of exposure e.g. close contacts ▲ *Develop guidance to inform the prioritisation of testing*

▲ = work underway or required	**1: No transmission in the community** *Cases being detected only in returned travellers in MIQ*	**2: Community Transmission** *Sporadic cases & clusters, through to wide-spread community transmission, with laboratory testing and public health capacity meeting testing demand*	**3: Community Transmission placing burden on response capacity** *Widespread community transmission, with testing demand exceeding laboratory, public health and health system capacity*
People at higher risk of exposure to SARS-CoV-2 (asymptomatic)	Regular testing, includes returning travellers and border / MIQF workers	As per 1, including 'casual contacts' of cases in occupational or other settings and potentially those in particular workplaces and institutional settings, on Public Health advice (which escalates casual contacts to "casual plus"). Source investigation	As per 2. Prioritise people at higher risk of more serious disease outcomes and those who pose the highest risk of spread, to protect laboratory capacity. ▲ *Develop guidance to inform the prioritisation of testing*
People in high risk and special risk-settings including where disease transmission is likely (asymptomatic)	Not recommended unless they meet one of the other criteria above Industry may carry out its own surveillance in workplaces (eg, temperature and health checks)	Testing around a single case or outbreak Potentially routine screening on Public Health advice. Industry may carry out its own surveillance in workplaces (eg, temperature and health checks)	Testing within this group prioritised for people who have a higher risk of contributing to transmission. Any industry-led workplace screening should be put on hold. ▲ *Asymptomatic testing protocols would inform who and how to test higher risk individuals*

▲ = work underway or required	**1: No transmission in the community** *Cases being detected only in returned travellers in MIQ*	**2: Community Transmission** *Sporadic cases & clusters, through to wide-spread community transmission, with laboratory testing and public health capacity meeting testing demand*	**3: Community Transmission placing burden on response capacity** *Widespread community transmission, with testing demand exceeding laboratory, public health and health system capacity*
Asymptomatic testing of low risk populations	Not recommended unless they meet one of the other criteria above	Not recommended	Not recommended in likely NZ scenarios. In situations where transmission is very widespread and testing access is constrained, a well-designed sample survey may be useful to determine the prevalence of infection in the community. ▲ *Asymptomatic testing protocols would inform how to sample the population for prevalence*

Adapted from https://www.health.gov.au/resources/publications/coronavirus-covid-19-testing-framework-for-covid-19-in-australia

Ministry of Health is expanding the suite of other Surveillance tools for staff and DHBs

19. A "**testing prioritisation map**" has been put into production. It informs Ministry and DHB Public Health Units about which areas to prioritise for active testing, based the risk of transmission and the risk of consequences of infection in each place. An example of its ranking compared to current testing rates is in *Annex Three: Prioritising regions for testing*.

20. The **Country Risk Assessment Tool** is used by MFAT and border units to inform the risk of accepting travellers from each country.

21. To support Quarantine-Free Travel Zones, we are working with the Department of Prime Minister and Cabinet, the Joint Border Agency, and others to develop a '**Traveller Risk Assessment Model**' that uses recent travel route data to predict risk for individual flights and travellers.

22. A **Scenario Tree Modelling** project is being commissioned from Landcare NZ to estimate how confident we are that each region, ethnicity and age group is truly free of COVID.

23. The Ministry has been moving all surveillance data to a common platform. High-volume data, such as the results of all COVID testing, are managed through structured databases that feed a series of **Dashboards** which display key metrics based on consistent, timely surveillance data. MoH and DHB staff have better access to up-to-date and consistent information on cases, contact tracing, testing, border compliance and prioritisation of resources.

24. The dashboards have recently been extended to display data about the progress of vaccination across the New Zealand population.

Next steps

25. Officials are working on a formal update of the COVID-19 Testing Plan over the coming weeks.

26. The Surveillance Strategy will be reviewed by June 2021. In the meantime, specific topics are updated as needed to support changes in travel and the vaccination roll-out.

27. Separate memos will seek your approval for specific changes in testing strategy, such as the proposed increase in use of saliva testing for border workers.

Sue Gordon
Deputy Chief Executive
COVID-19 Health System Response
Date:19 March 2021

Annex One: Testing in different settings

Managed isolation testing

Current Status: Testing at Day 0/1, 3 and 12 is designed for early detection of COVID-19 that travellers have acquired during transit or within a Managed Isolation or Quarantine Facility (MIQF). PCR testing of nasopharyngeal swabs is our standard, as it has the best sensitivity.

Strengths & limitations: Coupled with pre-departure testing, testing at three time-points provides an effective way to detect COVID-19 as early as possible. On occasions a person who has tested negative for COVID-19 can later test positive. Serology testing and review of the PCR test's C_T values can provide additional information about whether a case is recently acquired or historical.

Scenario of use: The frequency and testing mode of arrivals into NZ is effective and should not be modified until the wider NZ population has been vaccinated.

Future utility and development: With more transmissible variants (e.g. B.1.1.7) it is possible that if there will be such cases of COVID-19 within a facility, there should be additional testing, such as more frequent testing, or testing of people in adjacent rooms or the same floor. How the vaccination status of individuals will impact on testing regimes at the border is yet to be determined.

Predeparture testing

Current Status: Predeparture testing (PDT) was implemented early in 2021 with the aim of slowing the flow of COVID-19 infections entering New Zealand and reducing the risk of inflight transmission from returning New Zealanders.

Strengths & limitations: The main limitation of PDT is that a test needs to be conducted as close as possible to a departure date to be most effective. The logistics of ordering a test means that a 72hr window was put in place. Despite PDT there are still cases (not deemed to be historical) being detected at the border within New Zealand - which demonstrates that PDT only offers limited protection and that isolation is still required.

Scenario of use: PDT is likely to remain in-place until the vaccine has been deployed globally. Increasingly PDT may move to point-of-care testing at departure airports.

Future utility and development: PDT may be supplemented at some point in the future with serology testing that can test antibody levels, based on a blood sample. A negative COVID-19 test coupled with detection of antibodies in vaccinated travellers may be considered in the later phases of easing of border controls.

Asymptomatic testing

Current Status: Testing of asymptomatic people occurs routinely at the border (e.g. weekly testing) and in contacts of COVID-19 cases detected in the community cases or at workplaces. It has been used previously in an untargeted fashion in the wider community early in the pandemic (e.g. 'pop-up' testing at supermarkets), but this is no longer recommended.

Strengths & limitations: The strength of asymptomatic testing is that it provides additional reassurance that the virus is not circulating undetected. The main limitation is that outside of the border, the current likelihood of detecting cases is very low and needs to be weighed against the cost.

Scenario of use: Asymptomatic testing is vital at the border and will play a key role once vaccines take effect among the border workforce, as it is likely that vaccinated individuals will be asymptomatic even after contracting COVID-19. Asymptomatic testing in the community is not recommended with the exception of testing around community clusters (e.g. students and families at the recent Papatoetoe High School outbreak).

Future utility and development: Asymptomatic testing will continue to feature heavily at the border and around outbreaks – rapid, and POC testing may enable this to occur with less burden on testing staff/laboratories as well as at lower cost. Results from wastewater testing may trigger some asymptomatic testing in the community, as has been the case in Australia.

POC (point-of-care) testing

Current Status: POC testing is not currently employed across New Zealand, instead samples are sent to an accredited diagnostic laboratory for processing. No point-of-care saliva test has been validated by ESR for general use.

Strengths & limitations: The rapid turn-around time of POC testing can be of advantage in some situations. The key limitation is that POC tests typically underperform relative to tests performed in controlled laboratory conditions, with lower sensitivity giving more false negatives. Many POC tests are designed to be self-administered, this can result in misinterpretation of the result or the test protocol not being followed.

Scenario of use: POC testing is used at some overseas airports as predeparture tests. While this may be useful as it is as near as possible to the time of departure, New Zealand requires laboratory-confirmed test results. There are currently rapid pathways for urgent samples within New Zealand, but there is no move to transfer these to point-of-care.

Future utility and development: The POC diagnostic marketplace is rapidly changing. While the accuracy and sensitivity claims made by some manufacturers usually fail to be realised under real-world scenarios, it is likely that end-to-end testing platforms for viral RNA (using PCR or LAMP) will become more commonplace in the next six to twelve months, and that there will be options to progressively move this to point-of-care.

Figure 1: Wastewater testing sites, March 2021

Wastewater testing

Current Status: Throughout 2020 the utility of wastewater testing was explored as an MBIE-funded research programme led by ESR. The method has been successfully trialled at 18 locations across New Zealand (see map above). The viability of the method has been demonstrated by the frequency of positive detections surrounding the Jet Park MIQ facility.

In 2021 wastewater testing has been used in response to community outbreaks but there are active plans to integrate it into routine testing at the 18 strategic sites mapped above.

Strengths & limitations: The primary strength of wastewater lies in the fact that samples can be collected that are representative of large number of people. In overseas jurisdictions the amount of viral RNA in a sample provides an accurate proxy of the disease burden within a catchment. Screening wastewater has, in some cases, provided advanced warning of COVID-19 in the community, but it is not a replacement for symptomatic testing in the community. The key

limitation of wastewater is the lack of certainty around the sensitivity of detection (thought to be 1-10 people in a population of ~100,000) and the fact that historical cases can trigger a positive PCR result.

Scenario of use: Regular wastewater testing of COVID-19 will be used at key sites and used strategically during community outbreaks (i.e. as surge capacity). Carefully crafted public communications on the use of wastewater testing and well thought-through public health responses are needed to avoid providing false reassurance to the public that the virus is not present.

Future utility and development: As a next step, we are using the maps of testing priority rank (Annex 3) to guide where to sample wastewater during an outbreak. When borders open without quarantine, and a vaccinated population is challenged by COVID-19, wastewater will likely become one of the key tools for monitoring and community awareness. This will be especially true in regions with low vaccine uptake. The ability to sequence the RNA from wastewater will become vital as it will provide important intelligence on the variants circulating, which may impact vaccine efficacy, and on the emergence of variants that have evolved 'escape' mutations in response to the vaccine.

Environmental Swabbing

Current Status: Environmental swabbing in and around workplaces or in MIQ facilities where transmission has been detected could identify where the virus is present. It has been used sparingly in New Zealand's pandemic management when investigating outbreaks within a workplace such as Americold and LSG Sky Chefs.

Strengths & limitations: The strengths of the approach is that swabbing is a way to understand how viral RNA is vectored within high-risk settings. Examples of use include high 'touch points' at quarantine facilities and/or ventilation systems. However, its overall usefulness as a surveillance tool is limited because it does not provide insights into the presence of viable virus. Case detection must still rely on testing of individuals. Increasingly fomite transmission is being ruled out as a common mode of transmission, but it is important to consider that for a virus to be detected via a swab on a surface, it likely originated from an airborne route.

Scenario of use: If environmental swabbing is deployed in case investigations that seek to identify source or transmission mode, it needs to be deployed rapidly. Failure to do will mean that any genetic signals will have degraded.

Future utility and development: With increasing emphasis on aerosol transmission, especially with transmissible variants, the testing of air samples may become more prevalent when commissioning or retrofitting isolation facilities. It is likely that vaccine roll-out will overtake the need for environmental testing. The main utility for environmental swabbing in the short term may be for use on exported goods to 'prove' they are free of SARS-CoV-2, and thus meet other countries' export requirements. This potential use is being reviewed by the Ministry for Primary Industries.

Annex Two: Test technologies

PCR testing – Nasopharyngeal Swabs

Current Status: PCR testing of nasopharyngeal swabs (NPS) is the 'gold standard' diagnostic test for SARS-CoV-2. The method is sensitive, fast, and able to be scaled rapidly by New Zealand's diagnostic labs who are familiar with PCR. Increasingly, viral RNA isolation and PCR are being automated on laboratory robots.

Strengths & limitations: The core strength of PCR on nasopharyngeal swabs is sensitivity. Viral RNA (converted to DNA) is "photocopied", meaning that (theoretically) only a single viral copy is needed to return a positive result – it therefore has excellent analytical sensitivity. However, in practice the method still needs a good quality swab sample to be taken, and not all PCR assays are equally sensitive. Because New Zealand often seeks to detect cases early following an infection, PCR of nasopharyngeal swabs remains the best method as it is typically detected in swabs prior to detection in saliva. The primary limitation of nasopharyngeal swabs is that; (i) it is invasive and (ii) that it is possible a swab sample is poorly taken.

Scenario of use: PCR testing of nasopharyngeal swabs is the default choice for a variety of testing situations and will likely continue to be the cornerstone of New Zealand's pandemic testing. It also provides the best samples for genomic sequence (and thus variant detection). In some situations, oropharyngeal swabs are an effective substitute.

Future utility and development: In the short term it is recommended that high priority samples be analysed using the most sensitive pathways possible. This should include conducting PCR replicates and employing the most sensitive PCR assays possible to obtain the best possible limit of detection. It is likely NPS testing using PCR will become increasingly available as point-of-care tests. The cost per test will likely fall.

PCR testing – Saliva

Current Status: Testing saliva for SARS-CoV-2 is used in New Zealand as a surveillance test in some high-risk settings such as MIQF. Options are available to integrate saliva testing alongside NPS tests. Some commercial providers are starting to provide testing services, as saliva or saliva swabs are easy to self-collect (unlike NPS).

Strengths & limitations: Early on in the infection NPS generally outperforms saliva. This performance gain early in the infection is often important in the New Zealand context as we tend to test contacts soon after exposure events. Saliva as a biological substrate is far more variable than NPS. Labs have reported difficulty in processing some samples, and there are concerns that some collection methods generate aerosols during collection. The primary limitation of saliva testing is that it can return a false negative result where a NPS sample would have been positive.

Scenario of use: It is invasive to conduct NPS more than once per week. Adding additional saliva tests can add an additional layer of protection. A positive saliva sample should be confirmed with a NPS sample, primarily to obtain a good sample for genomic testing. More frequent testing using saliva is possible but comes at a cost and may put pressure on testing staff and laboratories. Counterintuitively, given the protection afforded by vaccines, the rare cases where border workers contract COVID-19 will likely be asymptomatic and thus evade 'symptomatic' detection - which reinforces the ongoing need for regular testing.

Future utility and development: It is probable saliva testing will become increasingly used as collection methods and laboratory processing becomes more refined, automated and shifted to point-of-care. In some scenarios more frequent testing will become commonplace (e.g. for inter-NPS testing of border workers) and may even be used daily in the event of an outbreak. Alignment with Australia on regular testing may become important with regard to considerations of a Trans-Tasman bubble. Beyond COVID-19 it is probable that PCR testing (and genomic sequencing) for a variety of bacteria and viruses (especially respiratory pathogens) will become commonplace using saliva samples.

Whole genomic sequencing

Current Status: New Zealand's goal is to sequence the genomes of every case of COVID-19 that reaches our borders. The rapid integration of genomic surveillance into our pandemic response has been world-class, and its importance for studying viral evolution is now well recognised.

Strengths & limitations: The strength of whole genome sequencing is that scenarios of transmission chains and sources can be interrogated. The limitation is that in some instances, the relatively slow mutation rate of SARS-COV-2 means that we cannot always tell who infected who.

Scenario of use: Genomes will continue to be sequenced in order to understand the source of any community transmission and the viral variant that is responsible for any outbreak. A tight genomic surveillance net is required in order to interrogate possible infection pathways. Through ESR, New Zealand has recently built 'wet-laboratory' capacity in Auckland and Christchurch to add to its Wellington-based hub.

Future utility and development: New Zealand should continue to characterise all the SARS-CoV-2 variants that enter the country. There will be an increasing need to monitor what variants are entering the country and whether they pose a risk to both vaccinated and unvaccinated New Zealanders.

LAMP testing (isothermal)

Current Status: Isothermal testing for COVID-19 is an alternative to using PCR although, at their core, both detect viral RNA.

Strengths & limitations: The strength of isothermal tests is that the testing can occur at a low temperature (or room temperature), which makes them more suited for use as a point-of-care test. The limitation is that isothermal methods such as LAMP are not as sensitive as PCR.

Scenario of use: New Zealand continues to explore the utility of LAMP tests but at this stage they are unlikely to displace PCR-based testing due to their lower sensitivity. It is likely airport-based testing will embrace these technologies for their rapid turn-around times.

Future utility and development: Performance improvements over the next twelve months will likely see techniques like LAMP (and variants thereof) start to approach the performance of PCR-based testing. These technologies will likely become more commonplace as testing moves out of the laboratory towards point-of-care.

Antigen testing

Current Status: Antigen testing tests for viral proteins, as opposed to PCR which detects viral RNA. Due to its low sensitivity, antigen testing has not been used in New Zealand's pandemic response.

Strengths & limitations: Antigen tests are typically rapid and can tell if a person is actively shedding the virus. For recently infected or asymptomatic people (with low viral loads) their sensitivity can be poor. Given New Zealand's low risk appetite for cases the limitations far outweigh the risks. However, if conducted frequently enough, even a low-sensitivity test can provide a good level of security as a screening test.

Scenario of use: At the current state of the pandemic there is limited value in integrating antigen testing into our testing portfolio due to its poor performance. The New Zealand context is very different to that elsewhere where high community prevalence means that even a test with poor sensitivity can still add value. New Zealand currently accepts antigen tests as a pre-departure test as it is trying to stop individuals that are actively shedding virus to board aeroplanes.

Future utility and development: It is possible that antigen tests may become more sensitive (e.g. using mass spectrometry based instruments) but there would have to be a large performance jump to compete with PCR tests. It is unlikely that antigen-based detection technologies will replace molecular tests in the next 12 months.

Serology testing

Current Status: New Zealand has some limited capacity for serology testing of blood samples to detect the presence or absence of antibodies to SARS-CoV-2. Commercial providers are rapidly developing diagnostic tests.

Strengths & limitations: The detection of antibodies can assist in establishing the timelines of infection and inform a judgement call on whether a case is contemporary or historical. The limitation is that it requires a blood sample and is not currently high-throughput. Some serology tests provide quantitative measures of antibody levels, others are simply presence or absence. Serology is not a confirmatory diagnostic test for COVID-19.

Scenario of use: In cases with high C_T values, serology can assist in assigning a case as historical. The presence of different antibodies types (e.g. IgG, IgA) can provide key information on the timelines of infection.

The other main use is in seroprevalence surveys, used to assess the immune status of populations or in specific regions. Seroprevalence surveys may be useful if there is an outbreak in a partially vaccinated population, or if there is an outbreak of a new variant of concern. Serology testing could also be useful for monitoring the immune status of exposed groups such as border workers.

Future utility and development: Serology will increasingly be used to measure if a person has sufficient antibodies to be deemed protected – this is known as a 'correlate of protection'. Rapid POC antibody testing will likely become commonplace for border workers and arrivals into New Zealand so that the efficacy of the vaccine (at an individual level) can be assessed. Sourcing commercial providers for quality serology testing (that are scalable and have secure supply chains) will become increasingly important for New Zealand.

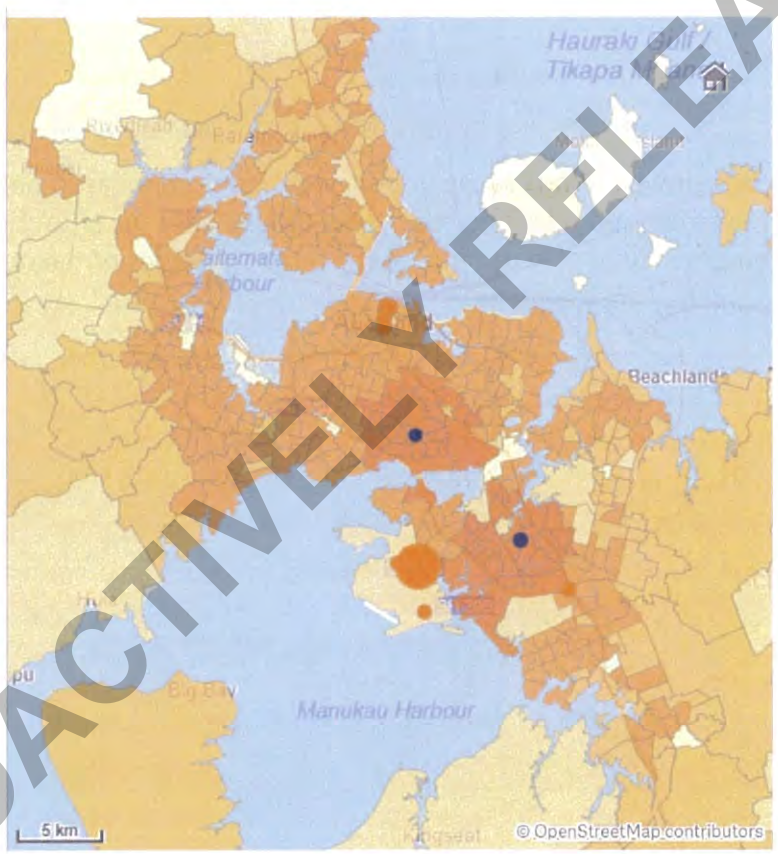
Annex Three: Prioritising regions for testing

The Ministry of Health has recently launched a first version of a mapping system that the Ministry and DHBs can use to rank the need for testing in each region.

The rankings of each are based on the likelihood of undetected cases, the potential for exposure and transmission, and the potential consequences of an outbreak in each community.

Data include: EpiSurv data on current active cases; testing results; residence of MIQ workers; surveillance of Influenza-like Illness; and background Census and national health data collections.

Figure 2: Areas ranked by priority for testing



The main use of the system during the current situation of very low to zero prevalence is to monitor testing rates compared to the overall DHB ranking. The weekly surveillance report now includes the following graphic, to inform DHB testing rate targets:

Figure 3: Community testing rate compared to prioritisation level for each DHB during the week ending 7 March 2021

Source: Éclair testing database 08 March 2021 and Testing Priority Maps 08 March 2021

The data elements and their weightings in the underlying model were based on expert opinion. The Ministry of Health is reviewing and updating the model to take account of vaccination and other changes such as the emergence of new variants of concern. Upgrades of the ranking model will be released progressively as they are developed.