

Using Rapid Antigen Tests to improve COVID-19 control in Aotearoa NZ

6 October 2021

Jennifer Summers, James Ussher, Nikki Moreland, Leah Grout , Nick Wilson, Michael Baker



Most COVID-19 testing aims to identify infected people. To date, Aotearoa NZ has relied almost exclusively on Nucleic Acid Amplification Tests (NAATs) for this purpose. However, Rapid Antigen Tests (RATs) have a complementary role, particularly if COVID-19 infection becomes widespread. In this blog we briefly describe RATs, their performance, and how they could be used to further improve Aotearoa NZ's COVID-19 response.



Figure 1: Rapid Antigen Test kit given out freely from the NHS in the UK

Throughout the COVID-19 pandemic, Aotearoa New Zealand (NZ) has largely relied on nasopharyngeal swabs to collect specimens to test for the presence of SARS-CoV-2 (the virus which causes COVID-19). These COVID-19 tests became available in NZ in January 2020^[1] and use RT-PCR (reverse transcription polymerase chain reaction [PCR]) or other nucleic acid amplification methods. These RT-PCR tests amplify segments of genetic material (such as part of the genome of SARS-CoV-2) to detect the presence of the specific organism of interest. Currently, there are two main types of publicly available COVID-19 tests in NZ:

Nucleic acid amplification tests (NAATs), including RT-PCR, transcription mediated amplification (TMA), and loop-mediated isothermal amplification (LAMP).^[2] These tests can be performed on nasopharyngeal swabs, combined oral and anterior nasal swabs, or saliva. NAATs on nasopharyngeal swabs are considered by the World Health Organization (WHO) as the gold standard for COVID-19 testing.^[2] A healthcare worker is required to collect a nasopharyngeal or combined oral and nasal swab test. NAAT tests can take anywhere from 20 minutes to 3-4 hours to process. However, the logistics of specimen transport to a laboratory, batch testing, and reporting, means that results may take a day or more from collection until communication to the end user. NAATs are classified as a molecular test.

Saliva may be preferred by some to nasopharyngeal swabs as collecting a swab can cause discomfort. Saliva testing was initially trialled in early 2021 amongst select border workers at Managed Isolation and Quarantine (MIQ) facilities in Auckland as an additional sample type along with the mandatory nasopharyngeal swabs. Since 11 August 2021, border workers have the option of having either a nasopharyngeal or saliva test. Saliva RT-PCR testing has also subsequently been rolled out for asymptomatic surveillance in other settings in NZ.

The antibody/serology (blood) test can be used to show past COVID-19 infection or vaccination, but does not accurately identify current COVID-19 infection due to the time needed for antibodies to be generated following infection (or vaccination).^[3] This testing is not discussed further here.

Another type of COVID-19 tests that are used internationally,^[4, 5] are the rapid antigen tests (RAT), which include the lateral flow antigen test, and antigen-detection rapid diagnostic test (Ag-RDTs).^[6] The NZ Government currently approves the use of NAAT (RT-PCR, LAMP, TMA) or antigen tests for pre-departure COVID-19 testing of travellers entering NZ but must be “processed by a laboratory recognised in the country of origin as authorised or accredited to conduct tests”. Furthermore, the type of test required depends on which country a traveller is coming from, for example, a person entering NZ from Australia currently needs to take a RT-PCR test.

There are currently two pilot studies of RATs in parallel with a NAAT, using 100,000 tests, that have recently been announced. One of the pilot studies is being conducted in Auckland’s Middlemore Hospital on patients arriving at the Emergency Department. It is for patients already undergoing a RT-PCR test and who also consent for the additional RAT. The details of the second pilot are being finalised but will be part of the ‘Reconnecting New Zealanders’ work and will involve people arriving at international airports.

The import of RATs was restricted early in the pandemic to prevent their inappropriate use during a public health emergency. This action was taken by Medsafe under the Medicines Act 1981, which specifies that point of care test kits are regulated as medical devices.

What are rapid antigen tests?

RATs are an alternative test to the NAATs such as RT-PCR tests. They work by detecting the presence of proteins from the virus of interest, such as influenza, respiratory syncytial virus (RSV) or the SARS-CoV-2 virus.^[4, 6] RATs for COVID-19 are available as single-use tests which are usually processed in a small handheld device. Most use a swab taken by a health care worker from the respiratory tract (usually the throat and nostrils), but some can also use saliva,^[7] with the specimen placed into a tube with a liquid solution. The liquid is then squeezed onto the test strip within the device. After 15-30 minutes, the results are displayed (much like a pregnancy test), with either a positive or negative result.

One of the advantages of RATs is that they can be conducted outside of a laboratory. Some do not need a healthcare worker to administer the test so can be conducted within the home. This approach generally reduces the cost when compared with using lab-based RT-PCR testing, and given the easier access compared to NAATs of swabs or saliva, may encourage wider public testing and quicker public health responses, particularly for communities who are high-risk and/or remotely located.^[8]

Several nations, including the UK and USA, where SARS-CoV-2 is endemic, have authorised

the use of RATs for COVID-19 in the home where appropriate for individuals (figure 1). Australia is currently rolling out RATs in high-risk areas such as Greater Sydney and Western New South Wales for individuals working in a variety of aged-care services. However, Australian officials generally require that the RAT be conducted by a healthcare worker, as they want all positive cases to be accurately reported and to then undergo further testing using a RT-PCR test. There are a large number of RAT suppliers licensed in Australia, with the cost per test estimated at ‘roughly \$5–20[AUD].’ This price is substantially lower than for RT-PCR tests.

RATs are generally considered to have lower sensitivity (that is the true positive rate) than molecular tests such as RT-PCR.^[9, 10] The ability of RATs to detect SARS-CoV-2 viral particles in individuals before the start of symptoms or later in their infection is lower than RT-PCR tests, meaning that there is a higher chance of returning a false negative result. RATs are also less likely to pick up cases amongst asymptomatic individuals. Therefore, RATs are better at detecting COVID-19 infection when there is a higher viral load.^[11, 12] Serial testing can overcome some of the limitations in sensitivity. The specificity (that is the ability of a test to correctly identify people without infection) of the best RATs is very high and not much less than RT-PCR tests.

Given the variety of RATs available worldwide with varying testing performance,^[12, 13] the WHO put out general recommendations for RATs in late 2020.^[9] These recommendations suggests a minimum performance of $\geq 80\%$ sensitivity and $\geq 97\%$ specificity compared with a standard molecular test such as RT-PCR.

The WHO also recommends the use of RATs when molecular tests are unavailable/unfeasible or in various scenarios such as:

- in supporting outbreak investigations;
- to monitor trends of disease incidence in communities or in areas with widespread community transmission;
- in areas with widespread community transmission for early identification of cases in health care settings.

Could RATs be used in NZ?

A recent *Lancet* article suggests that both molecular tests (such as RT-PCR) and RATs “have different but complementary roles in the pandemic response and case management”.^[6] The authors suggest that RATs may have a role in certain populations such as in low prevalence settings (such as workplaces, those returning to school, and travel). However, they recommend that positive results from a RAT be followed up with a molecular test (much like the approach being used in Australia currently).

If RATs are approved for public use in NZ, there are a variety of situations where they could provide a complementary tool alongside RT-PCR testing and other COVID-19 mitigation measures.

When NZ is maintaining a low tolerance for COVID-19 infections, there are several situations where RATs could improve our COVID-19 response:

- Just prior to flying to NZ at the airport of departure (in addition to the already required test within 72-hours of departure for most countries) and also upon arrival at a NZ airport as an extra control measure (this would be to detect infected cases at the

airport so they can be taken directly to an MIQ facility that is dedicated to managing infected people). A recent study found that even with pre-flight RT-PCR testing, active infection could be picked up at testing upon arrival^[14];

- Daily RATs for returnees in MIQ facilities (along with existing RT-PCR tests) to improve the speed of detecting infections within such facilities.

Specifically for the current Delta outbreak:

- For individuals (for example, essential workers such as truck drivers) crossing the internal border around Auckland (and other regions with ongoing transmission), RATs could be used as an additional border crossing check (in addition to the weekly requirement for a RT-PCR test). This approach may be further developed with input from the various workers who will be included in this cohort, enabling greater acceptability and compliance;
- Upon arrival of all attendees and visitors at health care settings. For example, the use of a RAT for all individuals entering hospital may have identified recent COVID-19 cases at Middlemore Hospital in Auckland more quickly, and reduced the number of patients and staff potentially exposed to COVID-19 (though a NAAT would still be required if symptomatic or otherwise at increased risk of infection);
- Regular RATs for asymptomatic screening in large essential workplaces in outbreak settings. Also for staff in health care settings such as hospitals and in aged residential care facilities (although there would be certain high risk staff, eg working on the COVID-19 ward, where a NAAT would still be required). Furthermore, a positive result from a RAT should require immediate isolation of the individual and then taking a RT-PCR test to confirm the COVID-19 diagnosis.

To prepare for a future scenario of COVID-19 becoming endemic in most of NZ:

- In this situation where the virus may be widely circulating, RATs may become a part of routine life. For example, prior to going to work or social events. Therefore, it would be prudent for guidelines/procedures to be developed for the use of RATs by the NZ public.
- Even in this scenario, RATs would ideally play a complementary role alongside RT-PCR tests and ways of collecting data for public health surveillance purposes should be considered (see below).

There are several steps that would assist the effective implementation of RATs in NZ:

- Exclude from the importation ban specific named RATs that have been well validated in international settings (such as the UK and Australia).
- The NZ Government to import a limited range of high quality RATs that have been well evaluated overseas and supply them for agreed purposes.
- Establish a mechanism to capture RAT results as part of the national COVID-19 surveillance database, for example, a phone app that can read and interpret a RAT result and upload the data for use by public health authorities would be ideal.
- NZ health officials could also consider further extending the use of saliva NAAT testing since this is more comfortable for people getting tested than the current nasopharyngeal RT-PCR swabbing.

As the current Delta outbreak has reminded New Zealanders, the pandemic virus causing COVID-19 can move swiftly through a community before a single case is identified. NZ officials should consider strengthening our public health measures by optimising the use of

RATs as an additional tool to support effective screening and public health surveillance.

*** Author details: Dr Jennifer Summers, Dr Leah Grout, Prof Nick Wilson, Prof Michael Baker are with the Department of Public Health at the University of Otago, Wellington. Assoc Prof James Ussher, is Director, Webster Centre for Infectious Diseases, University of Otago, Dunedin. Assoc Prof Dr Nikki Moreland, is with the Department of Molecular Medicine and Pathology, University of Auckland**

References

1. Geoghegan, J.L., et al., *New Zealand's science-led response to the SARS-CoV-2 pandemic*. *Nature Immunology*, 2021. **22**(3): p. 262-263.
2. Amaral, C., et al., *A molecular test based on RT-LAMP for rapid, sensitive and inexpensive colorimetric detection of SARS-CoV-2 in clinical samples*. *Scientific Reports*, 2021. **11**(1): p. 16430.
3. McAuliffe, G.N. and T.K. Blackmore, *COVID-19 serology: use and interpretation in New Zealand*. *The New Zealand Medical Journal (Online)*, 2021. **134**(1538): p. 144.
4. Organisation for Economic Co-operation and Development. *Testing for COVID-19: How to best use the various tests? OECD Policy Responses to Coronavirus (COVID-19) 2020* [cited 2021 8 September]; Available from: <https://www.oecd.org/coronavirus/policy-responses/testing-for-covid-19-how-to-best-use-the-various-tests-c76df201/>.
5. Centers for Disease Control and Prevention. *Nucleic Acid Amplification Tests (NAATs): Summary of Recent Changes*. 2021 [cited 2021 8 September]; Available from: <https://www.cdc.gov/coronavirus/2019-ncov/lab/naats.html>.
6. Peeling, R.W., et al., *Scaling up COVID-19 rapid antigen tests: promises and challenges*. *The Lancet Infectious Diseases*, 2021. **21**(9): p. e290-e295.
7. Robinson, J., *How reliable are lateral flow COVID-19 tests?* *The Pharmaceutical Journal*, 2021. **306**(7949).
8. Hodges E, et al., *Use of Rapid Antigen Testing for SARS-CoV-2 in Remote Communities — Yukon-Kuskokwim Delta Region, Alaska, September 15, 2020–March 1, 2021*. *MMWR Morb Mortal Wkly Rep*, 2021. **70**: p. 1120-1123.
9. World Health Organization. *Interim guidance: Antigen-detection in the diagnosis of SARS-CoV-2 infection using rapid immunoassays*. 2020 [cited 2021 7 September]; Available from: <https://www.who.int/publications/i/item/antigen-detection-in-the-diagnosis-of-sars-cov-2infection-using-rapid-immunoassays>.
10. Centers for Disease Control and Prevention. *Interim Guidance for Antigen Testing for SARS-CoV-2*. 2021 [cited 2021 7 September]; Available from: <https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antigen-tests-guidelines.html#performance>.
11. Blairon, L., et al., *Efficacy comparison of three rapid antigen tests for SARS-CoV-2 and how viral load impact their performance*. *J Med Virol*, 2021. **93**(10): p. 5783-5788.
12. Lanser, L., et al., *Evaluating the clinical utility and sensitivity of SARS-CoV-2 antigen testing in relation to RT-PCR Ct values*. *Infection*, 2021. **49**(3): p. 555-557.
13. Schuit, E., et al., *Diagnostic accuracy of rapid antigen tests in asymptomatic and presymptomatic close contacts of individuals with confirmed SARS-CoV-2 infection: cross sectional study*. *BMJ*, 2021. **374**: p. n1676.
14. Tande, A.J., et al., *SARS-CoV-2 Testing Prior to International Airline Travel, December 2020-May 2021*. *Mayo Clinic Proceedings*.

Public Health Expert Briefing (ISSN 2816-1203)

Source URL:

<https://www.phcc.org.nz/briefing/using-rapid-antigen-tests-improve-covid-19-control-aotearoa-nz>