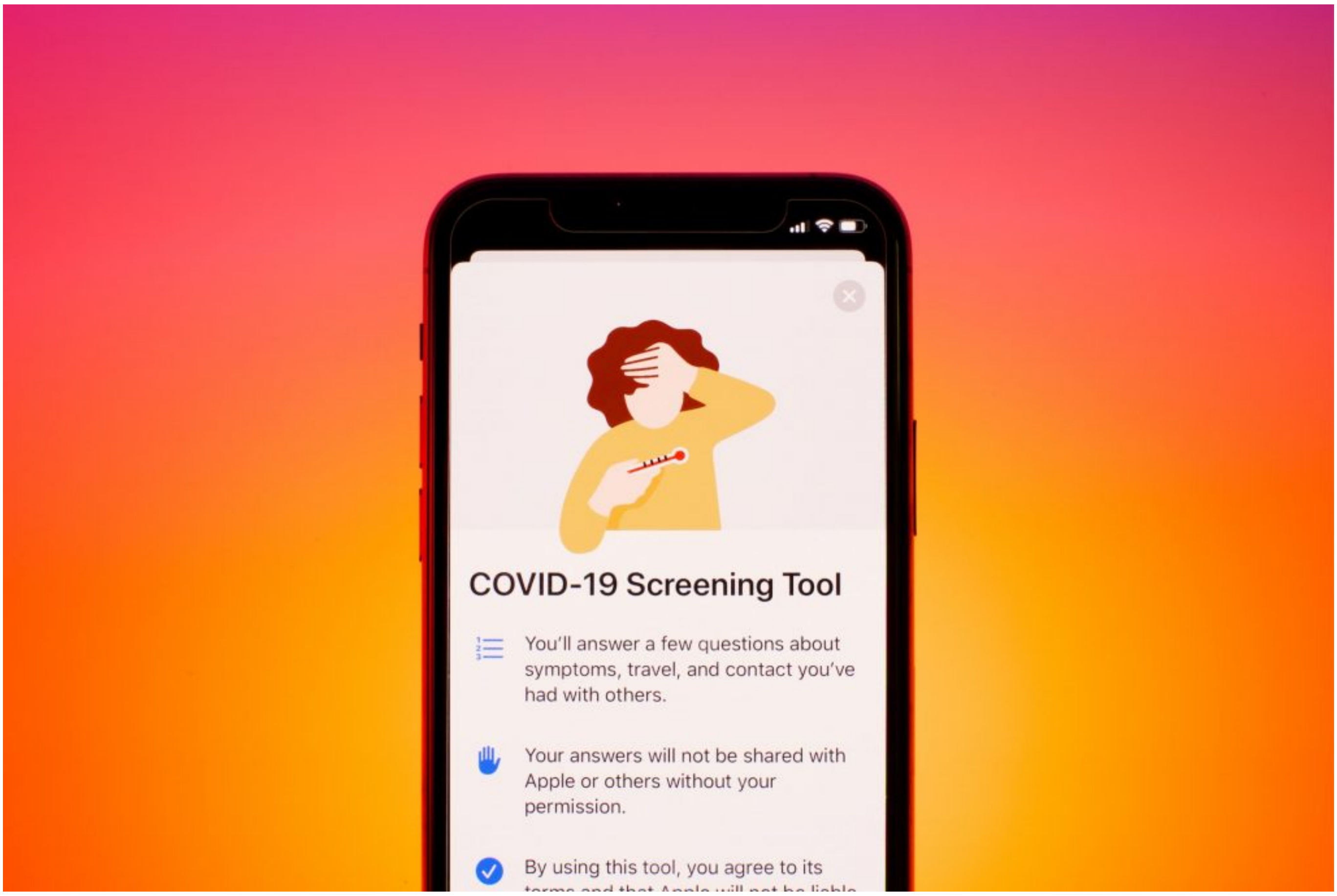

We need rapid progress on digital solutions to help eliminate COVID-19 from New Zealand

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In this blog we discuss some of the emerging technologies New Zealand could adopt to support the country's COVID-19 elimination strategy. We argue for the prioritisation of technologies to assist with contact tracing, border controls, early diagnosis and surveillance. These technologies present major benefits for the collective effort against COVID-19 and can also strengthen our preparedness for future pandemics. Nevertheless, they also present major challenges related to

privacy, public acceptability and coordination that must be overcome if these innovations are to make substantial contributions to the pandemic response.

The scale of the COVID-19 pandemic has quickly overwhelmed existing health systems in affected countries. Most countries are working hard to refine and implement an effective response. On 2 April, the World Health Organization hosted a high-level meeting between technology and health experts, signalling the urgent need for digital solutions to help tackle this global threat (1). Currently, NZ is considering several digital solutions to support the public health response to COVID-19 (2). While the NZ Government is being overloaded with proposals for new digital solutions (2), the success of the elimination strategy requires prioritisation of solutions that address the key public health problems. In this blog, we discuss the potential priority areas for the COVID-19 response and the technologies that have been developed to address them.

Prioritising digital solutions for the COVID-19 response

New Zealand's elimination strategy requires a range of public health interventions including case isolation, contact tracing, home quarantine, promotion of hygiene (eg, hand washing), physical distancing and border controls (3). We need to prioritise digital solutions towards areas of the greatest public health impact and where the efficacy of existing solutions can be substantially improved. For example, existing solutions related to the Government's physical distancing restrictions appear to have been successful (4), so other areas require focus.

Interventions and their associated digital solutions can be divided into two main groups: (a) those where their success depends on their ability to identify individual people for legally enforceable control measures such as contact tracing and quarantine (with a correspondingly high level of integration with Government's response strategy, systems and privacy safeguards) and (b) those where the focus is supporting other personal and population health actions such as early detection, diagnosis and surveillance.

Digital contact tracing

There is global consensus that improving contact tracing efficiency and effectiveness is a critical feature of the COVID-19 response (2). The scale of COVID-19 infections has outstripped governments' capacities to conduct manual contact tracing (5). Existing contact tracing practices are resource intensive, slow and often subject to recall bias (6). Contact tracing for a single individual can take a team of three to five contact tracers several days to complete (7), while cases often have difficulty in remembering every personal interaction during the period when they are likely to have been infectious (which may have been for up to two days before they developed clearly recognised symptoms (5)).

Because of the need for high speed, good coverage, and interfacing between individuals and health care authorities (who coordinate and monitor contact tracing and testing), while also meeting reasonable privacy standards, digital contact tracing technology is the most demanding to get right.

The NZ Government has signalled the development of a digital solution that will integrate the COVID-19 testing information with National Health Index information (2). While promising, there is still great potential in innovations being developed internationally to augment our bespoke solutions.

Contact tracing innovations using Bluetooth technology have enabled the identification of close contacts unknown to, or not recalled by, the case. They have also automated contact tracing procedures by automatically informing close contact of their potential exposure. For example, the TraceTogether app developed by the Government of Singapore uses Bluetooth data from mobile phones to automatically inform its health agency of the close contacts of a diagnosed COVID-19 case (8). The TraceTogether app also completely anonymises data, increases citizen data control with clear data protection protocols and provides improved accuracy and privacy compared to GPS technology.

The advantages of the Bluetooth technology prompted questions to the Health Minister in an Epidemic Response Committee meeting about the lag on contacting the Singaporean Government (2). Currently the US (9), UK (9) and a European consortium led by Germany (10) are developing similar approaches using Bluetooth data. On 10 April, Google and Apple announced a partnership to develop a global digital solution for contact tracing set for release in mid-May (11).

Border protection – quarantining enforcement

Border protection and quarantining of incoming visitors is a central element in the COVID-19 response (3). The NZ Government has announced full government supervised quarantining of all incoming passengers from 9 April (12), so while this is maintained there may be less need for digital solutions to monitor the movements of these passengers. However, as NZ moves down the alert levels and international visitors increase, we may at some point allow incoming travellers to return to systems of self-isolation (technically self-quarantine) with an associated need to scale up monitoring and enforcement efforts. Technically this is a much easier challenge than contact tracing.

Hong Kong and South Korea use GPS data for quarantining procedures. In Hong Kong, incoming passengers are provided with wristbands that link to a GPS-enabled smartphone to enforce self-isolation rules (13). In NZ, incoming passengers' address information is already routinely collected. A digital app that uses GPS data may enable passengers to update their self-isolation plan online to expedite screening procedures, help monitoring and enforcement of self-isolation rules and provide support to visitors during their self-isolation period.

Early detection, diagnosis and surveillance

Digital solutions could help early detection and surveillance efforts. People infected with COVID-19 are possibly infectious before they become symptomatic, with one estimate being that 50% of all new COVID-19 infections being transmitted from someone who is either pre-symptomatic or asymptomatic (5). Thus, to decrease the overall level of transmission of the pandemic virus, we need to identify people as they start to develop symptoms, or even the precursors to visible symptoms.

Photo by Lloyd Dirks on Unsplash

UK researchers have developed a symptom tracking app that prompts users each day to record any symptoms and general wellbeing (14). The real-time data provides insights into disease pathology and epidemiology. In NZ, there are plans to incorporate symptom tracker functionality into the NZ COVID-19 WhatsApp Channel (15). Further, in NZ and Australia, an established influenza surveillance system (Flutracking) has had functionality added so it can track the spread of possible COVID-19 cases (16). This is crowd-sourced surveillance with people voluntarily signing up. The installed base of participants has increased in NZ (9 April had received 62,977 installations (17)).

Anecdotal evidence suggests data from wearable smart devices could provide diagnostic support by detecting physiological changes (18). Most fitness apps produce a composite score, often referred to as a recovery or readiness score, that is a percentage of your baseline “healthy” physiological metrics. These metrics could characterise pre-symptomatic cases in order to alert them to self-isolate and get tested if symptoms develop. Currently, at least three US universities are investigating the feasibility of using wearables to inform the COVID-19 response (19), while the Germany Health Authority has already launched an application to collect wearable data voluntarily from citizens (20). Ultimately, all these data could be incorporated into machine learning algorithms to try and provide diagnostic and surveillance support to health agencies.

Key limitations and ways to address them going forward

Privacy and data protection considerations are central to criticisms of some digital solutions. Examples in China of breaches to privacy, data ownership and civil liberties are unlikely to be tolerable for NZ society. Ferretti et al (5), outline a protocol for COVID-19 digital solutions. Ultimately, applications should enable users to control their data, collect only data directly related to the problem and when released to health authorities, have strict data-use and destruction procedures. Public communication of these privacy and data protection concerns could determine the success or failure of the innovation and our collective COVID-19 response.

The public uptake of digital solutions raises major issues of effectiveness and equity. Firstly, effectiveness is substantially impacted by uptake. For example, in Singapore, reports suggest around 16% uptake of their contact tracing app (21), which means any case with the app can detect 16% of close contacts, or have the sensitivity to detect 2.6% of close contacts in the population. Secondly, large groups in society such as those living in high deprivation, the elderly and those living in areas of poor internet connectivity may not have access to smartphones or may be unfamiliar with such apps. This would then drive down adoption and risk increasing health inequities. To address both concerns, digital solutions could be supplemented by the free provision of hardware (eg, smartphones or cards/tiles) that reduces the barriers to uptake and regular use.

Coordination and integration of solutions is another key challenge with hundreds of solutions being developed in the private and public sectors. The NZ Government is well-placed to lead the coordination and integration of digital solutions but addressing this pandemic requires an all-of-government, all-of-society approach. Nevertheless, if progress by the NZ Government is too slow, then it should be prepared to defer the development and delivery of these solutions to the private sector and may need to shift focus onto setting the correct legislative framework to enable these efforts to flourish.

Conclusion

The NZ Government’s decision to pursue an elimination strategy is an appropriate one but to ensure success all feasible control measures need to be explored. The lock-down has brought time, but this time must be dedicated towards implementing digital solutions that help tackle the most pressing public health problems presented by COVID-19. Government coordination and leadership is needed to maximise the chances of success with digital solutions in fighting COVID-19.

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