In Confidence

Office of the Minister of Health

Cabinet

COVID-19 Contact Tracing Action Plan

Proposal

1 This paper:

1.1 sets out the Ministry of Health's response to the recommendations from the recently completed review of its contact tracing service and its action plan to further strengthen COVID-19 contact tracing

1.2 seeks agreement to additional funding to support the action plan which provides a gold standard approach to protecting New Zealanders from COVID-19.

1.3 fulfils the direction of the COVID-19 Ministerial Group to report back on progress with implementing technology options to respond to COVID-19 [CAB-20-MIN-0130 refers].

Executive Summary

2 Contact tracing is a vital part of our fight against COVID-19. Effective contact tracing helps to prevent potential onward transmission, raise awareness about the disease and its symptoms and supports early detection of suspected cases. A comprehensive contact tracing system effectively allows the Ministry of Health (the Ministry) to 'vaccinate until a vaccine becomes available' through ensuring rapid identification and isolation of new cases.

3 Ensuring robust contact tracing is a priority piece of work for the Ministry, which will ensure the system is operational for when the alert level moves from Level 4 to Level 3, with ongoing enhancement and refinement to deliver a 'gold standard' service.

4 To support this, the Ministry commissioned Dr Ayesha Verrall to undertake a rapid review of the health sector's strengthened approach to contact tracing for COVID-19 cases (Appendix A). The Ministry reported to the COVID-19 Ministerial Group on the findings and recommendations of that review on 16 April 2020.

5 This paper sets out the Ministry's response to the recommendations of Dr Verrall's review and provides a plan of action, measures, and timeframes to deliver an enhanced comprehensive contact tracing approach in readiness for transitioning from alert level 4 to alert level 3 and beyond (Appendix B).

6 Additional funding of $55 million in 2019/20) is sought to deliver on the comprehensive contact tracing approach designed to protect the health and wellbeing of New Zealanders.

7 This paper also includes the cabinet report back to update on progress with implementing technology options to respond to COVID-19.

Background

8 Contact tracing is a vital part of responding to COVID-19. It helps to stop the spread of the virus and supports those who become unwell. A comprehensive contact tracing system effectively allows the Ministry of Health (the Ministry) to 'vaccinate until a vaccine becomes available' through ensuring rapid identification and isolation of new cases.

9 The purpose of contact tracing is to prevent potential onward transmission, raise awareness about the disease and its symptoms and support early detection of suspected cases. Close contact tracing is an existing practice performed by Public Health Units (PHUs) to manage infectious notifiable diseases. The high-level steps in this process are:

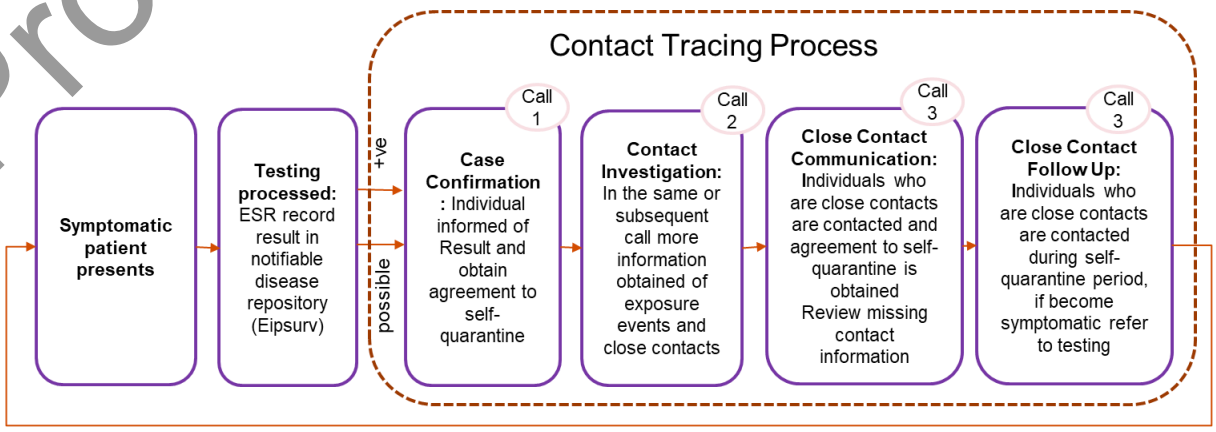
9.1 case Confirmation (informing an individual of their diagnosis and directing them to self-isolate)

9.2 contact Investigation (determining who the individual could have potentially infected)

9.3 close Contact Communication (contacting the potentially infected individuals, advising them to self- quarantine and provide health and welfare advice)

9.4 close Contact Follow-up (daily communication with the close contact to check if they are developing symptoms. If they become symptomatic they are then referred for clinical assessment to determine if they have now become a case).

Figure1. Contact tracing process



10 The National Close Contact Service (NCCS) was established by the Ministry to support Public Health Units (PHUs) to manage high volumes of contact tracing on 24 March 2020. The NCCS was rapidly implemented and at its peak had up to 190 staff.

11 PHUs remain responsible for the confirmed and probable COVID-19 cases and managing close contacts who are in the cases household. The PHU may choose to manage other close contacts, for example where the close contacts are considered especially vulnerable, such as rest homes.

12 The Ministry is providing the contact tracing service for all other close contacts. These are often complex to successfully trace and phone, for example where the exposure event is a bus tour and those exposed are tourists who have since dispersed around New Zealand. A range of agencies and experts have assisted with providing contact information including Customs and Police.

13 To support the Ministry's contact tracing work, the National Contact Tracing Solution (NCTS) was rapidly developed. The Ministry established the NCTS to provides case management capability. It is integrated with other trusted health system information sources including the National Heath Index and the National Enrolment Service. The NCTS solution has re-used technology that was commissioned to support the National Bowel Screening Programme, which has allowed the first iteration to be commissioned rapidly.

14 Ensuring robust contact tracing is a priority piece of work for the Ministry, which will ensure the system is operational for when the alert level moves from Level 4 to Level 3, with future ongoing enhancement and refinement to deliver a 'gold standard' service.

15 To support this, the Ministry commissioned Dr Ayesha Verrall to undertake a rapid review of the health sector's strengthened approach to contact tracing for COVID-19 cases. This review was undertaken to provide assurance to the Ministry and sector that it is well positioned to support timely contact tracing nationally that is able to be scaled rapidly.

16 The review was conducted on 9 April 2020 and received on 11 April 2020 and sets out eight recommendations to strengthen the contact tracing response to COVID-19. The Ministry supports Dr Verrall's recommendations and is in the process of implementing changes based on the recommendations. Dr Verrall's review is attached as Appendix A.

17 On 16 April 2020, the COVID-19 Ministerial Group received a brief report attaching the key findings and recommendations of Dr Verrall's review. This follow-up paper sets out the Ministry's plan to give effect to Dr Verrall's recommendations and to ensure its contact tracing system is fit for purpose, in readiness for the next phases of the COVID-19 response.

Ministry's response to the review recommendations

18 In response to the review the Ministry is setting up a national contact tracing unit to operate for the duration of the pandemic. PHUs will

continue to provide core contact tracing functions and expertise. Contact tracing will be a nationally delivered service.

19 National and regional surge capacity support will be delivered as and when required as part of an end-to-end service. This enhanced contact tracing operation will be supported by a comprehensive national data platform which will enable end-to-end reporting.

20 The Ministry has grouped the actions it is taking in response to the recommendations under the four themes below. A one-page overview of the actions is set out in Appendix B.

Theme one: Capacity

1	***Recommendation 1****: The Ministry of Health should expand the capacity of Public Health Units (PHUs) to isolate Covid-19 cases and trace their contacts, three to four-fold for as long as Covid-19 remains a public health threat. Some of this additional capacity should include contact tracing teams that can move from one PHU to another*

2	***Recommendation 2****: The Ministry of Health should develop a Covid-19 outbreak preparedness plan that includes how to rapidly scale case identification and contact tracing and regain control. The plan should specify the task-shifting arrangements between PHUs and NCCS and any additional resources required to deal with up to 1,000 cases per day maintaining high performance.*

21 The Ministry is developing a COVID-19 outbreak preparedness plan in collaboration with PHUs that will incorporate, by 24 April 2020:

21.1 the operating principles between PHUs and the NCCS

21.2 a national capacity plan, including PHU and Ministry

21.3 an increase of Ministry, PHU-based and other resources that can be scaled according to demand and capacity requirements

21.4 the governance and reporting arrangements for the national contact tracing service.

22 On 17 April 2020 the Ministry requested updated guidance from its Technical Advisory Group (TAG) regarding peak case planning assumptions post-alert level four, to address recommendation two of Dr Verrall's report. TAG have reviewed the recommendation and have indicated they are supportive of the Ministry's approach in planning for a range of scenarios under the different alert levels.

23 In March 2020 the Ministry provided $15 million to PHUs to support the COVID-19 response which included strengthening and expanding PHU capacity. Additional funding is sought to ensure further scalable and timely delivery of high-quality services.

24 The current NCCS call centre has transitioned to a scalable national outbound call centre. There is capacity to scale up to 10,000 calls a day if required which provides capacity to manage a range of scenarios under different alert levels. In addition, PHUs currently have combined capacity to contact and investigate up to 185 cases per day. The NCCS is working with the PHUs to specify task-shifting arrangements between PHUs and NCCS to scale additional resources as required.

25 Additional funding is requested in this paper to provide further resources to PHUs to strengthen their baseline capacity to ensure sufficient localised and regional response particularly at times of cluster outbreaks.

26 A national centralised service ensures that resources can be directed to coordinate localised and national capacity to meet the contact tracing timeframes.

Theme two: Performance

3 ***Recommendation 3****: The Ministry of Health should develop a system that monitors case-isolation and contact tracing process from end-to-end in the NCCS and PHUs. Recommended key performance indicators are listed in the appendix. Of these 17 indicators, 3 are critical, 3 are urgent and 10 are high priority and 1 is moderate priority. Ability to measure these indicators in real-time should be*

27 Currently contact tracing is delivered by the 12 PHUs with support from the NCCS and there is no single overview of service performance and case management. While this was an appropriate model to achieve the urgent turnaround required for the COVID-19 response, it did not provide the national monitoring and oversight required for an ongoing response. In order to achieve this the Ministry:

27.1 has completed a clinical and technical review of the proposed indicators and are developing a monitoring framework for national contact tracing

27.2 collated PHU and Ministry information to provide a national and regional view of contact tracing performance

27.3 is expanding the new NCTS to deliver real-time reporting to monitor contact tracing performance across the system. Initially it will be deployed to PHUs that do not have digital capability to manage contact tracing (by 22 May 2020).

Theme three: Response coordination

4	***Recommendation 4**: The NCCS and its providers must ensure close contacts in home quarantine are contacted every day to monitor for adherence to isolation and to assess for the development of symptoms.*
5	***Recommendation 5**: The NCCS and the Medical Officers of Health should collaborate to better define referral protocols and triage systems, especially with respect to more complex or high-risk contacts.*
6	***Recommendation 6**: The Ministry of Health should give PHUs access to the NCTS in order to retain visibility of contacts traced by the NCCS.*

28 The Ministry is engaging with PHUs to prepare a COVID-19 preparedness plan for national contact tracing by 24 April 2020. The plan will focus on agreed optimal referral protocols and triage systems with respect to the delegation of work from PHUs to the NCCS. The underpinning drivers are to ensure:

28.1 clinically safe practice

28.2 timely, consistent and high-quality execution

28.3 the optimal use of staff available across the system (in particular with respect to cluster analysis, complex cases and high-risk contacts).

29 The Ministry has commissioned Healthline to provide daily wellness calls to individuals who have been directed to home-quarantine, consistent with best practice. This is being delivered currently.

30 The Ministry is in the process of providing by 24 April 2020 to all PHUs access to close contact status along the pathway of all those processed through NCTS.

Theme four: Enablement

***Recommendation 7**: The Ministry of Health should engage with PHUs to determine if the NCTS could be suitable, with modification as single national contact information system.*

***Recommendation 8**: The Ministry of Health should rapidly complete development of a smartphone app to assist contact tracing and pilot it in New Zealand. Evaluation of the app should include assessing the proportion of contacts identified by the app who develop Covid-19, as well as other relevant parameters in the appendix*.

31 Technology is a highly valuable tool in the fight against COVID-19. It will enable greater speed and effectiveness of contact tracing at scale, better monitoring of disease progression and spread, and support predictive and proactive public health responses. Technology will be increasingly important as New Zealand enters the less restrictive COVID-19 alert levels.

32 Technology complements, but does not replace, public health and non-digital response activities for contact tracing. Technical solutions are just one part of

contact tracing, with manual processes still the critical component to complete this function.

33 No single technological option can "solve" contact tracing. Innovative solutions have been created and are emerging that can collectively speed up and fill in the gaps for contact tracing. The Ministry technology approach is to enable information from multiple sources to be accessible and to ensure that multiple technologies can be deployed in an integrated and accessible way with appropriate privacy and security controls. This approach aligns strongly with the four key outcomes defined within the Strategy for a Digital Public Service and the strategic intent of the national Health Information Programme.

34 The Ministry is delivering a plan of technology initiatives that will speed up contact tracing and contribute to enabling an effective COVID-19 response. The plan complements and supports the contact tracing implementation plan and is attached in Appendix C. The plan includes:

34.1 Case management capability to support contact tracing in the PHUs and the Ministry:

34.1.1 The NCTS is operational and is being extended so that it can support PHUs. The Ministry has gathered valuable insights from PHUs as to how to enhance the NCTS to better support the end-to-end execution of contact tracing. These requirements are now being developed and support the PHU implementation plan and will be completed by 8 May 2020.

34.1.2 The Ministry will collaboratively develop a proposal for a broader implementation of the NCTS across PHUs that will reference other strategic initiatives such as National Health Information Platform (NHIP) by 30 May 2020.

[redacted] s 9(2)(f)(iv), s 9(2)(j) [redacted]

34.3 A smartphone application for consumers to record contact information that can be made available with consent if an individual tests positive for COVID-19:

34.3.1 the first release is scheduled for 20 April 2020 and will allow users to register their contact details

34.3.2 the second release on 1 May 2020 of the application will allow the user to record their close contacts and locations they have visited

34.3.3 s 9(2)(f)(iv) [redacted]

34.3.4 s 9(2)(f)(iv)

34.4 s 9(2)(f)(iv)

34.5 s 9(2)(f)(iv)

s 9(2)(f)(iv), s 9(2)(i)

[1] Dr Verrall recommends that when an individual receives a positive diagnosis, 80% of their close contacts should be contacted and placed in self-isolation within 24 hours.

s 9(2)(f)(iv), s 9(2)(i)

40 The Ministry with the support of GCDO will work to ensure that all innovators and suppliers of technology understand privacy, security, standards and other requirements that need to be met in order to complement Government effort to enhance contact tracing. The Privacy Commissioner is actively engaged in the development of the Ministry smartphone application and Ministry data governance and information security functions are providing oversight of all delivery. GCDO officials are providing advice and assurance to the Ministry.

41 The GCDO has a functional leadership mandate to provide oversight, due diligence and assurance for new and emerging government technology solutions. This includes assuring Ministers and New Zealanders that technologies will be effective, while ensuring issues of privacy, security and digital inclusion are recognised and protected.

42 In addition to the GCDO's existing role, there is a need for oversight of technology options being developed across the public sector to support the COVID-19 response. This will provide a common operating picture for Ministers and other stakeholders to support long-term strategic decision-making. Continuing with the current approach of agencies making independent decisions presents significant risks to effective implementation.

43 Complex technical, policy, human rights and operational considerations associated with new technologies will also require input from across government and the private sector. A process to assess and potentially endorse future technical solutions with oversight from GCDO, Health and other relevant agencies will also need to be developed.

44 We recommend that the GCDO reports back to this Ministerial group with an analysis of technology response oversight requirements from a whole of government perspective and a proposed governance structure. The GCDO should also be directed to lead the development of a COVID-19 Technology Response Plan. This plan would complement the broader COVID-19 response plan work being undertaken by the Ministry and incorporate broader economic and social considerations, enabling New Zealand's economy and social life to recover faster. This plan will bring together the growing number of potential technical solutions, enabling decision-making to channel efforts into those that will be most effective.

Implementation

45 The attached plan sets out, in detail, the actions and associated timing for implementation (see Appendix B). The Ministry is already moving apace to ensure contact tracing is ready and fit for purpose when the Government

moves from alert level 4 to alert level 3. The work will continue to be enhanced to ensure contact tracing is ‘gold standard’.

46 The Ministry is now leading the implementation of a single integrated contact tracing model that will have the Ministry providing:

46.1 national leadership

46.2 oversight

46.3 policy development

46.4 monitoring and quality assurance of the process.

47 Contact tracing surge capacity will be delivered as part of an end-to-end system that is able to respond nationally or regionally depending on where outbreaks occur or where services are identified as needing assistance.

Financial Implications

48 Additional funding of approximately $55 in 2019/20 million will be required if the Ministry’s enhanced contact tracing approach is to be delivered to the standard required. This funding cannot be met out of PHU or Ministry baselines.

49 Funding assumptions are based on procurement advice on the market price of funding the below activities. All figures are estimated and as work to establish the NCCS continues funding requirements will become clearer:

49.1 in order to achieve the gold standard for contact tracing further funding is required to support PHUs to deliver surge capacity beyond their current levels. It will also enable PHUs to implement quality improvement to enhance pathways and improve timelines in line with the monitoring indicators. This includes an estimated surge capacity across PHUs of up to 300 FTE

49.2 the Ministry’s existing contact tracing service requires additional resources to provide the surge capacity to support PHUs and manage complex investigation and analysis such as detailed cluster analysis

49.3 funding is also required to set up the functions of a national unit to direct and deliver the integrated national contact tracing service throughout the duration of the pandemic

49.4 the new NCTS is being enhanced to support quality, speed and timeliness of contact tracing. This includes the purchase of further licences to nationalise the system and extend its operation during the pandemic

49.5 an expansion of the NCTS will enable national delivery of a COVID-19 vaccine when it becomes available. The current National Immunisation Register (NIR) cannot manage the vaccine process. A business case

has already been developed to support the Ministry's Budget 20 bid for expanding the NIR. However, approval of these funds needs to be expedited to support a six-to-eight month design and build process for a November 2020 delivery

49.6 EpiSurv is the core information system to manage communicable diseases, including COVID-19 which is administered by ESR. This technology is older and is unable to support full integration with the NCTS. Additionally, other related systems will also require enhancement to deliver timely information on tests and results.

Legislative Implications

50 There are no legislative implications from proposals in this paper.

Human Rights

51 The public health benefits associated with the proposed approach and any new technology will be assessed against the Government's agreed principles of public health efficacy, respect for privacy, freedom of movement and technical feasibility.

Consultation

52 The Ministry of Health, National Centre for Crisis Management, Police and the Government Chief Digital Officer have been consulted on technology options and their views are represented. The Department of the Prime Minister and Cabinet (PAG) was informed.

53 Due to time constraints associated with this report back, further consultation was not possible before the paper was finalised. Officials will proactively engage with MBIE, Crown Law, Statistics NZ, the Office of the Privacy Commissioner, the Government Chief Security Information Officer and the Government Chief Data Steward to ensure they are aware of the paper's contents.

Communications

54 The Ministry will develop a communications plan for the release of Dr Varrell's report.

s 9(2)(g)(i) [redacted]

Recommendations

The Minister of Health recommends that Cabinet:

1 **note** this paper fulfils the direction of the COVID-19 Ministerial Group to report back to that group with an update on progress with implementing technology options to respond to COVID-19 [CAB-20-MIN-0130 refers]

2 **note** that the Government Chief Digital Officer will report back to this Ministerial group with an analysis of COVID-19 technology response oversight requirements from a whole of government perspective, including a COVID-19 technology response plan, and a proposed governance structure.

3 **note** that effective contact tracing is a vital part of the COVID-19 response (by isolating cases promptly and stopping the spread of the virus)

4 **note** that the Ministry of Health (the Ministry) commissioned an independent review into contact tracing of COVID-19 and reported on the findings to the COVID-19 Ministerial Group on 16 April 2020

5 **note** that the Ministry has developed a comprehensive approach to contact tracing informed by the eight recommendations of the independent review

6 **note** that the comprehensive approach to contact tracing means the health sector will be ready when the Government decides to step down from alert level 4 to alert level 3

7 **approve** the following changes to appropriations to implement a comprehensive approach to contact tracing:

	$m – increase/(decrease)				
	2019/20	2020/21	2021/22	2022/23	2023/24 & Outyears
Vote Health					
Minister of Health					
Departmental Output Expense: Managing the Purchase of Services (funded by revenue Crown)	5.400	-	-	-	-
Health Sector Information Systems (funded by revenue Crown)	10.000	-	-	-	-
Capital injection	15.000	-	-	-	-
Non-Departmental Output Expense:					
National Health Information Systems	4.000	-	-	-	-
Public Health Service Purchasing	20.600	-	-	-	-
Total operating	40.000	-	-	-	-
Total capital	15.000	-	-	-	-

8 **agree** that the proposed change to appropriations for 2019/20 above be included in the 2019/20 Additional Supplementary Estimates and that, in the interim, the increase be met from Imprest Supply

9 **agree** that the funding in recommendation 7 will be charged against the COVID-19 Response and Recovery Fund with a corresponding impact on the operating balance and net core Crown debt.

Authorised for lodgement

Hon Dr David Clark

Minister of Health

Appendix A – Rapid Audit of Contact Tracing for Covid-19 in New Zealand report

Rapid Audit of Contact Tracing for Covid-19 in New Zealand

Dr Ayesha Verrall
University of Otago
10 April 2020

Executive summary

Rapid case detection and contact tracing, combined with other basic public health measures, has over 90% efficacy against COVID-19 at the population level, making it as effective as many vaccines. This intervention is central to COVID-19 elimination in New Zealand.

New Zealand needs to anticipate a 'new normal' of local transmission and small clusters without alert level four restrictions, with the potential for one or more very large outbreaks over the next two years. Examples, such as the church outbreak in Korea, which reached over 4000 cases in just over two weeks, show how COVID-19 outbreaks can expand very quickly. However even large outbreaks can be brought under control without lockdowns if the public health response is ready and adequate.

The capacity of the 12 Public Health Units (PHUs) in New Zealand is the primary factor limiting New Zealand's ability to scale up its case management and contact tracing response to Covid-19. In March the workload of PHUs exceeded their capacity to conduct rapid contact tracing on occasion, even though case numbers were less than 100 per day. Expansion of the Public Health Unit workforce is an urgent need.

The 'National close contact service' (NCCS) hub has been operational since 24 March. The NCCS was established in the Ministry of Health, together with a technology solution (NCTS), to perform contact tracing at times of high demand for PHUs. It is a scalable initiative underpinned by high quality technology. It is currently used by PHUs in a narrow set of circumstances. With better triage of referrals and protocols this could be expanded further. There are also difficulties in finding contacts that need to continue to be addressed. The NCCS is an impressive service especially considering it has been established in just weeks. However it is not a suitable nor desirable system for managing all contacts. The NCCS also has limited use in certain important situations, such as in the event of a large complex cluster or specific scenarios that require intense involvement of Medical Officers of Health.

At the present time the only centrally visible performance indicators relate to the completion of tracing for contacts referred to the NCCS. However this does not capture the upstream events that impact the timeliness of contact tracing, like case referal processes and testing times. Nor does it capture contact tracing activity in PHUs. Measuring performance indicators to drive improvement is an urgent priority. This report proposes a set of indicators for this purpose.

At the time of writing the Ministry of Health and local developers are building a smartphone app to assist with contact tracing. As it is not yet completed and a number of key aspects are under consideration, it cannot be meaningfully evaluated. Near instantaneous notification of contacts following case diagnosis is promising from a public health perspective, but other elements of the process of case assessment, testing and notification will still need to be optimised. High levels of uptake will also be required to achieve impact.

Recommendations

1. The Ministry of Health should expand the capacity of Public Health Units (PHUs) to isolate Covid-19 cases and trace their contacts three to four fold for as long as Covid19 remains a public health threat. Some of this additional capacity should include contact tracing teams that can move from one PHU to another according to need.

2. The Ministry of Health should develop a Covid-19 outbreak preparedness plan that includes how to rapidly scale case identification and contact tracing and regain control. The plan should specify the task-shifting arrangements between PHUs and NCCS and any additional resource required to deal with up to 1000 cases per day while maintaining high performance.

3. The Ministry of Health should develop a system that monitors the case-isolation and contact tracing process from end-to-end in the NCCS and PHUs. Recommended key performance indicators are listed in the appendix. Of these 17 indicators, 3 are critical, 3 are urgent, 10 are high priority and 1 is moderate priority. Ability to measure these indicators in real-time should be proven.

4. The NCCS and its providers must ensure close contacts in home quarantine are contacted every day to monitor for adherence to isolation and to assess for the development of symptoms.

5. The NCCS and Medical Officers of Health should collaborate to better define referral protocols and triage systems, especially with respect to more complex or high-risk contacts.

6. The Ministry of Health should give PHUs access to the NCTS in order to retain visibility of contacts traced by the NCCS.

7. The Ministry of Health should engage with PHUs to determine if the NCTS could be suitable, with modification, as a single national contact information system.

8. The Ministry of Health should rapidly complete development of a smartphone app to assist contact tracing and pilot it in New Zealand. Evaluation of the app should include assessing the proportion of contacts identified by the app who develop covid-19, as well as other relevant parameters in the appendix.

Introduction

On 9 April 2020 I met with Ministry of Health Officials and National Close Contact Service workers and interviewed Medical Officers of Health by telephone. This report summarises my findings and makes recommendations for improvements to contact tracing to control Covid-19 in New Zealand.

Contact tracing and Covid-19

Contact tracing is the identification and isolation of people who have been exposed to an infectious case, to prevent onwards transmission from the contact to others. The contact tracing system is the final part of a process that begins with someone who is ill with Covid19, called an index case. The index case becomes ill and infectious, is assessed and tested, isolated and if they test positive their close contacts are traced and quarantined. The contacts of probable cases are also traced and quarantined. Contact tracing is a key preentive measure for covid-19 and is recommended by the World Health Organization (1).

Ideally, contact tracing promotes good clinical management of the contact who is at risk of developing Covid-19 and who might need testing and medical care, as well preventing further disease transmission. Contact tracing is a well-established public health process that is routinely performed in public health units (PHUs) in New Zealand. In practice PHUs are often simultaneously managing index cases and their contacts in an integrated way, as they will usually share households, workplaces or social networks.

This case-identification and contact tracing system has been a key component of successful control of Covid-19 in countries like Singapore, where contact tracing led to detection of more than half of Covid-19 patients (2). Transmission models show Covid-19 outbreaks could be controlled through this system provided tracing is fast enough (3). Indeed, rapid case contact management, when used with other basic public health measures, has over 90% efficacy against Covid-19 disease at a population level (4), which makes it as effective as any vaccine that might be developed.

Specific characteristics of Covid-19 make contact tracing more effective than for influenza. Firstly the time from a person being exposed to Covid-19 to developing illness is longer (5-6 days) meaning there is time for contact tracing to occur. Secondly, it appears easier to identify Covid-19 cases who transmit the infection, as unlike influenza, there is as yet no evidence that asymptomatic cases transmit the disease (5). This means contact tracing is a important activity to achieve elimination or ‘stamp out’ covid-19 when case numbers are low. It also means contact tracing and other public health measures can control outbreaks, as has been demonstrated in China(6) and South Korea. This ability to reverse outbreaks through public health measures is has led the World Health Organization Director General to characterise plans to abandon or relax public health measures in the face of an outbreak as “wrong and dangerous” (7). In other words our contact tracing system needs to be suitable for moderate case numbers or clusters as well as outbreaks.

Description of the current system

New Zealand’s communicable disease control system is highly devolved with 12 Public Health Units (PHUs) taking responsibility for case and contact management as well as the monitoring and evaluation of this work. PHUs are staffed by public health nurses, health protection officers and Medical Officers of Health who are public health medicine specialists experienced in communicable

diseases control. Their routine work includes contact tracing for illnesses like tuberculosis, and during outbreaks of diseases like measles and mumps. The type of information system used for outbreaks varies across different PHUs and ranges from basic excel templates through to purpose-built clinical systems. In February and early March 2020, PHU staff were involved in aspects of border control as well as case management and contact tracing to control Covid-19. Many cases were returned travellers who had taken domestic flights, meaning the contact tracing workload was extremely high. As case numbers rose in March it became apparent that the workload would exceed the capacity of many PHUs.

A hub, called the 'National Close Contact Service' (NCCS) was established in the Ministry of Health to coordinate centralised contact tracing. In this new model PHUs continue to receive notifications of new confirmed or probable cases from laboratories and clinicians. PHUs experiencing heavy workloads can choose to divert parts of the workflow to the NCCS. PHUs inform the case of their result, arrange their home-isolation and identify close contacts. Close contacts who live with the index case are managed by the PHU. Other contacts can be transferred to the NCCS for tracing. These lists of close contacts, which take various forms, are forwarded to the NCCS either via entry into REDCap (an existing webbased database used by some Public Health Units), secure file transfer, or email. The NCCS has developed a 'finding service' that seeks contact information from various health and other government datasets. NCCS staff call close contacts and advise they are contacts of a Covid-19 case and obtain the contacts' agreement to quarantine (commonly called self isolation).

The NCCS started operations using manual processes on 24 March 2020. A national contact tracing technology solution (NCTS) was developed, piloted on the 27 March and used to process all calls from 6 April. This cloud-based platform repurposes case management software designed for the National Screening Unit, called the National Screening Solution. The platform stores case and contact details linked by exposure events, and supports contact management. It provides links to existing health information sources, primarily for sourcing contact details and the unique identifier from the National Health Index. Training in use of the new system for the contact tracing process was completed for all 200 NCCS users on 6 April.

The NCCS call centre is staffed by workers from a variety of professional backgrounds trained in the use of standardised scripts to guide their conversations. The call centre staff provide the close contact with self isolation advice and complete a health and welfare check. Clinical supervision is available on site by experienced Registered Nurses who can also escalate clinical questions to Public Health Medicine Physicians in the Ministry of Health. Contacts with more complex health questions are advised to contact their primary care provider for advice. Telephone translation services are also available. Following a call from the NCCS the person's information is referred to Healthline for follow up calls, on day seven and day 14 of the isolation period. Healthline checks on the people self-isolation and their health and wellbeing. They will place additional calls if there are reasons for concern. This differs from the standard practice in PHUs, which is daily calls or sometimes text messages in order to ensure both adherence to quarantine or the early testing and confirmation of Covid-19 in the contact.

Initially, the timeliness of the process was poor. For, example between 2 and 8 April the average time from referral to instructing a contact to isolate was 2.3 days. However this likely reflected the

staff training and software changes that were occurring at the time. At the time of my audit the main remaining quality concern was that only 60% of contacts could be easily reached by phone, either because of incorrect contact details or because people choose not to answer calls from an unidentified number. Linkages between the National Health Index and other health datasets were being established to address the first problem. Planned improvements include changes to have outbound calls show a local number as the caller, rather than the current mix of four digit numbers. If the person attempts to return the missed call an explanatory text message will be sent, and by the end of April, missed outbound calls will soon be followed by a text message.

The Medical Officers of Health I interviewed were broadly supportive of the concept of a 'hub' and agreed the NCCS could be an important part of measures to deal with the intense workload they faced in the last half of March. However, they were cautious about diverting contact tracing to the NCCS in many situations, because once they did they lost visibility of the outcome for the contact. The types of situations where that were felt to be best managed at the PHU level included:

- contacts who themselves have lots of contacts (currently these are mostly essential workers), because if the contact developed Covid-19 a new larger contact investigation could be required.
- medically complex people including rest-home residents who cannot not be adequately assessed by a call centre.
- transmission in institutional settings such as aged residential care or schools requires a high level of stakeholder engagement by a local public health official who is across all aspects of the situation.

For a greater proportion of contact tracing to be diverted to the NCCS, Medical Officers of Health would need to have access to the NCTS to be confident that the contact is traced in a timely way. This is particularly important for cluster management as otherwise second or third generation spread can be missed. Clusters that spread across multiple PHUs would also be visible. PHUs would also need to be confident that the frequency of follow up was appropriate for higher risk contacts. These areas need to be discussed further between PHUs and NCCS and appropriate triage processes and protocols refined. The underlying technology (NCTS) will also enable delegation of a case to the NCCS but this process will need to be very carefully defined, as cases need clinical care and are the highest risk group with respect to transmission.

At the time of my audit the NCCS was working to establish clinical governance structure and an equity plan.

System capacity and ability to scale

PHUs are indispensable for the public health response to Covid-19. As described above, only portions of their workload can be safely transferred to the NCCS even with better protocols guiding this process. When New Zealand moved to alert level 4 on 25 March, many PHUs were at or beyond their capacity to manage cases and contacts, even with increasing support from the newly established NCCS. During that week, nationwide daily case numbers ranged from 70-86. Some PHUs have since

expanded their contact tracing workforce on a temporary basis – drawing on staff normally involved in vaccination and school programmes – but this is unlikely to be sustainable once routine public health work recommences when the level 4 alert is lifted. Even these temporary increases are insufficient for the likely future workload. The capacity of PHUs is the primary factor limiting New Zealand's ability to scale up its case management and contact tracing response to Covid-19.

The NCCS model and its underlying technology is designed for scaling up and has had some experience of moderately high volumes. On 1 April, 701 contacts were traced by the NCCS. A suitable flexible workforce is being sought for the coming months. This service will be an important component of a scalable system that can be accessed by PHUs on an as-and when needed basis.

Even if the public health response to Covid-19 is improved through better surveillance and quarantine of returned travellers, the risk of further transmission remains, especially when level 4 restrictions are lifted. It is highly likely that there will be multiple instances of community transmission needing case management and contact tracing at intervals and across the country for the next year and beyond. To avoid regular nationwide returns to level 4 restrictions, PHU capacity must be increased. PHUs need the capacity to confidently manage cases and clusters through a combination of case isolation, contact tracing and potentially targeted restrictions on movement. If cases can be quickly identified and isolated and contacts quickly notified and quarantined then we have the potential to slow or stop transmission without widespread social disruption.

There is also a threat of a large outbreak, as experienced in many other countries even those with strong public health systems. For example, the Shincheonji church outbreak in Korea in late February/early March rose to over 4482 cases in less than 3 weeks (8). Such situations pose a challenge for planning because exponentially increasing demand will need to be met in a short period of time. Case isolation and contact tracing remain effective against Covid-19 even during large outbreaks. Therefore as a matter of preparedness there must be a plan to rapidly scale PHU and NCCS capacity to manage up to 1000 new cases a day if needed, while maintaining the essential performance quality to minimise the chances of transmission beyond identified case contacts.

Smart phone contact tracing technology

The primary way in which smartphone technology could support contact tracing is through Bluetooth detection of close contact between people's smartphones and, if one is later found to be a case, instantaneously notifing contacts of their exposure and the need to selfisolate. There is also the potential to use QR-codes to 'check in' to high traffic settings like public transport or cafes. This latter function has received less attention but seems particularly important as many clusters appear to arise from transmission in closed crowded environments (9,10).

Together, these features could identify contacts that would be missed by manual methods due to poor recall or anonymous contacts in a crowded venue. The time from case diagnosis to contact isolation could also be reduced. At the time of writing the Ministry of Health and local developers are building a smartphone app to assist with contact tracing. As it is not yet completed and a number of key aspects are under consideration, it cannot be meaningfully evaluated as part of this audit.

However, it is possible to comment on some aspects of the public health impact of whatever product is developed. First, it needs to be available quickly, piloted and continuously improved. Second, potential impact will not be realised unless it is acceptable to a large proportion of the population and enjoys high uptake. Less than a fifth of the Singaporean population downloaded the tracetogether app in ten days, which, assuming random mixing, means only 1 in 25 exposures will be captured by the app and public health impact will be negligible. Third, an app will also only produce incremental improvement in the time to isolate contacts as many other steps are involved and need to be managed, as described below. Fourth, an app cannot replace the option to interact with a real person as many contacts will develop illness, have welfare needs, or face issues with accessibility.

The monitoring and evaluation for a contact tracing app needs to consider the same parameters as the system as a whole, detailed below. In particular, the proportion of contacts identified by the app who develop illness should be closely followed, in case the app identifies too many low risk people and adjustments are necessary.

Reporting requirements

An effective high-quality contact tracing system for Covid-19 will have the following characteristics:

- Scalable – able to respond to exponential growth in case numbers
- Fast – contacts should be placed in isolation quickly.
- Effective – contacts will adhere to the self-isolation direction and onwards transmission from contacts will be rare
- Equitable – high performance across age and ethnicity
- Acceptable – to contacts and PHUs

A monitoring system is required to ensure the contact tracing system achieves these characteristics, and if not corrective action is taken quickly (2). A strength of the NCTS is that it allows tracking of the timeliness and completeness of contact finding and tracing (from the time of referral to the NCCS). However, the crucial measurement for contact tracing success is the time from case symptom onset to contact isolation. Data on this measurement was not available during my audit because the current monitoring system will not provide visibility of the upstream events relating to case management. The time taken to be assessed clinically, tested and notified of results should be considered components of a single system, and measured and managed accordingly. This will require information systems that make some clinical, laboratory and PHU processes visible at a single point within the Ministry of Health. Contacts traced through PHUs, with their various different contact information management systems, will also need to be captured.

The NCTS links case and contact data and has excellent reporting functions. Extending use of the NCTS to PHUs, with appropriate support for implementation and adjustments, would offer a high quality data system for improving performance.

A proposed set of reporting requirements is included as an appendix to this report. The target specified for time from index case symptom onset to isolation is based on two recent modeling reports (3,11). This is likely to need to be revised as more becomes known about the incubation period and by investigating instances of transmission from close contacts to third persons that occur in New Zealand.

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Appendix. Recommended reporting system for Covid-19 contact tracing

Reporting requirement	Proposed performance indicator	Interpretation	Remedial action if target not met	Priority
System capacity – number of cases able to have contact tracing completed/ day, overall and by PHU	To scale up to 1000 cases and their contacts within 5 days	This relates to the threshold at which physical distancing measures are introduced/reduced.	Expansion of PHU and NCCS capacity.	Critical
Proportion of contacts quarantined within 4 days of symptom onset of index case *(or exposure to index case)*	>80%	Too slow means onwards transmission will have already occurred.	Improve time from case symptom onset to sampling, sampling to PHU notification of result and time from contact isolation to isolation.	Critical
Time from case symptoms onset to test, stratified by ethnicity	<2 days in 80%	Late detection delays case isolation and potentially increases number of contacts	Raise awareness to promote early presentation Adjustment of case definition to emphasise early symptoms	High
Time from sampling of suspected case to test result *(at least PHU notification of positives)*	<24 hours in >80%	Slow turn-around times delay in case isolation and contact tracing.	Adjustment to sample transport or laboratory analysis processes	Urgent
Time from PHU notification of case to contact identification	<24 hours in >80%	Delays case isolation and contact tracing.	Increase PHU capacity, use of smartphone apps, digital or manual 'check in' to venues	High
Time from contact identification to isolation	<24 hours in 80%	Timeliness of contact tracing will prevent onwards transmission	Increase contact tracing capacity at PHU or NCCSor smartphone app. Or explore additional data sources for contact details.	Urgent
Number and distribution of close contacts per case **Characteristics of contacts** *e.g. age, sex, ethnicity, occupation, exposure setting*	No target	This information required under various physical distancing settings to understand system capacity	N/A	High

Reporting requirement	Proposed performance indicator	Interpretation	Remedial action if target not met	Priority
Proportion of suspected cases who should have a test, who have a test done *(per case definition – though still elements of discretion in CD)*	>90%	Low rate means cases won't be detected or isolated.	Increased availability of testing centres. Audit of referral processes	High
Proportion of identified contacts who are traced, stratified by household or other contacts and ethnicity.	>80%	Failure to complete contact tracing increases the likelihood of onwards transmission.	Review systems for interviewing case. Options for use of other govt datasets	Critical
Proportion of contacts with confirmed or suspected covid-19 at time of tracing	<20%	High rates means testing, notification and tracing process are too slow.	Improve time from case symptom onset to sampling, sampling to PHU notification of result and time from contact identificaton to isolation.	Urgent
Proportion of contacts with covid-19 over follow-up	No target but understanding this parameter important as informs whether contact definition is appropriate.	If high definition of close contact maybe too restrictive, if low definition may not be restrictive enough.	To inform definition of close contact.	Moderate
Proportion of contacts adhering to quarantine	>90%	Poor adherence risks onwards transmission from contacts.	Improve advice on quarantine, increase frequency of checks, use quarantining apps.	High
Proportion of contacts of covid-19 positive contacts who become covid-19 positive	<1%	This is a sign of failed contact tracing or isolation.	Improve time from case symptom onset to sampling, sampling to PHU notification of result and time from contact isolation to isolation.	High
Timeliness of reports	In real time	Enables continuous quality improvement.	Assess ability to develop real-time reporting into national contact tracing solution	High
Accuracy of reporting	proof of accuracy required	Poor accuracy on these KPIs impairs decision making especially with respect to social distancing interventions.	Audit	High

Turnaround time for a change to any policy related to case contact management system	< 5 days	Enables continuous quality improvement.		High
	Proposed performance indicator			
	>80% of PHUs find the practice acceptable >80% of cases and contacts find the practice acceptable			
Reporting requirement **Acceptability**		**Interpretation**	**Remedial action if target not met**	**Priority** High

Priority: Critical>Urgent>High>Moderate
Abbreviations: PHU: Public health unit; KPI Key performance indicator; N/A: Not applicable.

Appendix B: National Contact Tracing Service Action Plan

Theme	Audit reference	Actions	Time Frame
Capacity *Does the system have enough capacity to support a high-quality response?*	Recommendation 1 Recommendation 2	• The Ministry has requested updated guidance from its Technical Advisory Group (TAG) regarding peak case planning assumptions post alert level four. • The Ministry is developing a national COVID -19 outbreak preparedness plan for contact tracing in collaboration with the PHUs that will incorporate: o the operating principles between PHUs and the NCCS o the PHU's capacity plans o the NCCS capacity plan o an increase of Ministry, PHU-based and other resources that can be scaled according to demand and capacity requirements o governance and reporting arrangements.	Completed 17/4/2020 24/4/2020
Performance and Quality *Is the response measurable and high quality?*	Recommendation 3	• The Ministry is completing a clinical and technical review of the proposed indicators • Confirm a monitoring framework for national contact tracing • The Ministry will collate PHU and Ministry information to provide a national view of contact tracing performance. • The Ministry will collate PHU and Ministry information to provide a regional view of contact tracing performance. • The Ministry is enhancing the new national contact tracing information solution (NCTS) to deliver real-time reporting to monitor contact tracing performance and deploy, as a minimum to those PHUs that do not have digital capability to manage	Completed 17/4/2020 Completed 17/4/2020 22/4/2020 22/5/2020

Theme	Audit reference	Actions	Time Frame
		contact tracing.	
Coordination *Is the response nationally consistent and optimal?*	Recommendation 4 Recommendation 5 Recommendation 6	• The Ministry is engaging with PHUs to prepare a COVID-19 preparedness plan to agree the optimal referral protocols and processes with respect to the delegation of work from PHUs to the NCCS. The underpinning drivers will be to ensure: o clinically safe practice o timely, consistent and high-quality execution o the optimal use of the people available across the system (in particular with respect to cluster analysis, complex cases and high-risk contacts). • The Ministry has commissioned Healthline to provide daily wellness calls to individuals who have been directed to home-quarantine, consistent with best practice. • The Ministry is in the process of providing PHUs with access to close contact status along the pathway processed by the National Contact Tracing Service.	24/4/2020 Completed 14/4/2020 24/4/2020
Enabled *Is the response making the best use of technology to enhance its performance?*	Recommendation 7 Recommendation 8	• The Ministry has gathered valuable insights from PHUs as to how to enhance the NCTS to better support the end-to-end execution of contact tracing. These requirements are now being developed and will support the PHU implementation plan. • Once the NCTS is enabled to support contact tracing nationally, the Ministry will collaboratively develop a proposal for a broader implementation of the solution that will reference other strategic initiatives such as the National Health Information Portal (NHIP) • s 9(2)(g)(i) [redacted]	8/5/2020 30/5/2020

Theme	Audit reference	Actions	Time Frame
		s 9(2)(g)(i) [redacted]	20/4/2020 1/5/2020

s 9(2)(f)(iv), s 9(2)(i)