Contact tracing in South Africa

❖ **Contact tracing alone is only able to curb the spread of COVID-19 if we identify 50% of positive cases, they are informed and quarantined, and 60% of their contacts traced within 48 hours.**

❖ **Most automated contact tracing solutions require smartphone ownership, internet access and Bluetooth technology. With only half of the rural population and around 65% of the urban population owning a smartphone, a national contact tracing system dependent on smartphone ownership alone would leave a large section of the population locked out of the contact tracing programme as well as undermine the effectiveness of the programme itself.**

❖ **There is no one-size-fits-all solution to contact tracing. South Africa needs a contact tracing approach that blends different technologies and manual approaches and interacts with other efforts to contain the pandemic. The South African Department of Health should continue with manual contact tracing augmented by the *COVIDConnect* and *COVID Alert* applications.**

❖ **While the COVID Alert app and the Google Play Services library that is required to run the contact tracing system on Android phones should be zero-rated to ensure that income level does not determine the likelihood of using the app, this may prove hard to do on a technical level. Data rebates for installing the app or free data bundles for quarantine/isolation and working from home could be a way of incentivising use.**

❖ **Contact tracing regimes must all be privacy-preserving and should be private and secure by design. There should be security audits as well as plans for deletion of the data after the pandemic or anonymisation of the data if it is to be used for research, this should extend to contact tracing efforts outside of the public sector as well.**

Introduction

Containing the spread of COVID-19 (and the SARS-CoV-2 virus) involves an interlocking set of activities and none of these alone are a silver bullet to technically containing the virus. Due to the high natural rate of infection for COVID-19 (it has a basic reproductive rate or R_0 of 2.3),[1] a very radical set of steps are required to control its spread. The prime challenge is that we are always one step behind controlling the spread of the virus if we only self-isolate when we know we are infected. This is due to the virus spreading asymptomatically (while not presenting typical COVID or cold and/or flu symptoms). Modelling data shows that we

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[1] In epidemiology, the basic reproductive rate/number or R_0 is used to measure the infectivity of a virus and refers to the number of cases expected to be generated from one case in the population, or the amount of people one person infected with the virus will infect.

can only stop the spread of the virus if those with symptoms are identified and isolated within two days.[2] One cannot stop the spread of the disease if one is already likely to have passed on the illness.

There are only two paths to reduce the number of people encountering a contagious person; a shelter-at-home style policy or targeted quarantines. Shelter-at-home is a course tool that severely impacts the economy whereas targeted quarantines are a more fine-grain approach that allows some people back to work. Contact tracing is a key component of targeted quarantines as potentially infected individuals need to be detected and then informed that they need to start self-isolation (and ideally this should be monitored).

Contact tracing as a component of measures to fight the spread of COVID-19

Contact tracing is not the only tool to combat the spread of the virus, some subset of the following six components are typically found in any country fighting against a pandemic and are an essential component in the fight against COVID-19:

This will include:

- ❖ **Symptom screening** usually involves healthcare workers going door to door or in public spaces asking a set of questions such as "Have you had a fever and cough?" or "Have you travelled to a high-risk area?" Based on this screening, a test may or may not be carried out. Symptom screening can also be conducted virtually, like for example with an app, or with the **COVID Connect** WhatsApp and SMS platform.

- ❖ **Testing** is normally carried out by public health officials or private health care providers. Swab samples are sent to test labs and reports are sent back to health officials who then inform the patient of the outcome. Testing is normally only carried out on high risk individuals who have symptoms and are therefore contagious or potential carriers, or individuals who work in high risk environments.

- ❖ **Contact tracing** is the process of checking who the infected patient has been exposed to. It can be a manual or digital process or a hybrid of both. In the manual process, the patient is asked who they have been in contact with when they do a test. Registers in public places with your details and time of entry are also used to check contacts in these public spaces. The digital process makes use of an automated approach where a location or proximity system on a user's phone or some other identifier provides information on who the infected individual has been in contact with.

- ❖ **Exposure notification** is the process of notifying users who might have been exposed to someone with COVID-19. When contact tracing is automated, an infected individual's device running contact tracing software can report their positive status to a central datastore using de-identified information and this can be broadcast to

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[2] According to Ferretti et al (2020), while a three-day notice period will have some rather limited effect in controlling the virus, ideally the notification period should be under two days to allow for some margin in missing some positive cases and isolating their contacts.

other user's smartphones to inform them that they have been exposed (such as with the South African COVID Alert app).[3]

❖ **Hotspot detection** is a helpful tool to issue warnings about hotspots that could contribute to extreme spread of the virus. This can help direct focussed efforts for sanitizing areas or carrying out testing. Hotspot detection can be performed either manually or digitally or using a hybrid of both approaches.[4]

❖ **Immunity passports**: Some work environments, such as public transport, the health sector and schools have higher risk for infections. Immunity passports would, in theory, enable employees, customers, travellers, and contractors, to set individual limits for persons who have shown symptoms of COVID-19. An immunity passport could be issued when somebody has recovered or been vaccinated. The WHO has argued against certificates as the science is neither certain as to whether recovery provides one with complete immunity, whether antibodies mean immunity, nor are they certain how long the antibodies last. There are also many other risks such as score settling by employees, company sabotage and trying to encourage spread of the disease, where individuals try to get infected with COVID-19 in order to get immunity and obtain an immunity passport. A paper in *The Lancet* warned in May that "immunity passports would be ripe for both corruption and implicit bias," and that existing inequities may be reproduced by immunity passports (Phelan, 2020). Cases of corruption to obtain the clearance to get back to work or travel, have been reported in various part of the world.

The constraints of contact tracing

Efficient containment requires almost immediate notification of contacts. Feretti et al. (2020) created an epidemic model that shows a zone of control of spread of the virus for different combinations of (i) fraction of cases isolated, (ii) fraction of contacts quarantined and (iii) number of days until a COVID-19 positive person is isolated and their contacts notified. The model showed that:

❖ If only 50% of the positive cases are identified, 60% of their contacts need to be contacted immediately;

❖ A delay beyond two days in the identification of contacts dramatically reduces the likelihood of containing the virus.

About 50% of the rural population and 65% of the urban population own a smartphone, which presents challenges to automated contact tracing.

This puts enormous strain and pressure on manual contact tracing regimes to meet these tight requirements and provides motivation for other more automated tools that use smartphones or some other means to help provide faster notification times.

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[3] COVID Alert, using GAEN, broadcasts a positive user's randomised tracing keys to other users' smartphones and if the random IDs generated from these tracing keys match the random keys they have received, they are informed that they have been exposed.

[4] For the manual case, patients who test positive and possibly their contacts can be plotted on a map with randomization of their position. For the digital case, software can use de-identified geolocation data from a GPS to plot movements on a hotspot map. Additional general population movement data from sources such as the Google community mobility report can be used to check movement patterns in the hotspot and estimate the risk of spread of the disease in that area.

In countries, like South Africa, that have a dual economy with high income inequality and unemployment, there is no one-size-fits-all solution to contact tracing. Most automated contact tracing hinges on owning a smartphone, Bluetooth technology or having Internet access. With limited smartphone ownership, which correlates with Internet access, uptake of South Africa's new COVID Alert App will be limited. Current estimates from the 2018 After Access survey are that between 49 and 52% of the rural population and between 63 and 69% of the urban population own a smartphone. A national contact tracing system that depends on smartphone ownership alone would leave a large section of population (mostly the low-income portion of the population) locked out of the contact tracing programme.

There is an argument to be made for smartphone-based contact tracing in urban areas due to its higher smartphone penetration. Modelling shows that if a contact tracing application was installed on smartphones in urban areas this would still require 100% uptake (of the roughly 60% of the population that have smartphones with the required contact tracing features); with a detection rate of around 36% of the contacts made.

Epidemiology models show that this level of contact detection would require 80% of the cases to be detected with immediate notification and isolation to have an impact on reducing the spread of the virus (Ferretti et al., 2020). Thus automated contact tracing alone will not be enough to contain the spread of the virus.

Once contact tracing systems notify individuals that they have been exposed to a COVID-19 positive individual, there could be mechanisms to incentivize them to self-isolate for 14 days to help contain the spread of the virus. However, incentivisation to isolate is difficult to carry out fairly in South Africa's current economic climate. For example, an individual may not have labour protection such as sick leave, may be in precarious or part-time employment, may be engaged in "gig work", or could be in informal employment. Working from home is also constrained in South Africa due to the price of data for a large fraction of the population.

President Cyril Ramaphosa has announced that the zero-rating of the app by mobile providers would allow users to overcome cost of data as an obstacle to using the app. Despite looking at various options Research ICT has established that there are no instances in which the download of the app app is zero-rated. Zero-rating one app alone on the Google Play Store or Apple App Store, is not technically feasible as almost all websites and web services today are encrypted. ISPs have to zero-rate entire sites as the link to specific parts of the site that need to be zero-rated cannot be isolated for that purpose (Comninos et al., 2020). This can be observed in the current list of zero-rated sites during COVID-19 (McKane, 2020).The encrypted connection to the app store (essential to the security and privacy of users) means that only the whole store, not a single app can be zero-rated.

While zero-rating of COVID-19 related content, communications channels, and applications should be encouraged, the difficulty of zero-rating in general points towards the need for a deeper approach for bringing down the cost of data or providing free data to support the fight against COVID-19. While the download of the Android app is only 3MB (with a possible required upgrade of the Google Play services app of approximately 45MB), and the data it transmits is even smaller (a couple of kilobytes), the use of the app is only a small component of the data needed for contact tracing (including contacting contacts through WhatsApp for example). Contact screening, consuming information about COVID-19,

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working from home, and quarantining/isolating while still enjoying and exercising one's freedoms to communicate and associate are critical to creating a fair and just socio-economic environment during a pandemic.

The importance of public access points, such as free public wi-fi at all public buildings as proposed in the national broadband plan, SA Connect, has been highlighted by the pandemic and lockdowns.

Policy recommendations

The following contact-tracing approach is suggested:

❖ Continue with manual contact tracing augmented by the ***COVID Connect* application** and ensure that the notification interval does not exceed 2 days and ensure that checking the status of test outcomes can be carried out in privacy.

❖ Rapidly scale up South Africa's new Google Apple Exposure Notification (GAEN)-based contact tracing system, ***COVID Alert***, for users who have smartphones – specifically targeting the major city centres.

❖ In addition to zero-rating data used by the app, explore mechanisms such as **data rebates** once the app is installed to ensure that the data required to download the app itself does not preclude use of the app for low-income users. The data rebate could make use of a code generated by the app that is sent to the operator to get, for example, 100MB of data back on your data package.

❖ For users without smartphones, users that don't want to install the GAEN-based application due to security concerns or users who want additional knowledge about potential contacts, deploy the QR code-based ***CoviID system***.

❖ An **external security audit** should be regularly carried out on the central database, to ensure it is POPI compliant and the sensitive data is only used for its original intended purpose and is anonymized for research or deleted once the pandemic is over.

❖ Continue with **country-wide hotspot mapping** (such as the one being run at the CSIR in partnership with NDoH) using randomised locations of individuals who test positive and aggregate movement data from operators and platform providers such as Google. This system can be supplemented with a GAEN-based contact tracing system and the CoviID system to provide a more complete picture of where there are higher risks of infection.

❖ **Use an incentive scheme** to encourage users and businesses to make use of contact tracing applications. For example, medical aids schemes that have reward programs that already have some tracking systems for fitness and safety purposes could provide rewards for 14-day self-isolation. For users that are not on these medical schemes, mobile operators could partner with the government to provide data rewards for users that self-report their status. Tracking users not on private medical aids who haven't opted into their health and safety tracking systems is fraught with privacy concerns and should be avoided.

❖ Ensure that all deployed systems can **interoperate in a secure manner**. Data formats for contact and location data and security mechanisms for shared data should be agreed on. This will help, for example, provide notifications to individuals where detection of this exposure could have been through manual contact tracing, smartphone-based contact tracing or QR-code-based contact tracing.

❖ **Cross-border contact tracing** will become critical as South Africa opens up its borders. South Africa should participate in discussions in various regions on how to exchange encrypted tracing keys of infected individuals to enable travellers who enter the country to be alerted if they were in contact with somebody who tested positive for COVID-19 while outside the country.

❖ The challenges of zero-rating sites and health apps like COVID Alert and the lack of access for many low-income users who are required to stay home and continue to be economically active or continue their education provides strong motivation for a free basic data rate service in South Africa. This basic data rate service would provide always on, low-bandwidth access for all South Africans on any operator network and ensure that a basic level of access to critical digital services is always available. Extending free public wi-fi at all pubic buildings, particularly in rural areas, as proposed in SA Connect, would be another measure, that could have been swiftly deployed to ensure at least those with devices could get relief.

References

Ferretti, L., Wymant, C., Kendall, M., Zhao, L., Nurtay, A., Abeler-Dörner, L., Parker, M., Bonsall, D., & Fraser, C. (2020). Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing. *Science*, 368(6491). https://doi.org/10.1126/science.abb6936

McKane, J. (2020, June 17). Here is the full list of zero-rated websites in South Africa. *My Broadband*. https://mybroadband.co.za/news/internet/356371-here-is-the-full-list-of-zero-rated-websites-in-south-africa.html

Phelan, A. L. (2020). COVID-19 immunity passports and vaccination certificates: Scientific, equitable, and legal challenges. *The Lancet*, *395*(10237), 1595–1598. https://doi.org/10.1016/S0140-6736(20)31034-5.

Comninos, A., David, J., & Gillwald, A. (2020, September 25). Has South Africa's COVID Alert contact tracing app been zero-rated? *Research ICT Africa Blog*. https://researchictafrica.net/2020/09/25/has-south-africas-covid-alert-app-been-zero-rated/

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