The Big Digital Contact Tracing Experiment

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Abstract
Over a third of the world’s countries have launched contact-tracing apps in response to the COVID-19 pandemic, generating much hype about the prospect of automating contact-tracing to manage outbreaks and to alleviate costly and labour-intensive ‘manual’ contact tracing. Despite the stringent scientific criteria applied to the development of vaccines and other ‘biomedical countermeasures’ in responding to the pandemic, digital contact tracing has been widely recommended despite being an unproven public health intervention. Evidence for its effectiveness is thin, based on theoretical mathematical modelling and unsystematic observations across diverse country contexts. Establishing evidence of effectiveness is complicated by the fact that two private corporations, Apple and Google, own the technology upon which most government contact-tracing apps are based and which, by design, restricts access to needed data on privacy grounds. In this policy insight, we make the case for why public health authorities urgently need to establish the effectiveness and societal implications of this big digital contact-tracing experiment.

1. The big digital contact tracing experiment
Within the first year of the COVID-19 pandemic, at least 70 countries had launched apps to automate and assist established ‘manual’ contact-tracing (Global Pandemic App Watch, 2020). Contact-tracing is a core public health strategy for breaking chains of transmission by identifying and notifying close contacts of infected individuals, who can then present for testing and quarantine and isolation.

Contact-tracing apps are designed to ‘automate’ this process. In brief, individuals download an app onto their smartphones. If the user is infected and registers information about this into their phone, an algorithm promises to identify and inform their close contacts about a possible exposure to contagion. Apps developed in the first few months of the pandemic were often based on GPS location data that fed into a centralized data-base, which were controversial because they are privacy invasive and raise fears about digital surveillance by the state. A year later, most apps use a new Bluetooth-based technology developed jointly by Apple and Google to track other nearby phones and create a local register of close contacts onto the user’s phone that does not give public authorities access to the user’s personal or location data.

Across the EU, there has been cross-party political support for such apps, with authorities claiming that digital tracking of infections will be important for the free flow of labor and goods within the European market (European Union, 2020). But although public health authorities claim that digital or ‘automated’ contact tracing ‘can be an effective tool’ in the fight against COVID-19 (Norwegian Institute of Public Health, 2020, p. 3), the scientific evidence for this claim is very thin.

Initial calls to include digital contact tracing in the COVID-19 response often pointed to positive experiences with similar technology in past disease outbreaks. Yet a Cochrane systematic review of the evidence of digital contact tracing from past disease outbreaks (Ebola in Sierra Leone, tuberculosis in Botswana and pertussis in the US), disease outbreak simulations and mathematical models concluded that the efficacy of digital contact tracing is largely unproven (Anglemyer et al., 2020). Though it may help curb epidemic growth if combined with robust public health efforts, the review warned of negative equity implications for at-risk populations.

Evidence from mathematical models also provides an important rationale for digital contact tracing in the COVID-19 pandemic. At the start of the pandemic, University of Oxford modellers predicted that tracking apps alone could succeed in containing COVID-19, if a large enough proportion of a population used the technology (Ferretti et al., 2020). Since then, over a third of the world’s countries have

1 This policy insight draws partly from a research article published in Global Public Health (Storeng & de Bengy Puyvallée 2021) and an op-ed published in the Norwegian weekly Morgenbladet, available at: https://morgenbladet.no/ideer/2020/12/det-store-smitte-stopp-eksperimentet

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developed tracking apps, but all have struggled to get their populations to use them, even in countries like Singapore, where downloading the app has been mandatory. Nevertheless, those behind the models insist that infection apps are not just ‘a gimmick’, albeit now nuancing them as a valuable supplement to – rather than alternative to – manual efforts, whose use is justified because small effects can accumulate over time (Lewis, 2020).

2. Practical experience

Some experiences with digital contact tracing in Asia, notably from China, Singapore or South Korea, are often quoted as success cases and used to justify digital contact tracing in Europe, even though such apps could not be rolled out in Europe without breaking data protection regulations. In Singapore, for instance, the police secured access to personal information collected through the contact tracing app (Illmer, 2021). South Korea, meanwhile, has used GPS-tracing, credit card information and the publication of an infected person’s travel history to conduct digital contact tracing; measures that would have been unacceptable, not to mention illegal, in EU countries (Nissen, 2020). The case of Japan, which grants similar level of data protection as European countries through its Contact-Confirming Application (COCOA) app, shows low uptake (roughly 20 per cent of the population) and an ‘abysmally low’ number of people have actually used the app to register their infection status. The total in January 2021 was 9,736 – merely 3 per cent of the 380,000 positive cases tallied so far (Osaki, 2021). Regardless of privacy concerns, digital contact tracing has been implemented in these Asian countries as part of coherent strategies that build upon solid and well-functioning public health and preparedness systems. In other words, apps have not on their own solved the challenges associated with the roll out of a ‘test, trace and isolate’ strategy to contain the epidemic.

In Norway, authorities justify their recommendation that citizens download their contact tracing app by claiming that they have benefited from ‘knowledge and expertise from other countries that have been working for longer on this’ (Norwegian Institute of Public Health, 2020, p. 7). The new privacy-friendly app launched in December 2020 built on the Danish app, SmitteStop, which allegedly has proven useful in Denmark. Available statistics, however, nuance this claim. After 6 months of use, the Danish app was downloaded over 2.2 million times, which represents a relatively good uptake (38 per cent of Denmark’s total population). Although over 58,000 notifications of possible exposure that were sent through the app to close contacts of people who tested positive, only 875 individuals who tested positive reported having received a warning from the app (Smittestop, 2021). To put this statistic into perspective, over 200,000 people were infected in Denmark since the app was launched (WHO, 2021). Moreover, we do not know whether those notified through the app were contacted by human contact tracing teams in addition, or were notified of possible exposure directly by the individuals who may have infected them.

Germany’s Corona-Warn-App is also often cited as a successful example of digital contact tracing. But, despite 26.1 million people having downloaded the German app, its effectiveness remains uncertain (Robert Koch Institute, 2021). Only 60 per cent of app users who tested positive entered the code provided by health authorities in the app to warn their contacts. At the time of writing (March 2021) around 272,000 people had notified their close contacts about a positive test result via the app, but it is not known whether this information was subsequently shared with the health authorities’ contact tracers, nor whether these people went into quarantine or were tested. One estimate is that a mere 5-6 per cent of infections are traced by the app (Sholtz, 2020). A doctor involved in infection tracing in Berlin was recently quoted as saying, ‘the app does not give us the information we need to break the chain of infection’ (Roland, 2020).

3. Documented value?

Across the world, then, the roll out of COVID-19 tracking apps has occurred despite the lack of any robust documentation or evidence of their effectiveness. This means claims about their role in the pandemic response are in large part either anecdotal or based on statistics about the number of downloads and notifications, which in themselves, as we have indicated, have limited value. An important reason for this is that Apple and Google limit government and researchers’ access to relevant data for privacy reasons. Indeed, in its rapid assessment of whether to continue its pursuit of digital contact tracing, the Norwegian Public Health Institute acknowledged that ‘the biggest concern is that it is not possible to validate and measure the effectiveness of the solution’ (Norwegian Institute of Public Health, 2020, p. 2).

Whether contact-tracing apps will play a significant role in pandemic response globally remains to be established. For the Norwegian Public Health Institute, there remains a great deal of uncertainty as to whether they will ‘get enough attention and enough downloads for the app to have an effect’ (Norwegian Institute of Public Health, 2020, p. 2). The assumption is that high uptake will improve effectiveness. But to get an answer to the question about the effectiveness of the contact tracing app, we need more than just statistics about downloads, as the Institute itself acknowledges.

We also need, for a start, knowledge about how the app works among different groups. Digital contact-tracing is also likely to increase inequality in access for those who do not own a smartphone or are unable or unwilling to use the system for other reasons, such as previous negative experience of algorithmic-enabled discrimination or policing (Eriksen, 2020). Will people understand and trust the app and follow the advice on testing and quarantine they receive from it? Will people who download the app avoid using it to not risk ending up in quarantine? What is the added value to established manual contact tracing systems, besides a potentially – though not necessarily – financial one? What will be the
cost to the public sector if a large number of people have to test themselves or undergo quarantine unnecessarily? Will the app give its users a false sense of security?

4. ‘Manual’ vs. automated contact tracing

With public health authorities now promoting digital contact tracing as a supplement, rather than alternative, to established ‘manual’ contact tracing, we need more evidence of how the two work alongside each other. This requires consideration of the inherent differences between this new technological tool and established contact tracing approaches (Table 1). An important concern is that contact tracing apps based on Apple and Google’s exposure notification system cannot be integrated with manual contact tracing, and partly hand control of a core public health intervention and its associated data away from public authorities, and over to multinational corporations. It also shifts more responsibility for infection control onto individual smartphone users, who must decide not only to download the app, but also to seek out and enter a notification code into the app when they receive a positive test result and take the initiative to get tested or respect a quarantine when notified of a possible exposure (Storeng and de Bengy Puyvalèe, 2021).

We also need an explicit assessment of whether the costs that go into the design and running of digital contact tracing apps might have been better spent on scaling up established, effective contact tracing systems. This is important since systems run by humans perform much wider public health functions than simply notifying users of possible exposure, including offering advice and resources for testing and support for quarantine and isolation (Erikson, 2020). Contact-tracers can contextualize the potential infection situation – was the encounter with the positive case outside or in a poorly ventilated room? With or without a facemask? Was there a wall between the two phones that Bluetooth did not register? Human contact-tracers can also follow-up positive cases to make sure they comply with quarantine and isolation. An automated exposure notification, however, only sends a generic text message to an individual, who must both understand and comply with the ‘test, trace and isolate’ strategy based on their own good will.

5. Conclusions

It is striking that despite the stringent scientific criteria applied to vaccines and other ‘biomedical countermeasures’ to the pandemic, the reality is that digital contact tracing is an unproven public health intervention, whose proponents’ claims to effectiveness within real-life public health systems have not been peer-reviewed (Anglemyer et al., 2020). The evidence upon which over one third of the world’s countries are experimenting with this technology derives largely from theoretical mathematical modelling and unsystematic observations across diverse country contexts. We do not actually know if and how contact tracing-apps, for example, perform relative to established ‘manual’ contact tracing systems (though there is growing evidence that they cannot replace them), or how digital technologies work in distinct health systems or social and political contexts. Rigorous research into the effectiveness and societal implications of digital contact tracing should be an urgent priority for public health authorities promoting this new technology as part of the solution to the pandemic.

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Table 1. Manual vs. automated contact tracing

| Responsibility to trace contacts | ‘Manual’ contact tracing | Automated contact tracing |
|---------------------------------|--------------------------|---------------------------|
| Contact-tracing teams | Patients (who needs to enter a code in the app) & algorithms (notifying contacts) | Anonymous; no record of contact-cases notified. |
| Tracing process | List of contacts compiled by authorities | Standard (signal based) |
| Definition of ‘close contacts’ | Contextualized | Generic SMS |
| Communication with patients | Direct (phone) | Individual good-will |
| Compliance with testing and isolation | By law, follow-up possible | |

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