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Contact tracing is a fundamental public health intervention, and a mainstay in efforts to control and contain severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for the COVID-19 pandemic. At the time of writing, the pandemic has caused more than 13 million cases and more than 578 000 deaths.[1] Regions with the most successful containment to date have approached the pandemic with integrated measures that include cohesive leadership, effective communication, physical distancing, wearing of face coverings, improvements in the built environment, promotion of hand hygiene, and support for the staff, supplies, and systems needed to care for patients—with testing and contact tracing as cornerstones of the approach. Despite the emergence of some promising therapies[2] and work towards a future vaccine,[3] basic public health approaches remain the best available prevention and control interventions at this time.

Along with efforts to expand conventional contact tracing programmes, there has been an ongoing debate about the value of digital contact tracing, ranging from issues of privacy, questions about efficacy, lower user adoption rates, and concern from some public health experts that mobile apps might distract resources from the core work of conventional contact tracing. Yet, in the face of ongoing challenges in disease control, the question of whether digital technologies can supplement existing efforts is one that we cannot afford to ignore.

In *The Lancet Public Health*, Mirjam Kretzschmar and colleagues[4] model key steps in SARS-CoV-2 testing and contact tracing across a spectrum of scenarios and identify opportunities to maximise the effectiveness of the process in reducing the effective reproductive number of COVID-19. The study is important as initial large-scale physical distancing policies are relaxed and movement of people increases. Research into how and where to best invest in improving systems of contact tracing is essential, as even those areas with low case burdens will face ongoing transmission events and must be prepared to quell outbreaks as they occur. Not surprisingly, the authors conclude that speed is of the essence in testing and isolating: the study finds that keeping the time between symptom onset and testing and isolation of an index case at 2 days or less is imperative for success in reducing the reproductive number, and that rapid testing of symptomatic people is at least as important as the efficiency of contact tracing. This study adds to the literature on the role of contact tracing in COVID-19 and highlights the need for adequate testing capacity. The authors also suggest a meaningful contribution to contact tracing from mobile apps, which might minimise notification and tracing delays, although they do not consider a hybrid approach combining conventional and mobile app-based contact tracing.

The authors make several assumptions that might blunt the impact of their findings: they assume that index cases are isolated with no further transmission, yet household transmission has been reported as important even when contact tracing was in place;[5] that all traced contacts, regardless of symptoms, are offered testing, yet capacity to test remains an important challenge in many areas;[6] and that those testing negative (once) do not spread infection, yet this might be an over-simplification of the sensitivity of tests and the dynamics of infectiousness.[7] The importance of these assumptions could be tested in future research and modelling efforts, as could an analysis of a hybrid approach where exposure notification is used to support conventional contact tracing rather than replace it, which seems more likely in practice.

A limitation of the study is the lack of detail on the mobile app technology in the model. While the researchers focus on uptake and speed of notifications—two important parameters—there is a lack of discussion of the efficacy of an app in terms of its detector function (ie, the sensitivity and specificity of an app to determine if a contact event has occurred between two users[8]) and its effector function (ie, the effectiveness in contributing to the desired public health actions by the user, such as entering self-quarantine). The conclusion of the researchers,[4] therefore, that "app-based tracing on its own remains more effective than conventional tracing alone, even with 20% coverage, due to its inherent speed" seems premature without a more nuanced discussion of efficacy and of the potential challenges and harms of digital approaches. This is not to claim that mobile apps are lacking in promise, but they do remain unproven as a public health intervention. Therefore, as jurisdictions around the world roll out exposure notification apps, there are crucial questions that must be investigated to understand the efficacy of these apps and to make adjustments necessary to build user trust and adoption, if they are to make a contribution to pandemic response.

First, how well do smartphones measure proximity? In other words, what is the effectiveness of the detector function and how many false alarms might be expected for each true contact detected?

Second, how will mobile apps integrate with overall contact tracing programmes? Good contact tracing offers not just an epidemiological intervention—quarantining enough individuals to reduce the reproductive number—but also a human one, that investigates outbreaks and understands linkages, and that recognises and addresses the challenges inherent in quarantine and isolation by providing a variety of supports. In our experience, success at this challenging endeavour requires public health workers as human beings to connect with a person, to build trust on a human level. These vital dynamics are not captured in epidemiological models, nor can we expect that notifications provided by a mobile app will fill the place of the detective work and supportive human interventions at the core of contact tracing.

Third, what factors will encourage users to trust the privacy and security properties of mobile apps? Current adoption rates are low in every jurisdiction where apps have been deployed, with most peaking at download rates of about 20% of the population, and little data available about actual usage levels, which are likely to be lower.[9] Mobile app user behaviour depends on a subtle trust–benefit ratio calculation by users that is challenging to predict in advance.[10] What is behind the public's decision to use or avoid these apps? Do they have privacy or security concerns or question the benefit of the service? Do they trust public health authorities with their data and do they trust the authorities' pandemic response?

Fourth, how will mobile apps affect health equity? To be successful in addressing the pandemic, any contact tracing system—conventional or digital—should be evaluated within a health equity framework to avoid perpetuating the deep disparities that the global pandemic has so glaringly exposed.

As contact tracing remains a crucial component of the COVID-19 response, mobile apps offer promise, especially when considering the speed and scale required for tracing to be effective—as highlighted in Kretzschmar and colleagues' study.[4] However, understanding the potential impact of apps as part of a comprehensive integrated approach requires more evaluation of their use in real life and multidisciplinary engagement of technologists, epidemiologists, public health experts, and the public.

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