global POLICY

# COVID-19 Mobile Phone Apps Fail the Most Vulnerable

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**Abstract**

COVID-19 mobile phone apps proliferate. They appear to offer easy disease detection, containment, and require little personal sacrifice. But apps designed to locate, contact trace, and report on social distancing have not shown good return on investment, do not solve pandemic health governance challenges, and fail to help the people most likely to become sick from the virus. If policy makers are concerned with protecting the members of society most vulnerable to the disease and disproportionately sick, they must contend with evidence that shows how the apps fail on both the public health and health equity fronts.

**Policy Recommendations**

- Prioritize public health work focused on people who are most at risk for getting, spreading, and dying of COVID-19, recognizing the opportunity costs of disease apps.
- Enforce COVID-19 safety and prevention protocols, with first attention paid to low-wage worksites like long-term care facilities and factories, as well as prisons.
- Hire into government people who understand both health app technology and a government's obligation to protect the most vulnerable. Do not let business lead on phone-based care.
- Use social science (i.e. medical anthropology research) to assess the impacts of new disease-targeted technologies on vulnerable populations.
- Remember the long game: Concentrate political will and devote policy time and attention to evaluating and regulating health app claims.

Covid-apps proliferate. Some are imposed by governments, like the color-coded health-rating apps rolled out in some Chinese cities – green means permission to roam freely, but red means stay-at-home. Others are imposed by corporations or encouraged by landlords, as in the case of a midtown Manhattan real estate company app that uses thermal imaging and geofencing to ensure physical distancing and display restroom heat maps for employees to go when crowd flow is low. Some apps are in the development stage, like Harvard University's House Call app for students, "which can bring you a testing kit along with honey and tea" soon after your first cough. Other apps fall into the "Really? Apps can do that?" category, like the COVID-19 Voice Detector diagnostic app. Its developers, who are seeking US FDA approval, profess to use the unique signature of the human voice – much "like DNA and fingerprints" – to detect the disease.

The emergence of hundreds of covid-apps since the initial COVID-19 outbreak in December 2019 has
been profound. Even for the most skeptical, the appeal is hard to deny. They seem to offer easy disease detection and containment and require little personal sacrifice. They promise information, convenience, and hope at a time when people feel confusion, inexpedience, and despair. This essay provides an overview of what some of the new apps say they offer and a research-informed critique. Additionally, I examine the tensions between health and business domains, and explore what apps may be accomplishing when they fail. Throughout, I encourage government policy makers to do their job: Make decisions that protect the people who no one else is looking out for, and who are most vulnerable to getting sick. Prioritize them because it is most ethical, but also because it is public health prevention of the first order.

**Exacerbating Health Inequities**

As the demographics of COVID-19 show, disease prevalence is highest in communities that already bear the burdens of systematic and institutionalized discrimination. We do not need an app to find them. Sickness clusters are acutely obvious without high-tech detection; they are in long-term care facilities, prisons and detention complexes, and meat-processing factories. People in these places – unable to leave or shape the conditions of their contact with others, or control even how many times a day they wash their hands – are endangered just by being there. In countries with long-term care facilities, more than half of COVID-19 deaths are people in care. Prisons and other detention facilities have had huge breakouts; in one US prison 80% of the inmates tested positive for COVID-19. Meat factories, where people labor shoulder to shoulder, are hotspots throughout the world. Singapore, which managed COVID-19 well early on, saw a meteoric rise in COVID-19 positive cases in migrant dormitories where workers sleep 20 to a room.

Sickness clusters – of seniors and other long-term care residents; of the disproportionately black and brown people incarcerated; of immigrant and migrant laborers – account for large percentages of COVID-19 cases. Structural inequity and institutionalized racism during the COVID-19 pandemic will not be remedied by a location, social distancing, or contact tracing app because the remedies for these sickness clusters are social, political and economic, not technical.

To illustrate how incommensurate-to-need covid-apps can be, I review my opening gambits for equity. People most vulnerable to COVID-19 may not have a phone, and they are much less likely to have a recent model smart phone with a late-release operating system, as the COVID-19 Voice Detector requires. To be eligible for COVID-19 house call and tea, you must be a Harvard University student. Using the restroom heat map requires an employment situation able to provide physical distancing optimizations, like those in expensive office buildings. Most base, though, the map requires easy access to a restroom, which has been an issue for the spread of COVID-19 among homeless people.

App developers promise wider application in the future. But right now, apps target the 'already haves', that is, the demographic best

able to access healthcare and pay for disease prevention. These people have control over their housing, work schedules and commutes, and how many times a day they wash their hands. They are more likely to have discretionary incomes and can afford to stockpile food, bleach, and toilet paper. Apps for this demographic are optimizations. With or without an app, Harvard students have healthcare, Manhattan office workers have restrooms.

I have studied mobile phone technology use during pandemics before. When I began research in Sierra Leone during the 2014-16 West Africa Ebola outbreak, I hoped to discover that something as globally ubiquitous as a mobile phone would prove a powerful tool for Ebola containment. Mobile phone data were, in theory, supposed to be able to locate sick people, and the public health system was, in theory, supposed to deploy that data to provide care. As the research shows, however, the computational epidemiologists' model did not work. Their Ebola big data model had intractable limitations: mobile phones could not be linked to sick individuals; they mis-applied a malaria disease model to Ebola; and spotty network coverage beleaguered the areas where people first got sick. Rollout was hindered by telecommunications companies' reluctance to give up their call data, resulting in incomplete datasets. Even if computational epidemiologists had gotten all the data they demanded, escaping detection was anyone who did not have a new-enough phone, or easy recharging capability, or didn't want to be tracked, or simply gave their phone to someone else.

**Experimentation, Repurposing, and Racism during Pandemic**

During pandemics, as in war, there are many unknowns and healthcare problem-solving requires some trial-and-error. But during a pandemic, people's lives are at stake, and there are opportunity costs to experimentation. Time spent on finding or fitting a purpose for a technology during a pandemic is time not spent on other public health remedies, as I found in Sierra Leone.

In my most recent research on the value of mobile phone use during pandemic, I note that, again, basic questions are often not asked of COVID-19 apps. Beyond the hype, do they actually work to improve health outcomes? For the most vulnerable? Are apps built-for-purpose, or do their promoters grappled to find-a-purpose for an older technology?

The computational epidemiologists who failed in Sierra Leone have now repurposed their location models for 'social distancing reporting,' that is, using phone location data to identify whether people are safely staying away from one another. Their intention, they say, is to give policy makers information to "protect the most vulnerable populations" by providing "a more accurate and actionable understanding of the effectiveness of social distancing and other policy interventions aimed at reducing or slowing the spread of COVID-19". But just as in Sierra Leone where their modeling theorizations stopped far short of providing the care people needed to be well, computational epidemiologists are also now failing to consider the social, political and economic contexts within which their social distancing reporting are deployed. However well-intended, social distancing reporting can have dire consequences at the time of enforcement.

Analysis of New York City Police Department data, for example, found "stark racial discrepancies in social distancing enforcement across New York City". Between March and May 2020 over 80% (304 of 374) of the social distancing violations issued by police were to black and brown people. In Brooklyn alone, where black Americans make up 34% of the population, 88% (35 of 40) of the arrested were black. Health technology use is always contextual, colliding with ignominious normative social behavior, like police brutality in the US or discrimination against Uyghur people in China. In these contexts, covid-technology can further exacerbate social wrongs while further catalyzing disease exposures through detainment, which is reason enough for governors and policy makers to decide not to use them.

**Do Contact Tracing Apps Add Value?**

Contact tracing apps have been heralded during the COVID-19 pandemic. But what is their actual value-added? Apps are designed to supplement – not replace – manual contact tracing, which is a labor-intensive public health action widely considered an essential, low-tech approach to infectious disease containment. Apps are supposed to work in conjunction with manual contact tracing like this, in two stages:

**Stage 1:** Manual contact tracing works like this: Once someone tests positive for a disease, usually within 24 hours, a disease case investigator calls or visits them to take a full oral history of their movements while symptomatic. They create a list of people and their phone numbers from that person's household and workplace, as well as anyone who the person spent more than 10 minutes within a 6-foot periphery during the time they were contagious. People they passed briefly in transit or at the grocery store, including checkout clerks, are typically not included in the list. Next, a contact tracer uses that list to, usually, first text and then call the contacts, inquiring as to any symptoms.

'[The contact tracer] goes through a script, first informing the contact that they were likely exposed to the coronavirus, not revealing who they were exposed to, but sometimes it's obvious…[They] tell them they are required to quarantine for 14 days and ask about their living situation: whether they have a separate bathroom to use, whether they can take days off work, whether they have enough groceries. [They] can refer them to services that will help with cleaning supplies, food, and notifying their workplace. [They] ask about any symptoms of COVID-19 — fever, dry cough, shortness of breath — and refers anyone with symptoms for testing. [They] enter all the information into the online system. After the initial phone call, contacts receive follow-up text messages for 14 days asking about new symptoms. If they report any, they'll get another call to connect them with testing.' (Bai 2020)

**Stage 2:** A contact tracing app (e.g., TraceTogether) is voluntarily uploaded by mobile phone users. Phones loaded with the same app 'talk' to each other via Bluetooth technology and, in theory, log encounters of nearby phones, storing contacts in the phone. (The app must remain on and top screen, although this has been found to trouble other phone functions and makes the phone more vulnerable to hacking). Later, if an app user tests positive for COVID-19, they are expected to register their sickness in the app, which then sends alerts to their earlier encounters, at least those who have the app and whose app was on and top screen during the encounter.

Producing a good or better list of contacts for the disease case investigator is heralded as the reason to use the apps. But let's unpack that: After developing a master contacts list, a disease investigator must then check the app to see if it collected any contacts that the investigator does not have. The app may not have contacts to add to the investigator's master list, or could be listing false positives (i.e., neighbors within a phone's range but with whom there is no actual contact, or people encountered through plexiglass, masks, or face shields who were not at risk of exposure). But the checking takes time.

Once the list is turned over the contact tracers, the apps do not actually *do* the contact tracing. (This is the main reason that apps launched later in the pandemic were renamed as 'exposure notification' apps.) The actual contact tracers do *care* work, which includes the human/e elements of care – the calming and educating of contacts, as well as the directing of people to testing sites and other health resources.

Syncing apps with the public health data system is also an issue. When a public health contact tracing unit must configure its manual contact tracing system to sync with a private company app to get the two systems to 'talk' to each other, there are typically concomitant delays because of operating systems incompatibilities, old hardware upgrades, non-integrating software and plug-in issues. The question of *who* the technological sovereign is arises – Can the public health IT system *as is* incorporate the app's standard operating requirements or does the app

demand changes to that system to work? Syncing systems takes time and occurs when the time means lives.

**Privacy and Surveillance**

Public debates about the apps have centered on privacy and people's rights to move around in society unmonitored and undetected. Privacy concerns are cited most often by people refusing to upload the app. Tensions between public health imperatives and the presumptive rights about freedom of movement are not new; they have existed since the earliest days of public quarantine. Public health surveillance – 'the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice' is widely understood as righteous public health action. But the surveillance tacit in contract tracing apps connote Big Brother control and privacy surrender antithetical to freedoms presumed in liberal democracies.

Non-compliance with government efforts to use contact tracing apps has been widespread. Singapore, which rolled out a contact tracing app early in the pandemic and expected high rates of compliance, now admits that too few people downloaded the app, only about 20% of its six million people. That means that in any random encounter between two people, the chance that both will have the app is only 4%. There's also the issue that every user who downloads the app may not, if they test positive for COVID-19, share that information via their app. There is stigma attached to having disease. Downloading the app does not mean *actually using it* for its public health intension, not anymore than possessing a condom means actually using it.

Why do covid contact tracing apps appear to work to achieve public health goals in China? There they plug into vast and interlocking government systems of surveillance and control, as well as widespread COVID-19 testing. In China, access to mobile phone location data is simple; the government, which is in charge of pandemic response, has control and majority ownership of the telecommunications companies, making phone data for location analyses easily available for public health surveillance. In China, phone data is combined with other technologies, like continuous and pervasive use of facial recognition technology in public places. QR code scanning is required at checkpoints throughout the country to enter workplaces, apartment buildings, transit hubs and other public sites. For many years now, the Chinese government has embedded codes in citizens' phones to sanction different levels of mobility in everyday life. In a country where an individual's ethnicity and religion are encoded in phones, adding colorized health status codes may not in fact be the most stigmatizing.

**What Else Apps Might be Doing during a Pandemic**

As I found previously, pandemics are times of experimentation. 'Never let a crisis go to waste' is a business adage precisely because during calamity there is future business advantage to be gained. Pandemics, wars, and social cataclysms are boom times for some. In this section, I consider what else happens behind the scenes during a pandemic. If covid-apps are not very good for containing disease, what else might they be accomplishing?

*Business:* Businesses play the long game; data collected now is data that can be used in the future, to sell off, to improve product lines, or to price their business risks for future investors. Big Tech (Amazon, Google, Apple and Microsoft) is already planning for decades beyond pandemic times. Google has already been sued by Australia for misleading users about its location data uses, and Google's former CEO has been candid about using the pandemic to accelerate a digital revolution.

*Data Sharing and Selling:* Some covid-apps are leaky, and location and personal data are shared or sold without consent. In the US, for example, the states of North and South Dakota hired ProudCrowd to make their covid-app. For Care19, ProudCrowd repurposed their technology that enables fans to troll popular sportsbars during sports

events. ProudCrowd shared Care19 user location and personal data with Foursquare, which sells data to marketers and advertisers. Such third-party sharing is common, with little regulatory oversight. One journalist recently found 5,400 trackers collected data from his iPhone apps over a one-week period.

*Threatening Universal Health Coverage (UHC):* As private sector technology companies move stealthily into healthcare, the very nature of the arrangement poses a deep and immediate challenge to UHC ambitions (that all people can get health care without financial hardship). Big Tech is getting into healthcare for a particular demographic market: the people and governments *who can pay* for their products and services, not for the poor who need universal healthcare and its policy supports the most.

There is troubling evidence that despite massive health technology innovation in recent decades, improvements in public health outcomes have not kept pace. That disconnect – that population health outcomes need not improve for Big Tech businesses to succeed now and in the future – is at the heart of the health tech-equity dilemma.

**A Rubric for Policy Making during a Pandemic**

During a pandemic, global policy makers must make decisions quickly and often outside their comfort zones. The best governors make decisions that decrease suffering, grief, and risk of death for the largest number of constituents possible, prioritizing the needs of the people most vulnerable and least able to provide necessities for themselves.

Public confusion about how big a role business should play in organizing public health is a problem. But health equity is not Big Tech's job. Their job is to make things and find customers. Make no mistake, humans need health technologies, but Big Tech should not be in charge of ensuring health equity or good health outcomes. Only good governors safeguard that.

Here are some things to keep in mind when making decisions about pandemic disease apps:

**1.** Apps for disease tracking, social distancing, and contact tracing will not work and show good return on investment in most countries. Germany, for example, spent 20 million Euros on the development of a contact tracing app that must be voluntarily downloaded onto its citizens' mobile phones to work. It is highly unlikely to enhance the German manual contact tracing system, which works very well. Germany has one of the highest COVID-19 case detection rates in the world and a low death rate. Twenty million euros plus the social capital involved in bringing Deutche Telekom, SAP, research institutes, and the German government together to make the app is not a health equity proposition. Few countries could afford that level of investment with so little likelihood of improved health outcomes, nor should they.

**2.** People will find ways to avoid using apps for disease identification. App promotors ignore the fact that there is social stigma attached to being identified as having a disease, and humans find innovative ways to avoid disease stigma. This has been well documented for HIV and Ebola by medical anthropologists. In liberal democracies, avoiding disease detection and the labeling is as simple as not downloading an app or leaving a phone at home. Phones are still not selves.

**3.** Learn step-by-step how apps actually work. Avoid the mistakes of placebo studies – don't compare an app to nothing. During a pandemic, assess an app's value in comparison to public health practices already in place and working, like manual contact tracing.

**4.** Enlist social scientists to explain disease app equity quotients. Policy makers need help wading through the hype that indubitably accompanies new commercial technologies. And not only should global policy makers be concerned with what Big Tech will do with location and personal data today, they need to also anticipate what Big Tech is planning to

do tomorrow. To assess ‘digital technologies for good’, they need the critical expertise of social scientists who study health technologies for a living.

**5.** Infrastructure matters. People need to live in societies with infrastructural support that does first order pandemic care work. More people get tested when testing is free. People need bathrooms for preventive health hygiene, but they need clean water and sanitation systems first. Affordable housing averts many health problems. Pay people a livable wage. Universal Health Coverage is a big-ticket economic investment that has huge social, economic, and political returns during pandemics. Fix what’s possible, as soon as possible, for the next time.

Shiny apps can distract governors during a pandemic. More useful, equitable pandemic apps may be developed in the future. But in the meantime, ignore technological optimizations for people best able to get what they need during a pandemic. Turn a laser focus instead on care that helps the people least apt to secure it.

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