

The ethical dilemma of mobile phone data monitoring during COVID-19: The case for South Korea and the United States

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Abstract

Governments across the world have integrated a variety of advanced technologies to respond to the COVID-19 crisis. In particular, the use of surveillance programs that leverage data and tools from mobile phones have become important components of public health strategies to contain the spread of SARS-CoV-2 across the globe. Currently, big technology companies around the world are helping governments evaluate the effectiveness of their social distancing protocols by examining and analyzing movements of millions of mobile phone users in order to determine how the virus is spreading across the various geographic locations, and the effectiveness of the various social distancing methods that have been implemented. The collection and use of individual mobile phone data as a public health surveillance tool presents tensions between several ethical priorities. Such a dilemma resides in the tensions between public health ethics goals and clinical ethics goals. While public health ethics pursues goals that seek to ensure the good of the community, such goals are often achieved at the expense of clinical ethics goals which emphasize individual autonomy and civil liberty. In using persons' mobile phone data as a tool to fight the COVID-19 pandemic, we must address the tensions associated with weighing the needs of "the many" with ensuring the rights of the individual.

Keywords

Mobile phone data, COVID-19, data ethics, consent, civil liberties, public health

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Introduction

This paper identifies and discusses the many ethical issues associated with the collection, use, and sharing of individual mobile phone data as a public health surveillance tool in the fight against COVID-19. It seeks to answer the question of whether it is morally permissible to use mobile phones to collect and or monitor individuals' activities in order to reduce the spread of COVID-19. To do so, I examined how mobile phone data is used as a public health surveillance program in two politically and culturally divergent systems; South Korea and the U.S. I have also compared and contrasted how these two countries have applied the concepts differently and shed light on the differences in results achieved by both countries. The paper also discusses the tensions between public health ethics goals and clinical ethics goals when using mobile phone technologies as public health surveillance tools and provides areas where the two overlap.

In answering the question "Is it morally permissible to use cell phones to collect/monitor location data in order to

reduce the spread of Covid-19?" I offer detailed ethical analysis and defend my position that such public health surveillance is ethically permissible.

In conclusion, I offer recommendations on how we can concurrently seek to maximize the good of the whole while protecting individual liberties, privacy, and autonomy when we use mobile surveillance programs to combat the spread of SARS-CoV-2, the virus that causes COVID-19.

Background

Nations across the globe have struggled to contain the spread of COVID-19, the highly infectious disease that is

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still yet to be fully understood. As part of their response, governments have leveraged individual mobile phone data collection capabilities to mitigate the pandemic. A number of different mobile phone technologies in the form of applications (apps), have been developed and deployed as part of public health surveillance programs to meet public health goals across different countries around the globe in efforts to combat the COVID-19 pandemic. Such programs have been deployed and employed differently in the different countries and have achieved different results. There are key insights to be learned from how these programs have been implemented and deployed in the different countries and the differences in the impacts they have had.

By using mobile phone data, public health systems are able to conduct symptom tracking, mobility and density mapping, contact tracing, quarantine enforcement, and create digital health and immunity passes. While such surveillance methods can help public health systems mitigate the pandemic, they raise individual privacy issues, and individual liberty concerns. Whenever citizens' data must be collected for public health surveillance purposes, we must carefully consider and evaluate challenges posed by ethical and legal limitations. Such challenges are grounded in the principles of clinical ethics; respect for patient's autonomy, beneficence, non-maleficence, and distributive justice. As history has shown, data collection and data sharing, nationally, and globally during pandemics have not always aligned with core clinical ethics values to safeguard against infringement on patients' privacy, social justice, and fairness.

South Korea's model

South Korea's model to combat COVID-19 has been applauded as the gold standard by other countries. It relied on voluntary social distancing measures, and an aggressive tracking and contact tracing system. This resulted in minimal lock down activities across the country when the COVID-19 pandemic struck.¹ The country used a centralized approach to mobile surveillance to track infections, identify populated areas at risk, and enforce quarantine orders. To enforce quarantine rules, and engage in documentation, the government mandated individuals under quarantine orders, to include incoming travelers, install a customized app (developed by the Ministry of Interior and Safety) on their mobile phones. Through this app, the government was able to monitor those individuals and provided for them a means to keep in contact with their government case officers. Once the app was installed, users were required to log in twice a day for a 2-week quarantine period and indicate symptoms. This app monitored individuals by sending alerts when the device left the individual's home of residence or when it was powered off. Such actions prompted authorities to contact or visit

the individual.² Over 93% of the South Korean residents who were ordered to self-quarantine had the app installed on their smartphones. This allowed public health authorities to monitor individual movements and COVID-19 transmission risks. For example, residents who violated quarantine protocols had to wear location-tracking bracelets as a punitive and a corrective measure.³

Data collected from mobile phones via the app were pooled into a centralized data base which is managed by the country's Ministry of Public Administration and Security. It is important to note that the download of this app was mandatory only for individuals who were under quarantine orders as a result of showing symptoms, being exposed to, or infected by the virus, being close to an infected person, or who had traveled recently. They simply could not opt out. The government also required all infected persons to be interviewed for contact tracing. Local government authorities were provided a list of individuals in these criteria for the purposes of monitoring, in an effort to enforce this mandate.

In the event of suspicious infection of an individual, or a confirmed case of COVID-19, location-based emergency notification alerts were sent out via mobile phones to all persons who had come within close proximity to that individual. Such data were combined with contact-tracing maps, and the information provided in text alerts, helped identify exposed persons.²

Consider this real-life scenario in South Korea; a positive test result on an individual sets in motion contact-tracing procedures. Closed-circuit television (CCTV) footage, mobile phone tracking data, and credit card spending records would be quickly accessed by authorities. It is common practice that loudspeakers and text messages are employed to broadcast information about the places and times where the infected person had visited.⁴ In fact, citizens would regularly receive messages about patients and locations to keep them informed about their immediate environment in real time.⁵

When mobile phone data was collected, age, gender, ethnicity, and district of residence for each infected person were published, along with location history. Published details made it easy to identify individuals. There is no limit on how long such data can be stored by South Korean authorities. In fact, archived alerts can be found on websites of local governments indefinitely.²

Even though the government did not reveal names of infected patients, their ages, geographic locations, and places visited were publicly revealed. It would therefore be quite easy for close relations or acquaintances of such individuals to guess the names of patients. This approach can in fact violate the privacy and civil liberties of the patients.⁶ Citizens without mobile phones were monitored using the traditional methods of phone calls to land lines by a case officer.⁷

The United States model

In enforcing quarantine rules and implementing contact tracing in order to combat COVID-19, the U.S. employed a mobile phone surveillance program which is quite different than what we had in South Korea. The U.S. did not implement a national mobile phone contact-tracing program. Contact tracing was mostly carried out by local and state health departments and did not require mobile phone data or apps. The apps that were used were developed by different (mostly private) companies and relied on phone numbers and names provided voluntarily by individuals.

In 2020, the U.S. government engaged in active talks with Facebook, Google, a slew of tech companies, and health experts to discuss ways to use location data gleaned from Americans' phones to combat the spread of COVID-19. This included tracking the effectiveness of, and compliance with social distancing rules.

Public-health experts were interested in the possibility that private-sector companies could take steps to protect the privacy of citizens by anonymizing and aggregating the data used to map the spread of the disease. While health experts considered this approach as a powerful tool to track the spread of the virus, they also feared that such an approach could leave many Americans uncomfortable, depending on how it was implemented, given the sensitivity when it comes to details of their daily activities and whereabouts. According to multiple sources at the time, even if they proceeded with the idea, it would not involve building a government database.

Facebook executives confirmed in interviews that the U.S. government was interested in understanding patterns of people's movements through data that the company collected from users who allowed it.⁸ The tech giant in the past, had provided such information to researchers in the form of statistics, which in the case of the SARS-CoV-2, could help officials predict the next hotspot or decide where to allocate overstretched health resources. Google also confirmed that it had been in talks with government officials, tech giants, and health experts to facilitate its work to tap into the troves of location data (such as their popular maps app) and use aggregated anonymized location information to glean insights into impacts of social distancing.⁸ A spokesperson for the company stressed that any such partnership "would not involve sharing data about any individual's location, movement, or contacts."⁸ To date, it appears that this program was not pursued.

The US Centers and Disease Control and Prevention (CDC) utilized anonymized citizens' location data from mobile devices including population movement and close person-to-person contact outside households to determine whether the mandatory stay-at-home orders helped reduce the spread of COVID-19. This publicly available data was obtained to estimate county-level raw data regarding

movement. This analysis is one of the latest to use personal devices and the data they generate to describe behaviors relevant to public health. It estimated population movement by calculating the percentage of individual mobile devices reporting each day to be completely at home. In this case, where a mobile phone device (an individual), had not moved beyond a 150-m radius of its common nighttime location) within a given county. A 7-day rolling average was then used to smooth each county's pre- and post-order time series values.⁹

Tech giants Google and Apple teamed up with various government organizations, local and state authorities to build systems that monitored potential exposures while keeping mobile phone users' identities anonymous. In the following paragraphs, I describe a set of mobile phone apps and how they were used as public health surveillance tools for COVID-19 in the U.S. The message here is three-fold: (1) that the U.S. did not have a centralized (mobile phone) surveillance system, (2) that the use of, or the establishment of mobile phone surveillance programs was a decision that was made by state and local authorities independent of the federal government's involvement, and (3) that participation by citizens was totally voluntary. There was no mandate for citizens to use or download apps even when under quarantine orders.

The COVID Near You App: This was one of the very early mobile phone apps established to combat the COVID-19 pandemic. It is a crowdsourced symptom tracker, built by epidemiologists and software developers at Harvard Medical School, Boston Children's Hospital, and HealthMap. The goal was to collect data that would provide local and national views of the COVID-19 illness through publicly reported COVID-19 symptoms and testing activity.²

This app uses between-device Bluetooth technology rather than data collection into the cloud. Users were required to provide their age, gender, and zip code. Participants reported COVID-19 symptoms into the tracker after being prompted by the introductory question: *How are you feeling?* A healthy response routed the user to register with information as to whether or not he or she had a flu shot, and then optionally asked for a mobile number for texts. An answer that suggested illness would route the user to an interrogation of 21 signs and symptoms, as well as the individual's flu shot history, travel history, possible contact with a COVID-19 patient, COVID-19 test history, and whether the user had been quarantining. From these responses, the app would separate the "healthy" users from the potentially sick users and populate the map with users whose symptoms matched COVID-19. These maps also showed geographic locations where users have tested positive or experienced COVID-19 symptoms.¹⁰

COVIDWISE: This is the official COVID-19 exposure notification app for the Commonwealth of Virginia's Department of Health (VDH). The app allowed users to

anonymously share positive test results. When a participant reported a positive test to the app, the app would send signals which quickly searched for other mobile phone users using the same app and emit a warning. The signals are date-stamped, and the strength of the signal provides an estimated range of how close the two devices are. If the timeframe exceeds 15 min, and the estimated distance was within 6 ft, then the other user receives a notification of possible exposure. There is a high level of anonymity in these processes. No forms of user identifications or locations are shared. Mobile phone users are able to download the free COVIDWISE app on their mobile phones. They must then follow a set of instructions to opt in and turn on the Exposure Notification feature. The Exposure Notifications System generates an anonymous token for each mobile phone device. To help ensure these anonymous tokens can't be used to identify individuals or their locations, they change every 10–20 min. On a daily basis, a mobile phone device downloads a list of all the anonymous tokens associated with positive COVID-19 cases and checks them against the list of anonymous tokens it has encountered in the last 14 days. If there was a match, COVIDWISE will notify the individual and provide further instructions from public health authorities on what actions to take next to keep you and the people around you safe. For the purposes of this app, Apple and Google have incorporated Exposure Notification tools in their respective operating systems and claimed that these exposure notification tools would be deleted once the pandemic reached a point when the technology is no longer needed for public health surveillance.¹¹

The above examples generally provide insights on how mobile phone technologies were used in the U.S. to combat the pandemic. This selected group present a very small sample of the many mobile phone technologies used in the U.S. during the pandemic. Most of these technologies were launched at the state and or local levels to combat the spread of the virus.

Comparative analyses of models

In this section, I provide comparative analysis of South Korea and the U.S. approaches to using mobile phone technologies to combat the spread of COVID-19. My analysis compares and contrasts the two countries in the areas of their citizens' public surveillance acceptance, surveillance types used (local vs national), the two health care systems, and the two countries' privacy protection laws.

South Korea's model for contact tracing was controlled at the national level because the country has a national health care system. This is possible because the South Korean culture encourages solidarity with, and public cooperation with government and other local authorities in times of national crises. The country provides national health insurance to all its citizens through the National

Health Insurance Corporation under the Korean Ministry of Health and Welfare (MHW). The government authorizes the MHW to collect and use information on all COVID-19 patients and their contacts for public health surveillance and disease control. This centralized architecture is in stark contrast to the U.S. approach. The U.S. did not exercise a centralized approach. Instead, the burden of conducting mobile phone COVID-19 tracking and calling people individually to identify contacts was placed solely on the shoulders of the states and local authorities.¹² Because the U.S. constitution places public health under the jurisdiction of the states, the federal government would have had to work with all states to achieve a centralized architecture. Even though the U.S. is home to many of the world's big technology companies, its citizens hold mixed views on whether the use of cell phone data in the pursuit of public health goals is acceptable. Part of the reason is that the U.S. is an extremely individualistic society where most citizens believe that individuals must be left free to enjoy their basic civil rights.

As previously noted, South Korea successfully enrolled over 93% of residents who were ordered to self-quarantine to use the app. On the other hand, in the U.S., such systems were only available in only a handful of states. Even though close to 85% of the total U.S. population are familiar with and use smart mobile phone technologies consumers and information technology professionals expressed privacy concerns about personally identifiable information collected via these mobile phone apps.¹³

The South Korean model has been criticized because it appears to violate individual privacy and civil liberties. The country's coronavirus surveillance methods revealed more information than was necessary on infected persons. I would argue that the country's success in the use mobile phones to track the spread of the coronavirus reflects a culture of collective behavior and a shared sense of responsibility. South Korean citizens, in solidarity with their government, saw value in sharing their information for the good of the whole. Public health functions differently in the U.S. than in South Korea. The U.S. does not have a national health care system. There are no solid national public health laws that provide uniform guidance and directions to all citizens across all states.¹⁴

To use the South Korean model, the U.S. would require a change in the constitution or an unprecedented and improbable agreement of all 50 state governments. It would also require a cultural change, one that tolerates the level of surveillance used by South Korea.¹⁴

A recent survey by a leading South Korean policy think tank, STEPI, found that there is high favorability among South Koreans of continuous public health measures for infectious disease control, to include health surveillance.⁷

In the U.S., unlike South Korea, each state had to build its own app if they wanted to. Building an app for local authorities and many states was not a priority as they were

already overwhelmed by the stress and strain on limited medical resources and medical supplies by the pandemic. The information obtained from such surveillance methods in the U.S. would not have been worth the efforts at all. Alerts generated are mostly good for density mapping purposes and do not tell the user exactly when, where or to whom they were exposed, and do not provide information such as the exact time a person tested positive, location, and duration of the exposure. To make matters worse, many state-issued apps do not work across state lines. A user who travels across state lines may not have any use for a previously installed app because the current state does not support such a program. Unlike what we see in South Korea, the U.S. COVID-19 alerts are limited in the amount of information they can provide. There is currently no known national database to tie these data together. Even though Apple and Google have made privacy protection a priority, the U.S. culture has struggled to embrace and trust the technologies.¹⁴

In tracking the spread of the SARS-CoV-2, the government of South Korea admitted that personally identifiable data collected from mobile phones will be kept for the long term. The Personal Information Protection Act (PIPA), the government's comprehensive data protection and privacy law, requires data to be deleted after being used for the purposes collected. However, the South Korean government recently admitted that it will permanently keep patients' data for the COVID-19 pandemic and previous pandemics.

Mobile phone surveillance methods in the U.S. are not governed by the Health Insurance Portability and Accountability Act (HIPAA). In developing their contact tracing apps, Google and Apple minimized privacy concerns by focusing on Bluetooth-based proximity detection. By design, and to protect users' privacy, their apps hold most information on users' phones rather than servers. Because neither Google nor Apple meet the definition of a covered entity under HIPAA, the companies' contact tracing apps are not subject to the law's privacy enforcing requirements. In the absence of privacy regulations, users will need to depend on the good will of technology companies to avoid misusing data or violating their privacy.¹⁵

South Korea and the U.S. have their own histories and past experiences to lean on. Such history and past experiences could have played a role in the levels of acceptance of mobile phone surveillance technologies during the COVID-19 era. For the U.S., appeals to "liberty" have been a central part of the opposition to health system reforms. Whenever health care reforms are discussed in the U.S, liberty concerns trigger fears that reform means "loss of choice," "government takeover," and "socialized medicine." These reactions arise from the cherished rights by Americans to do as they wish and be free from external control as long as they are not causing harm to others.¹⁶ Americans' perceptions in giving up privacy for the public

good has also been impacted by events after the 9/11 attacks. Memories of post 9/11 personal privacy invasions suffered by Americans in the name of keeping citizens safe, still remain.¹⁷

South Korea's measures to combat the COVID-19 pandemic can be described as democratic due to the public support such measures received. Such democratic response stems from the culture of solidarity with government and lessons learned from the 2015 Middle East Respiratory Syndrome (MERS) coronavirus failure. In fact, this experience instigated reforms and subsequent changes in laws to ensure effective control of infectious disease outbreaks and transparency in the process. Before the MERS experience, the country lacked a national strategy to control outbreaks.⁷ MERS placed the country into a state of panic. Many South Koreans were unhappy about the government's lack of appropriate response and the government's hesitation to share information regarding MERS patients, leaving hospitals and local governments scrambling to identify patients and potential contacts.¹⁷

Comparing the public health impacts of the two models

It is important to note that both the U.S. and South Korea had their first confirmed cases and first deaths in January 2020. As of 5 March 2021, the U.S., with a population of 328.24 million, had recorded an absolute number of confirmed cases at 28,715,678. The number of cases in the last 7 days (between 27 February and 5 March) were 362,861, the absolute number of confirmed deaths were 518,145, deaths in last 7 days were recorded at 10,300, and the daily increase in number of deaths was 1898. This brought the total deaths per million in the U.S. to 1578.56 as of 5 March 2021.¹⁸

In South Korea where total population is estimated around 51.7 million, as of 5 March 2021, the number of confirmed cases was 91,638. The number of cases in last 7 days (between 27 February and 5 March) was 2317, while absolute confirmed deaths were 1627. Also, the number of deaths in the last 7 days was 32, and the daily increase in number of deaths was eight. This brought the total number of deaths per million to 31.46.¹⁸ In economic terms, as of October 2020, South Korea had only recorded close to 500 deaths due to COVID-19 and its GDP was expected to decline only 0.8% for year 2020. This presents the best projection among The Organization for Economic Cooperation and Development (OECD) member nations. In contrast, the U.S. had over 226,000 deaths and the OECD projects GDP will decline by 7.3%. While the U.S. continues to struggle to combat the spread of the virus, and has become a major COVID-19 hotspot with the highest number of confirmed cases and deaths in the world, South Korea has managed the pandemic well and kept COVID-related deaths under one per 100,000 residents.¹⁹

Even though we cannot attribute the entire success achieved by South Korea's model to contain COVID-19 to the use of mobile phones as tracking devices, literature review suggests that many public health experts believe that the approach played a significant role in the country's successful fight against the pandemic. South Korean citizens have sacrificed a great deal of their privacy in the name of the good of the whole, but in return, have been spared the pain and hardships of nationwide lockdowns and the closure of their economies as was experienced by citizens of the U.S. The U.S. public health system struggled to track infections. This can be attributed to a set of complex issues related to political divisiveness, systemic racism, and increasingly untenable wealth and healthcare disparities. Besides, it had to deal with a culture that places so much emphasis on privacy and civil liberties, let alone implement the level of public health surveillance that led to a successful fight against the pandemic that South Korea achieved.¹⁷

Since January 2020 until December 2020, more people have died in the U.S. over a period of 5 h than the total number that have died of the disease in South Korea. The last time the U.S. saw fewer recorded COVID-19 deaths in 1 day than did South Korea was on 8 November 2020. Since April 2020, on over 204 occasions, the U.S. has recorded more deaths in a single day than South Korea has over the course of the pandemic.²⁰

Medical ethics versus public health ethics, tensions, and overlaps

Medical ethics focuses on the individual, the physician-patient fiduciary relationship, and on treatment and cure. The focus of public health is directed to populations, communities, and the broader social and environmental influences of health. Public health ethics also focuses more on prevention rather than treatment or cure.²¹

While there exist tensions between the four medical ethics principles and public health ethics, it is possible to find overlaps and some commonalities in goals. In the following paragraphs, I used Beauchamp and Childress' principles model to examine where we can find overlaps and tensions between the two frameworks when mobile phone technologies are employed for public health surveillance.

The principle of **autonomy** requires that we respect the decisions of adults who have decision-making capacity. When applied in public health ethics, it would require that a person is valued and cannot merely be treated as a means to the end of others' good.²² The ethical justification for employing mobile phone technologies without individuals' consent presents a challenge at the intersection of principles of clinical ethics and public health ethics. The competing ethical priorities in this case are: protecting confidentiality, which is derived from the ethical principle to respect for autonomy, and the public health agents'

responsibility to use the information to improve population health. Public health surveillance by necessity occurs without explicit patient consent. According to Lee et al., when public health goals must be used to justify overriding individuals' autonomy, then those goals must seek to improve public health, improve population health, reduce inequities, attend to the health of the vulnerable and disadvantaged persons, and prevent harm.²³

In addressing the principle of **beneficence**, public health ethics is mainly concerned with the population, in addition to the individual. The benefits of a policy to a single individual cannot be easily evaluated. Whose health benefit must we evaluate when mobile phone technologies are employed as public health surveillance tools? Some people would stand to benefit from the policy while others may not. However, if an individual, or a significant number of persons decide not to abide by a public health regulation, their actions can adversely impact others.²⁴ Thus, the ethical justification for employing mobile phone technologies resides in acceptable trade-offs between what is good for the community versus what is good for particular individuals within it.²⁵ A way to push for beneficence in public health terms is to understand the ethical imperative to produce benefit in a wider sense and to talk of the obligation to "social beneficence."

The principle of **non-maleficence** obliges that we do not inflict harm on others. To address the principle of non-maleficence in the combat against COVID-19, the use of mobile phone technologies poses privacy-related harms to individuals. This can result in discrimination and abuse by governments, employers, and insurance companies. Individuals can also experience social and reputational harms if personal practices or lifestyles are made public.² Within public health policies and practices, there are often occasions where degrees of harm are "traded off" against the possibilities of greater harms, or perhaps positive benefit. In employing mobile phone technologies for public health surveillance, consideration of the non-maleficence principle shifts the burden of proof to the government or authority exercising the potentially "harmful" behavior that it is justified to use such technology.²²

Justice demands equal opportunities for all citizens. This also includes a fair distribution of health outcomes in societies. The socially controllable factors that lead to health, in this case access to mobile phones, must be distributed in such a way that when the technology is used to protect public health, the health of all citizens is protected or restored as much as possible. Looking through Daniels' model of justice, the use of mobile phone technologies to combat COVID-19 would be fair and just and will likely ensure health equity if all citizens had equal access to the technologies. When we cannot ensure all citizens equal access to health goods and positive determinants of health, then it would be difficult to ensure fairness. It also will exacerbate inequalities, which in public health ethics is

extremely problematic. Access to mobile phone technologies in South Korea are almost 10% higher than access to the technology in the U.S. Using such technology in South Korea could easily be defended as closer to fair and just than in the U.S. and elsewhere.²²

Is it ethically permissible to use mobile phone technologies for public health surveillance? An ethical analysis

The impact of COVID-19 around the world reminds us that a public health event in a single location can rapidly become a global health crisis. Control of infectious diseases such as the COVID-19 disease can therefore be considered a global public good, and public health surveillance is a tool that helps achieve it.²⁶ Is mobile phone contact-tracing and location tracking ethically justifiable? Is it ethically permissible to conduct public health surveillance on a population using individual mobile phone data? Consequentialist theories would suggest that actions and policies that have the best consequences is morally right. Utilitarianism will support actions that maximize the good of the whole irrespective of the resulting distribution. By contrast, when we employ deontological theories, moral obligations and individual rights, such as respect for autonomy, are factors that determine which action is ethically mandated.²⁷ In fact, South Korea's approach would be better supported by consequentialist theories while the US approach would be supported by deontological theories.

In the face of an evolving threat, such as what we have witnessed with the COVID-19 pandemic, public health officials have no choice but to weigh personal liberties against threats posed by the virus. In using mobile phone data to combat the COVID-19 pandemic and other global pandemics, we are confronted with an ethical dilemma. We must weigh the interests of individuals with the interests of the broader public.²⁸

Public health activities by both the U.S. and South Korea in varying degrees routinely brought some of the key moral considerations into conflict. Both countries ran into ethical dilemmas that concerned restricting of individual choices in efforts to prevent the spread of the disease and promote general public health. While South Korea's application of mobile phone technologies yielded satisfactory public health results, one will always wonder whether a less restrictive approach would have yielded similar results. Would we then suggest that the U.S. approach and results provide insights into what we must expect for less restrictive methods? Not necessarily, I would opine. There were so many things the U.S. could have done differently even without using intrusive mobile phone technologies to realize much more satisfactory results.

The argument as to whether combating COVID-19 using mobile phone technologies is ethically and politically justifiable can be informed Stuart Mill's harm principle. Mill suggested that "the only purpose for which power can be rightfully exercised over any member of a civilized community against his will, is to prevent harm to others. His own good, either physical or moral, is not a sufficient warrant."²⁹ The fine line we must walk and the delicate balance we must seek when we invoke the harm principle is avoiding what may come across as paternalism.

According to Childress et al. paternalism occurs when the state or an individual interferes with the preferences of a person for her own benefit (in this case, to promote his/her health).³⁰

A desirable end state for public health actions would be to influence human behavior that promotes public health with little or no harm to others. A great way or tool to achieve such end state is public education. In fact, most public health experts would tend to agree that the least controversial methods for promoting behavior change are through an aggressive educational campaign. Public health officials can rely on educational tools to warn, without the need to compel individuals. The problem with educational programs is that they do not always produce the desired behavior change, particularly among the socially disadvantaged or vulnerable groups.²² In the early stages of the COVID-19 pandemic, South Korea and the U.S. embarked on aggressive educational programs to educate the public to maintain hand hygiene and social distance. Educational programs are effective public health tools when most citizens can afford to be educated.²⁸ Even though equal access to education is important, it does not always lead to universal compliance. This is a classic ongoing public health problem. As an example, nearly everyone has received some form of educational material pertaining to the effectiveness of face masks in reducing risks of exposure to the virus. But many people still do not use them.

When we engage in mobile phone technologies for public health surveillance, the public health goal would be to achieve a fair public distribution of health. The argument to support South Korea's utilization of mobile phone technologies to combat COVID-19 pandemic is that most of the population have access to and use mobile phones. The same cannot be said for the U.S. It turns out that the most vulnerable groups to the virus may be the group that mostly lack mobile phone capabilities. Using mobile phone technologies as a public health tool would most likely not result in a fair public distribution of health for in the U.S.

The ethical and moral justification for asking citizens to be monitored by their own electronic devices sometimes against their will, stems from the desire to balance risks to the public and respecting citizens' personal freedoms. If the magnitude of risk to the public is great, then there can be justification for involuntary actions.²⁸ When citizens

mobile phone data are collected for public health surveillance, public health agents have responsibilities to the public to use the data to improve public health such that the risks of collecting and holding the data is worth the expected outcome of the use of the data.¹⁷

I argue that the use of mobile phone technologies for public health surveillance during a pandemic such as the COVID-19 pandemics is ethically justifiable on conditions that all data collected from citizens' mobile phones are used for public health purposes only and My statement is not to suggest that South Korea got everything right when it deployed such methods. Public health surveillance by necessity, can occur without explicit patient consent as we saw in the South Korean model.

The South Korean model can be justified with the argument that governments have public health obligations to improve population health, reduce inequities, attend to the health of vulnerable and systematically disadvantaged persons, and prevent harm.¹⁷

Up until the early 2000s, and many years before the COVID-19 pandemic, public health surveillance data was mostly collected using traditional methods. Such methods include voluntary reporting methods such as individual persons reporting, media reports, phone calls, completing forms in hospitals and community health centers, and reviewing public records, just to mention a few. During this period, the idea of using mobile phone technologies for public health surveillance would not have been plausible because very few people around the world had access to the technology. Fast forward, today, more than 5 billion people, which is about two-thirds of the world population are more likely to have access to mobile phones and smartphones than access to basic needs such as water and electricity.³¹ Such growth in access makes mobile phone data an easy and affordable public health surveillance tool that will help provide accurate health data and monitor disease trends. Due to how rapidly recent pandemics, to include COVID-19 have spread across the world, infectious disease experts have to find a way to quickly gather and analyze a lot of data across populations, without putting communities and "disease detectives" at risk. Collecting mobile phone data meets all the above requirements.³²

As we have experienced with the COVID-19 pandemic, it has been proven that contact tracing is a well-established feature of public health practice during infectious disease outbreaks and epidemics. The very high rate of transmission of COVID-19 means that standard contact tracing methods would be too slow to combat the rapid progression of infection through the population.³³ The South Korean model presents ample evidence to support this assertion. Even though there are a number of features of the South Korean model that would not have been effective or acceptable in other countries, I argue that there are important lessons we can learn from the success of this model. The reason why the U.S. failed in combating the spread of the COVID-19 virus was partly due data quality

issues which lead to ineffective contact tracing efforts. The U.S. has not exercised a centralized approach. This renders the data gathered particularly not very useful for an effective contact tracing program and thus harder to justify than the more effective centralized South Korean approach. In fact, rapid contact tracing is the cornerstone of effective public health response for highly infectious diseases such as COVID-19.³³ Traditional public health surveillance methods such as those I have listed above, are not be able to keep up with the desired rate of contract tracing methods and other effective methods to combat fast spreading viruses.

Public health goals are aimed at ensuring population health and reducing suffering. To overcome any pandemic, both governments and citizens must take responsibility. The ethical dilemma and concerns about data protection, security and privacy are totally valid. Looking at the two models presented, it is easy to argue that some citizen privacy infringements are ethically justifiable where they have the potential to contribute to the saving of lives and reducing suffering. I recognize the fact that we cannot use the *saving lives* and *reducing suffering* argument without making the effort to address issues such as minimizing privacy impacts, establishing reliable standards of data security, ensuring transparency about the use of mobile data, and using mobile phone data only for the specific public health crisis. I realize that such issues are not impossible to address although it requires lots of policy and political effort. Efforts to ensure such issues are addressed, are worth investing in if they result in saving human lives. There are many instances when public health agents are not be able to simultaneously address all the issues. In this case, society must accept tradeoffs between giving up some degree of privacy to promote lifesaving public health actions. The people of South Korea made such trade-off. This resulted in a relatively low number of deaths but also resulted in not being subjected to the lockdowns and economic hardships that were endured by citizens of the US.

I understand the concern about possible conflicts between liberty and privacy and I understand that mandatory downloading of apps can come across as paternalistic. But is the mandatory downloading of apps unethical? I argue in support of the South Korean model where the download of apps was voluntary but mandatory for individuals who were under quarantine orders. One of the necessary requirements to combat pandemics is to minimize the spread of the virus by separating the infected from the healthy. This position would be supported by the harm principle. This action is ethically permissible if such a mandate for individuals under quarantine orders results in the prevention of harm to others, and the individual's own good, either physical or moral. The argument about the potential infringement of person's liberty and privacy when we mandate the download of COVID-19 apps is defeated by what we witnessed in the U.S. and other parts of the world during the pandemic. If the citizens of the U.S

and other countries agreed to endure lockdowns and other restrictive measures, how then can we argue that mandating the download of an app is ethically impermissible? In fact, a better argument would be that the app allowed citizens (in South Korea) to go about their lives freely without the constraints imposed by a lockdown.

Conclusion

Global pandemics elevate and expand the demand for data collection, use, and sharing. We have witnessed and will continue to witness tensions between public health surveillance methods and individuals' freedom of liberties during pandemics. Even though there exists strong public health rationale and support for utilizing mobile phone technologies to track and report infectious diseases in the conduct of public health surveillance, such actions can simultaneously impinge upon people's civil liberties and rights. When we override individual autonomy and infringe on persons' civil liberties and rights in the conduct of public health actions, we must justify those actions in terms of the obligation of public health to improve population health, ensure equity, and prevent harm. Avenues exist that allow public health experts to simultaneously achieve public health goals and respect individuals' autonomy and liberties. When such avenues do not exist, then we must consider trade-offs. A public health system's justification for using citizens' mobile phone data must be driven by acceptable trade-offs between the good of the whole, and citizens' privacy and civil liberties. Society will need to routinely reevaluate temporary measures that are established during pandemics and return to normal when such temporary measures are no longer required. The experience in South Korea demonstrates the usefulness of mobile phone technologies in containing the spread of highly infectious diseases. I understand that there are certain adverse effects of the program. Further refinements are needed to protect the privacy of citizens while simultaneously pursuing an effective program. When we must use mobile phone technologies as a public health surveillance tool, we must provide to the public a clear understanding of what public health problem we are trying to solve with the technology. In doing so, consideration must be given to what minimum specific data is needed or required to meet such goals, understanding the tensions between the need for adequate data to inform public health practice and the ability to protect citizens' privacy.

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