

Friend Finder
(Technical Paper)

Digital Contact Tracing: Mitigating the Impact of the Next Pandemic
(STS Paper)

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On my honor as a University Student, I have neither given nor
received unauthorized aid on this assignment as defined by the
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Introduction

The COVID-19 pandemic drastically impacted the lives of people around the world after it was first identified in December 2019. Many efforts have been made to inhibit the spread of the virus, including lockdowns, social distancing practices, and government policies. A critical method for controlling the virus is contact tracing, “a process in which public health officials attempt to limit disease transmission by identifying infected individuals, notifying their “contacts”—all the people they may have transmitted the disease to—and asking infected individuals and their contacts to quarantine, if appropriate”[10]. In the past, public health officials interviewed an infected individual to identify recent contacts, but with the advent of technology it is now possible for proximity tracing apps to do the same with more accuracy in near real time.

Smart phone applications allow a user to report his or her positive case of coronavirus and alert devices that were recently near them. Built-in GPS or Bluetooth capabilities are used in order to trace contact between individuals. While it would be ideal for there to be a universal app for contact tracing that enabled tracing across borders, this is not possible due to the nature of health systems and regulations across the world and in the United States. Rather, over the course of several months following the inception of COVID-19, several countries (and U.S. states) have rolled out applications based on different technologies. Currently, the highest download percentage in a state or country is around 40%, and much lower in others, which limits the effect of the applications. A study at the University of Oxford estimates that the epidemic can be stopped if close to 60% of the population in a region download such an application. Closing the gap between low download percentages and the 60% mark presents a problem worth examining.

Furthermore, most states of the United States do not have a contact tracing application, which presents an additional issue.

Technical Topic

Contact tracing has been essential for communicable disease control in public health for dozens of years. The smallpox disease was controlled not by universal immunization but by extensive contact tracing to find all infected individuals. After identified as being infected, infected individuals were quarantined, and the surrounding community and contacts at-risk were notified. Although contact tracing is most often used for controlling diseases, it is also used to investigate the traits of diseases, such as infectiousness, when the capabilities of a disease are unknown. Contact tracing can be used to determine links between cases of the disease, and to determine if secondary transmission is taking place in a certain region. Contact tracing is also used in the airline industry during larger pandemics, and for partner care, which involves notifying the sexual partners of an infected individual. Although contact tracing can aid in addressing an infectious disease, is not always the most efficient method. In areas of high disease concentration, focused testing can be more effective. There continues to be problems in successfully executing contact tracing, but the progression of technology has enabled more possibilities.

There are several modern technologies that make contact tracing effective. Case management software is frequently used in public health to keep records of cases. This information is usually stored in a database with the ability to notify people who have been in contact with a disease carrier. Today's smartphones can use GPS, Bluetooth or Wi-Fi to yield locational data for contact tracing. In 2018, Facebook released a Bluetooth on smartphones for such use cases. Apple and Google released tools for building COVID-19 applications for iOS

and Android in April 2020. Developers can now utilize the Google/Apple Exposure Notification (GAEN) system to create contact tracing applications, which relies on Bluetooth Low Energy (BLE) wireless radio signals for locational information and can notify people that they have been in contact with infected individuals.

Although technology exists for contact tracing, it is not perfect. Repurposing Bluetooth from its original communication function poses serious technical difficulties. At Trinity College in Dublin, researchers found Bluetooth can perform poorly when a phone is in the presence of reflective metal surfaces — in one experiment on a bus in Sweden, a mobile application built using the GAEN system did not trigger exposure notifications even though the phones were within 2 meters of each other for 15 minutes. An additional issue with the technology is that Bluetooth requires the main phone processors be turned on and can quickly drain battery power unless the apps are restricted to short listening periods. One alternative is to use GPS signals. However, GPS signals use the device's location and pose a privacy issue, and furthermore the accuracy of the signals is not capable enough to determine if two people are in close contact. Some studies have been conducted proposing for people to carry around RFID chips, but the incentive for this is low.

Beyond the technical challenges faced, all contact tracing apps suffer from the same general problem: unless a certain percentage of the population installs an app, it will not work effectively. People will not opt in unless they believe in the public-health strategy behind an app and in the personal advantages they can hope to gain from it, which poses a major challenge. In Germany, which has had some of the best results of any country in containing the virus, only 41 percent of the population has said it was willing to download the country's app. Researchers at the University of Oxford modeled the coronavirus's spread through a simulated city of 1 million

people and found that 60 percent adoption is needed to stop the pandemic and keep countries out of lockdown, although lower rates of adoption are still helpful. According to Abuhammad in a study of people in Jordan, 71.6% of people accepted to use COVID-19 contact tracing technology. However, the percentage of people who were using this technology was 37.8. The cause of this gap was discovered to be due to ethical concerns such as privacy, voluntariness, and beneficence of the data. Across the globe where using contract tracing apps is optional this appears to be the case.

The proposed technical project is to design and develop a mobile contact tracing application based on Google and Apple's Exposure Notification system. Since only 13 states currently use the GAEN system, such an app would be useful for the states that have not yet implemented a contact tracing application. When completed, this application prototype could be integrated with a state's health system.

STS Topic

Challenges with contact tracing can arise related to issues of medical privacy and confidentiality. Public health practitioners are usually mandated reporters, responsible for containing a disease within a population and for warning individuals of their exposure. At the same time, infected individuals have a right to medical confidentiality. Public health teams are obliged to disclose the minimal amount of details that can meet the goals of contact tracing — contacts are only informed that they have been exposed to an infection, and the source of the exposure is left unidentified. Additionally, some health providers believe that contact tracing may discourage people from seeking medical treatment for fear of loss of confidentiality, particularly in cases of sexually transmitted diseases. The goals of contact tracing must be

balanced with the maintenance of trust and sensitivity to individual situations, although privacy puts a limit on effectiveness.

Tracking COVID-19 patients and contacts' activities with mobile applications introduces more privacy issues. Safeguarding privacy is the core concern of health systems, however, an individual's privacy has not been taken into account for some contact tracing applications. Some COVID-19 mobile apps impinge on people's privacy as they collect, analyze and have access to personal health data such as health behavior, status, travelling history, household coordinates positions and location. Contact tracing apps should instead enforce the privacy of data from contacts, snoopers, and third-party health agencies. Privacy concerns also present a major issue in increasing download percentages: The higher the perception that user privacy is protected, the more people will adopt a contact-tracing app, but stronger privacy protections place limits on the effectiveness of the tool in tracing the spread of the virus, thus slowing the spread of the app. Although it would be helpful if an app warned users that individuals with whom they were thinking of getting together were infected, or was incorporated into social media, this would put risk at an individual's privacy.

The goal of the STS research is thus to investigate how a balance between privacy and adoption can be achieved, which can increase download percentages. From preliminary research, it appears that the GAEN system is designed to limit data that could possibly be used to identify an individual and works directly with the phones' hardware, which could help solve privacy concerns. In addition to researching the best underlying technology to choose for developing a contact tracing application, it may be useful to investigate what makes a mobile application popular and how that can be incorporated into contact tracing applications.

Conclusion

When dealing with a deadly pandemic such as COVID-19, it is necessary to value both the lives and well-being of people. This includes ethical responsibilities such as giving respect to an individual's privacy. Google and Apple's novel Exposure Notification system presents a safe and secure method of implementing contact tracing applications, without collecting personal data or using location services. However, download rates of existing contact tracing applications demonstrate a problem, as they are far lower than Oxford University's estimated 60% for stopping the pandemic. Furthermore, many of the United States do not have contact tracing applications in place, presenting an additional issue. This project's purpose is to research how to increase the number of contact tracing application downloads within the states that have systems in place, and to create one for those that do not.

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