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Digital Contact Tracing for COVID-19:
A Review of Its Application to the Global Pandemic

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ABSTRACT

The spread of the COVID-19 virus across the globe has permanently changed life for billions of people. Manual contact tracing has been utilized to assist in limiting the spread of contagious diseases for many years. The ubiquitous use of smartphones and similar wireless devices has allowed this process to become digital in nature through contact tracing applications installed on these devices. Various countries, and even various regional units within those countries, developed contact tracing applications. Such applications relied on location and short-range communication technologies associated with wireless devices and found varying degrees of success. This work reviews research conducted by universities, governmental organizations, and other entities with respect to the adoption, use, and ultimate success of, digital contact tracing applications across various countries and points to their rather limited success in fighting the spread of the disease. The authors also briefly discuss some implications regarding privacy and security that affected their use in certain countries.

KEYWORDS

COVID-19, Digital Contact Tracing, Wireless Application

INTRODUCTION AND THEORETICAL FRAMEWORK

In this work, we reviewed a wide range of scholarly, governmental, and mass media sources with respect to the development and implementation of contact tracing applications for use in the COVID-19 pandemic. Such applications seek to identify individuals who have had contact with an infected, or suspected infected, person in order to notify them and presumably have them quarantine to prevent further spread of the virus. These applications began to appear across the globe in the Spring of 2020

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as the pandemic spread from country to country. These applications rely on location-based and short-range communication technologies in order to pinpoint such "contacts" between an infected individual and others. As will be seen in this work, many countries, and even states or provinces, rolled out their own versions of contact tracing applications along with guidelines or laws on their usage. Populations in these countries and other regional units adopted and utilized them in a rather haphazard fashion overall with some countries having much more adoption and success than others. Often the success was a result of the culture in the countries or policies/laws enacted by the government there.

This work first briefly describes the origins of digital contact tracing. It follows with a discussion of some of the technologies involved. It is important to realize that these applications took advantage of technologies already present in cellular phones and related wireless devices and were not the result of new technological innovations. We then describe the variations in digital contact tracing applications/approaches and levels of success in reducing the spread of COVID-19 across various countries spanning the globe through reviews of the literature. Additionally, we explore some factors that affected the success of digital contact tracing such as mobile device use and privacy and data security concerns.

The main goal, and implied theoretical methodology for this work, is to show the diversity of digital contact tracing applications across the globe and gain some insight with respect to the issues that affected their success or failure through the examination of the literature. Also, one can learn about the differences between countries and regions in terms of how easily they accept the use of technology to assist in a crisis and how committed their governments were in utilizing such technologies.

LITERATURE REVIEW OF DIGITAL CONTACT TRACING TECHNOLOGIES

Early applications of digital contact tracing began in an area of the world where tuberculosis is more much of an issue for the population than the developed industrial world in the early 2010's. The use of a digital contact tracing application for tuberculosis was successfully tested in Botswana and later utilized in other African countries. Unlike most of the industrialized world, the limiting factor in its implementation was the availability of 3G bandwidth at the time. This lack of bandwidth hindered the ability of the application to complete its centralized reporting mechanism thus defeating its main purpose. Digital contact tracing was also tested in Africa in Sierra Leone from 2014 to 2016 (Danquah, et al., 2019). Unfortunately, the central collection of data was inefficient or nonexistent in some cases due to technical and human issues. Overall, the application of the digital contact tracing was not considered a success for its application to the Ebola outbreak in West Africa in this case.

As the COVID-19 pandemic began in 2020 health departments and governments across the globe raced to find a technological approach to augmenting the traditional person-to-person method of contact tracing. Considering the near ubiquitous use of smartphones in virtually every country, tapping into this technological resource seemed to be the smartest move. The technology that developers have utilized for digital contact tracing is Bluetooth since it is included in every smartphone.

Smartphones equipped with Bluetooth could be used to track COVID-19 in the following manner:

1. Smartphones would generate complex strings of characters and exchange them, providing a way to know what people have been near each other without the need for exchanging personal identifiable information (PII).
2. An app developed for contact tracing generates anonymous codes that change every few minutes.
3. If people with the app are within range (for Bluetooth approximately 32 feet) for several minutes (a time determined by the health department to allow for exposure to the virus), their phones trade codes via Bluetooth and create an encrypted record on their phones.
4. If someone is diagnosed with COVID-19, they can volunteer to work with a health agency to enter the test result in the app.