COVID-19 contact tracing applications: An analysis of individual motivations for adoption and use
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Abstract
In attempts to remediate the COVID-19 pandemic, governments internationally released contact tracing and exposure notification mobile applications seeking to limit the transmission of the disease by recording app users’ contact with other apps users. To address user adoption and usage challenges, we conducted a qualitative study of approximately 300 users and 300 non-users of one such contact tracing application, ABTraceTogether, a regional app for Alberta, Canada. This article highlights four of our main findings at the individual user level: having a sense of individual agency, trust in the application developers and sponsors, belief in the efficacy of the app and altruism or pro-social beliefs. These findings are useful for application developers to target development and promotional issues to address adoption and usage challenges.

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Introduction
To assist in combatting the COVID-19 pandemic, organizations and governments adopted or accelerated the adoption of new technologies and digital media practices, both to mitigate the disease and to continue necessary tasks while quarantining or social distancing. Within the field of mobile media, applications were developed for self-diagnosis, risk assessment and disseminating healthcare information (Kondylakis, et al., 2020) as well as other purposes. One such innovation was in digital contact tracing and exposure
COVID-19 contact tracing applications: An analysis of individual motivations for adoption and use

COVID-19 contact tracing apps are designed to limit the spread of the disease as they can quickly notify individuals of potential COVID-19 exposure and facilitate automatic recording of contacts (Altmann, et al., 2020). Contact tracing is an established public health approach to limiting the spread of infectious diseases. Although public health units quickly ramped up their contact tracing efforts during this crisis, the pandemic’s scope made manual-only work difficult, if not impossible (Clark, et al., 2021). Consequently, many governments worldwide responded to this healthcare crisis by implementing a variety of contact tracing type apps (Altmann, et al., 2020). Many of these apps were developed and launched within a comparatively short timeframe for such large-scale deployment and did not have the same extent of user research and testing to gather feedback to aid in refining the app, troubleshooting and effectively targeting promotional efforts.

Most contact tracing apps were optional for the public to use. To attain sufficient usage levels without mandating usage or other methods deemed too personally invasive, requires motivating the public to use the app and removing as many barriers as possible to facilitate voluntary and continued cooperation. Adoption and user experience challenges can result in insufficient uptake of any technology and/or result in discontinued usage (Venkatesh, et al., 2002). As López, et al. (2021) declared, “App adoption remains the key factor determining the efficacy of digital contact tracing”.

Early polling of public intention to use such apps revealed people were willing to use them. Hargittai, et al. (2020) found 67 percent of Americans would use a contact tracing app, while a study in the U.K. found similar results, with approximately 75 percent of respondents indicating they would likely download such an app (Taylor, et al., 2020). Despite such indications of willingness to download and use these applications, the actual adoption rates have been lower than hoped for, with rates of usage in some regions averaging 22.9 percent adoption rate in 21 countries worldwide (Kahnbach, et al., 2021).

Identifying this discrepancy is vital to attaining actual users. It is thus helpful to examine the issue in depth by examining one contact tracing app and the thoughts and experiences of both users and non-users of the app. In May 2020, the government of Alberta, Canada released ABTraceTogether, a mobile application to mitigate the spread of COVID-19 in the province (see https://www.alberta.ca/ab-trace-together.aspx). Alberta, a province in central Canada with approximately four million people, was the first jurisdiction in North America to release a contact tracing mobile application (Mertz, 2020). The app was built by Deloitte, based on Singapore’s open-source code for their contact tracing app. At the time of the app’s launch, the Canadian federal government was non-committal about ever launching a contact tracing app and only released their national app across Canada in October 2020 (Daigle, 2020). Although an early example of a contact tracing app, ABTraceTogether is consistent with many other apps launched worldwide. The app is designed to be constantly on and running whenever a user leaves their home. Using Bluetooth, the app
searches and will record any other apps within a designated distance, and if one of those users becomes infected, the infected user is instructed to notify the app. Then, with users’ permission, public health officials will use the data to assist their manual contact tracing work. At no point is a user’s location captured nor are their contacts shared with the public. The Government of Alberta describes the privacy protections in place with their app: “This data is anonymized and encrypted and does not reveal your identity or the other person’s identity ... This data is stored only on your phone, and is not shared with Alberta Health Services, and is cleared after 21 days.” The application relies on voluntary usage by Albertans. However, weeks after launching the app, approximately only five percent of Albertans had downloaded it (Epp, 2020).

To examine the adoption and usage barriers and concerns regarding ABTraceTogether, we conducted a study of users and potential users of the app. We developed and launched an online questionnaire that included both fixed questions and open text responses. After several weeks of the application being available to the populace, we conducted a survey of approximately 300 users and 300 non-users of the application to understand their motivations for using it or for not using it.

Although the circumstances propelling such new technology are not anything one would ever wish for, it behooves us to use this healthcare catastrophe to learn about the role of such technology to be better prepared for the next and subsequent pandemics as well as other healthcare related issues. Our findings from studying users of ABTraceTogether detail the microcosm of issues at play that affect whether a technological intervention can be successful in helping stop the spread of the pandemic. It also has implications for other m-health and digital healthcare apps that may share similar concerns about privacy or invasiveness of personal information. If app developers and promoters consider the experiences, feelings and beliefs of the public going forward, we can help position future pandemic technological interventions to be more effective. Additionally, our findings are useful for understanding adoption challenges of mobile healthcare (m-health) applications, particularly those with similar privacy and surveillance concerns.

This paper begins by providing background information on the technological and procedural nature and scope of contact tracing and the role of apps in assisting this. A review of extant literature is then conducted followed by an overview of our study methods. Findings and discussion sections are then covered together for clarity, with a focus on four factors deemed by the researchers to be most salient, that is having a sense of individual agency, trust in the application developers and sponsors, belief in the efficacy of the app or approach, and altruism or pro-social beliefs. We conclude with recommendations from the participants.

**Background**

*Issues with manual-only contact tracing and COVID-19*

Manual contact tracing is a practice used by many public health agencies to curtail the spread of a communicable disease. Once individuals have been officially diagnosed and identified by a public health agency as having the targeted disease, they are asked to list all the people they have come in contact with. Public health workers then manually contact (usually via telephone) each person who an infected person might have come in contact with and request that they get tested and/or self-quarantine.

Contact tracing relies on an individual’s ability to recollect all the people and places they have been in contact with since their exposure risk, although experts will interview and probe to aid in their recall. Such reliance on individual recall has been identified as a limitation of contact tracing (Watson, *et al.*, 2020; Altmann, *et al.*, 2020). Contact tracing is endorsed by, “Virtually all medical professionals and medical bodies from America’s Centers for Disease Control to the World Health Organization” and has played a vital role in combating prior epidemics, such as SARS and Ebola (O’Neill, 2020).
Manual contact tracing is even more difficult with COVID-19 as people “are infectious 1–2 days before experiencing symptoms and contacts on average become infectious 3–4 days after exposure. The window to achieve containment by manual contact tracing is thus extremely short”, according to Altmann, et al. (2020). Data suggests half of COVID-19 infections occur before symptoms appear, thus necessitating speedy contact tracing of presymptomatic infected people before they unwittingly spread it (Abeler, et al., 2020). Although many jurisdictions have been doing contact tracing manually during the COVID-19 pandemic, the highly contagious nature of this disease and the quantity of infections has made the scale of such manual efforts a barrier to curtailing the spread of the disease (Watson, et al., 2020; O’Neill, 2020). The surging and vast number of cases in some places resulted in public health agencies becoming overwhelmed and suspending manual contact tracing. For example, in Canada’s largest city, Toronto, the public health agency suspended most manual contact tracing in October 2020 and instead relied on infected individuals to notify their contacts themselves of their infected status and their contacts’ possible infection (CBC, 2020). The stigma of such self-disclosure and problems with memory recall, however, make such reliance on individual contact tracing highly problematic. Despite the efficacy of manual contact tracing, the COVID-19 pandemic demonstrated the unsustainable limits to human-only approaches in situations with large scale infection rates and urgent timelines (Clark, et al., 2021).

Benefits and concerns with contact tracing apps

Governments worldwide responded to this pandemic using various types of mobile applications and models of usage. Mobile apps to assist in combatting the spread of infectious diseases precede the COVID-19 pandemic, as there was a 2011 test project to reduce the spread of the flu (Yoneki, 2011) and to assist contact tracing with the Ebola epidemic in Africa in 2014–15 (Tom-Aba, et al., 2018). Countries in East Asia were the first to utilize mobile device data and to develop COVID-19 contact tracing apps. Many other countries and jurisdictions followed with a variety of different approaches and apps. MIT created a list to track the national contact tracing apps at https://public.flourish.studio/visualisation/2241702). In addition to contact tracing, other jurisdictions released applications to aid self-diagnosis, symptom tracking, finding vaccine clinics and healthcare.

Contact tracing apps were launched by many governments to aid in their manual contact tracing efforts or with a realization that the scope of the disease’s spread would make manual-only contact tracing difficult if not unfeasible. Altmann, et al. (2020) note that contact tracing apps are advantageous not only for their ability to quickly notify people of their exposure risk, but also “the automatic recording of contacts scales up easily and avoids the loss of information due to patients’ recall bias and/or imperfect knowledge of the people they have been in contact with.” The anonymous nature of contact tracing apps avoids the stigma inherent in asking infected people to conduct their own contact tracing. Although some critics claimed contact tracing apps are an insufficient substitute for manual contact tracing, this concern appears unfounded as most jurisdictions used the technology to assist manual efforts, not to replace them. Kleinman and Merkel (2020) noted, “Combining traditional and digital contact tracing may leverage the advantages, and mitigate the limitations, of each approach.”

However, there are limits and concerns with the apps beyond these factors. For example, the applications still rely on infected individuals becoming aware of their illness, choosing to get tested, waiting for test results (which could vary from as little as hours to several days) and voluntarily notifying the app. At any point there could be problems in this chain of events, let alone any and all delays will increase the likelihood of an infected person spreading the disease. These apps were not meant as a panacea and were intended to be used in conjunction with public health recommendations, such as quarantining, social distancing and masking.

Contact tracing apps only function when one has a smartphone to install it on — this omits those who do not choose to use a smartphone or who cannot afford one. Even though the apps themselves are free, the networks required to use are often not. Thus, contact tracing apps are likely not a viable option for emerging economy countries that average 45 percent smartphone ownership of the populace (Silver, 2019). Robinson, et al. (2020) examined the digital divide issues that they believe “are directly and increasingly
related to both life-or-death exposure to COVID-19”. To address economic barriers, Singapore offered free tokens to run the apps (Wong, 2020). In regions with more widespread mobile device ownership levels, people without smartphones can benefit from adoption of contact tracing apps, as any effort that reduces overall infection rates benefits smartphone users and non-users equally (Almagor and Picascia, 2020).

Contact tracing apps were launched in an environment of the politicization of the pandemic, with some members of the public, governments and media denying the severity of the disease, its transmission and repudiating measures to curtail its spread (Halpern, 2020). Misinformation was spread about these apps via social media (WTHR.com, 2020), which is believed to have negatively affected their adoption (Zhang, et al., 2020). In addition, applications that track users’ location and contain information about their medical status has been identified by Liang, et al. (2020) as a substantive concern for users.

**Overview of contact tracing apps**

There are different approaches to mobile contact tracing applications (Sabarigirisan, et al., 2021). The type that became the most prevalent with Western governments uses anonymous proximity detection through Bluetooth technology with decentralized data storage. This approach, as used by ABTraceTogether in Alberta, Canada, maintains user and contact privacy by anonymously logging other app users within a designated proximal distance (Government of Alberta, 2021).

Proximity based apps address concerns with having one’s location tracked. With location-based approaches a device’s physical location as determined by GPS is tracked and if an infection occurs at a specific location, all users who were at that location within the relevant time period are alerted. Several countries or regions used this approach, including Bahrain, Bulgaria, Cyprus, Ghana, Iceland, India, Indonesia, Israel, Kuwait, Qatar, Saudi Arabia, Thailand and Turkey (Ryan-Mosley, 2021). Norway originally launched an app using location tracing but switched due to widespread privacy and surveillance concerns (Ryan-Mosley, 2021). These concerns in other jurisdictions lead to proximity-based apps being the chosen approach instead.

Proximity-based apps, such as Alberta’s, do not track the user’s location but the device’s proximity to other devices with the app installed. Alberta uses 10 meters as this is roughly the extent of the range of Bluetooth signals. Proximity based apps are advantageous for preserving the privacy of the user as their specific movements and visited locations are not tracked. Should someone become infected, they report this to the app and the app either sends an anonymous alert to those who have come in contact with that individual (as with “exposure notification apps”) or alerts a public health agency who manually conducts contact tracing using the supplied contact data. The Government of Alberta initially used ABTraceTogether in the latter way (which was in effect at the time of our study), with alerts only going to public health agencies, but later updates switched to notifying users directly. Proximity based apps have limitations that can generate incorrect or incomplete results, such as requiring a pre-set length of time for devices to be in proximity for an exposure to be recorded and that Bluetooth signals travel through walls even though the COVID-19 virus cannot (Newton, 2020).

Another important distinction between contact tracing apps is whether the app uses a centralized or decentralized architecture and data storage model (Fraser, et al., 2020). With centralized applications, the user’s application data is stored on a single, shared, external server (such as one provided by the app’s sponsoring government agency), which entails greater data privacy concerns. Decentralized applications, such as ABTraceTogether, store the user’s data on their device, thus limiting risks of third-party surveillance or hacking of private data.

Countries have used other tracking data methods. South Korea used “cellular data, credit card usage information, and surveillance camera footage [that] traced the infected person’s steps to locate everyone that he or she had come into direct contact with” (Chung, 2020). Taiwan tracked cellphone signal locations of people quarantining to ensure that they did not leave their homes (O’Neil, 2020). Israel’s government at one point enacted temporary legislation allowing the government “cyber-monitoring” powers to enforce
quarantining and notify contacts without user’s permission (Tidy, 2020). China used a combination of these tracking and surveillance methods (O’Neil, 2020).

Another distinction in the approach of contact tracing apps is opt-out versus opt-in for public usage. In an opt-out scenario, the application could be downloaded automatically, by the device manufacturer and the app begins to work by default and without the user’s direct knowledge or actions. However, some countries, such as India, China, Qatar and Turkey, required all or some citizens to use contact tracing apps (Ryan-Mosley, 2021). Other governments and their citizenry opposed mandatory surveillance and instead relied on citizens voluntarily downloading and using an application regularly.

Although this study focuses on one government-sponsored and voluntary application, there are other application provider approaches, such as ones offered by private companies (e.g., Google and Apple), academic institutions (e.g., MIT’s PACT https://pact.mit.edu), non-profit NGOs (e.g., COVID-19 Watch, https://stip.oecd.org/covid/), and employers (e.g., Safer Me, https://www.safer.me). Such a multi-faceted approach and a lack of standardization has been criticized as a limitation in interoperability and ability to share results across jurisdictions (Marhold and Fell, 2022).

Literature review

As contact tracing apps represent a novel approach to contact tracing and digital health generally, and considering the crucial ramifications of this topic, it is not surprising that scholarly discourse has emerged on the efficacy of these applications and their technical frameworks (as previously discussed) as well as the privacy and ethical considerations (e.g., Cho, et al., 2020; Klar and Lanzerath, 2020; Masoodi, et al., 2020; Seto, et al., 2021; World Health Organization, 2020). In keeping with our focus, however, our literature review concentrates on studies related to the adoption and usage issues of COVID-19 contact tracing apps. The literature review below presents a sample of studies and focuses only on those found to contain relevant or novel findings.

A number of factors have been found to influence whether or not a person will choose to use a contact tracing app. Technical familiarity and risk of severe health problems as a result of contracting COVID-19 were found to be key adoption factors by Redmiles and Hargittai (2020). A survey conducted by Jansen-Kosterink, et al. (2021) found privacy concerns, age, attitudes towards technology and fear of the disease to be the leading factors. The public’s concerns over their privacy were found to be balanced with fears related to the pandemic in determining people’s willingness to self-disclosure private information about themselves such as health status and location (Blose, et al., 2021). Elkhodr, et al. (2021) and Kahnbach, et al. (2021) found usability issues or poor app design reduced adoption rates. Also, a person’s self-assessment of their ability to use such technology was found to affect a person’s intention to use contact tracing apps (Walrave, et al., 2020). In their survey, Wagner, et al. (2021) found that continued usage is primarily driven by the app delivering perceived individual benefits, whereas Fox, et al. (2021) found these perceived individual benefits to apply to one’s health status. In survey studies, Kokkoris and Kamleitner (2020) and O’Callaghan, et al. (2020) found that prosocial beliefs, that is a desire to help the public at large or one’s community, were leading factors motivating people to use contact tracing apps.

As countries around the world offered a contact tracing app, scholarly studies began uncovering the primary adoption issues of the local populace. Patterns emerge from these studies, yet there is contradictory evidence, which may be due to local variance of attitudes and experiences. Munzert, et al. (2021) in their study of Germans found that offering informative or motivational videos such as including appeals to the common good or personal advantage did not impact adoption rates, but that offering a small financial incentive was effective. In a survey of French citizens, Guillou and Kergall (2020) found trust in the app makers (i.e., the government) and one’s perceived health risks were associated with a willingness to use France’s contact tracing app. Hassandoust, et al. (2021) survey in the U.S. also found one’s perceived
health risk along with societal health and privacy to be the leading reasons motivating one to install a contact tracing app, while finding trust in government officials to be only indirectly related. A survey in Australia found “effort expectancy, perceived value of information disclosure and social influence are critical for adopting contact tracing apps” (Duan and Deng, 2021). A comparative study of the use of contact tracing apps in five countries, Scotland, Cyprus, Iceland, Ireland and South Africa found eight common factors present across all of the countries that influenced decisions to use a contact tracing app. These factors are, “perceptions of data collection and management, sense of community, communications and misinformation, accessibility and inclusion, trust in public/private institutions, policy and governance, response infrastructure and digital capability” (Phillips, et al., 2021).

In Canada, a survey of 317 Alberta doctors found that despite most of them being aware of ABTraceTogether, only 27 percent recommended it to their patients due to reasons such as privacy and security concerns, distrust of the provincial government and not feeling it was their responsibility (Jerome, et al., 2020). One of the most applicable studies to our research was conducted by the Association for Canadian Studies and Leger in August 2020. They found that although 73 percent of Canadians believe that contact tracing apps are important, 46 percent of Canadians did not intend to download the national app.

The literature surrounding the adoption and usage challenges of contact tracing apps revealed that studies have largely utilized quantitative instruments, specifically surveys and mathematical modelling. Few studies, however, have used qualitative methods to enable the public to share their issues and concerns more openly for and against using such an app. In addition, many of these studies surveyed participants before they had a chance to actually use their region’s respective app. These approaches limit the ability of actual users of the apps to identify their own issues and provide their experiences and beliefs in their own words. Many of the adoption studies identify the same results as other studies without covering the issues in substantial depth. In discussing the “thorny problems of COVID-19 contact tracing apps”, Osman, et al. (2020) call for a holistic understanding of the issues. Our study offers a more holistic approach than prior studies, providing insight from the public that gives a fuller picture of the overall factors and context, as well as providing a greater understanding of the personal scope and impact of any adoption and usage issues.

Method

This study was conducted via an anonymous online survey of over 600 participants. Participants were drawn from self-identified users and non-users of the contact tracing mobile application ABTraceTogether. Participation was open to anyone who lived in Alberta, used a smartphone, 18 years old or older and able to provide informed consent. The survey hosting company Qualtrics XM was used to host the survey and for access to their research participant panel. A small financial incentive was offered to participants. After filtering out invalid responses, we received participation from 309 users and 306 non-users of the application.

We offered a series of open-ended questions (Dillman, et al., 2009) to solicit participants’ own thoughts and feelings on this issue in a more unstructured manner. We asked three open ended questions of all participants, both users and non-users. The first question was the same for both groups, “In the box below, please identify your top three risks, challenges, or concerns about using ABTraceTogether and provide brief details on why each of these is an issue for you.” The second question varied slightly between users and non-users with users asked, “Provide brief recommendations for the developers of ABTraceTogether or for Alberta Health Services to improve your experience of using the app.” The non-users were asked, “Provide brief recommendations for the developers of ABTraceTogether or for Alberta Health Services to address your concerns.” The final question was also the same for both groups, “Do you have any additional comments you would like to provide?”
Using data analysis software, the qualitative data was first coded based on categories established from literature and as emerged from the data using Dey’s (1993) suggested methodology. Subsequently, Dey’s methods of splicing, splitting, linking and connecting categories were used to develop a codebook. This codebook was then used as a basis for an additional, final round of focused coding. With data coding completed, the next stage entailed analyzing patterns to arrive at overall conceptual findings.

This study was approved by the ethics review board of a North American university and followed all established procedures for conducting ethical research. Data collection took approximately two weeks and was conducted in 2020.

Findings and discussion

As participants were allowed to share their concerns and experiences, it was unsurprising that many factors were identified as affecting their willingness or ability to download or continually use the app as well as general thoughts on the pandemic and contact tracing. Participants often raised raw feelings about these issues based on their perceptions of the issues. Our findings can be grouped into two top-level categories, specifically issues at a device level and issues at a personal level.

Participants raised concerns at the device level, relating to the battery drain of the app, data costs from using the app, overall app fatigue, insufficient device memory, download and installation problems, performance errors and bugs, device incompatibility, language barriers, inaccessibility and usability issues. Some concerns were genuine glitches or limitations, while other responses come across as attempts at justifying a premade decision not to use the app, as some of the issues participants raised as a determining factor to not use the app could be addressed through relatively simple efforts (such as removing other apps to make room or contacting the app’s tech support). Participants also raised profound barriers and suggestions for remediation.

At a personal level, the issues raised by participants that influenced their willingness to download and use the app center around personal beliefs and values. Despite efforts by officials to assure participants that their privacy was protected and that their location was not tracked, participants were nonetheless concerned about their privacy of their health status (particularly if infected at some point), with the surveillance of their locations, with the security of this data and the possibility of it being shared or hacked.

Other personal issues include participants’ level of altruism or pro-social beliefs, sense of personal agency (i.e., that one’s use of the app can make a difference), confidence in the efficacy of the app, personal concern for safety or the safety of loved ones, peer pressure, level of trust in the app sponsor (i.e., the provincial government), comfort with technology and awareness of the application and how to download it. Beyond the scope of app developers, larger issues were raised, such as a lack of belief in the reality of the pandemic (i.e., that it is a hoax) and the nefarious actions of government. These issues should be considered when not only planning such an application, but also in tailoring support material or promotional efforts.

For the purposes of this article, we determined four factors to focus on based on those most frequently identified by participants or those not fully addressed in previous studies. These four factors are trust, efficacy, agency and prosocial behaviour/altruism. Trust is the first factor we will discuss, as people need to trust a) that the pandemic is genuine and b) that the apps’ creators and sponsors will not misuse their data. Second, one must believe the app can actually do what it sets out to do — that is the user needs to believe in the apps’ **efficacy**. The third factor is a **prosocial/altruistic attitude** which provides people with the desire to take individual action that primarily benefits others. Finally, users must have a belief in their own **agency**, that is, they must believe that their own use of the app will contribute to the fight against COVID-19. These four factors are important as they build upon one another and work together to help propel someone to download and motivate them to continually use the app.
Trust

For the purpose of this study, trust is defined as (1) the participants’ belief that government and public health officials are telling the truth about the severity of COVID-19, and (2) the participants’ belief that the makers and/or sponsors of the app (in this case the Alberta government) are trustworthy in their collection and use of personal data and in their competence in protecting their data. Trust was found in a survey by Guillon and Kergall (2020) and Philips, et al. (2021) to be a leading factor for willingness to use a contact tracing app, and it was a major issue for many of our participants. Our participants expressed both a trust and distrust for officials. This factor becomes more nuanced as participants indicated degrees of trust.

Pandemic is real

Given the spread of misinformation on social media, including the conspiracy theory that the entire pandemic is actually a “plandemic” orchestrated by world governments to control people, we were curious whether such beliefs were a major factor in the decision of participants not to use the contract tracing app. In their study, Philips, et al. (2021) found that the spread of misinformation was an influencing factor in some users deciding not to use contact tracing apps. Some participants expressed that they would not use any app because the pandemic was a complete hoax or because the pandemic’s effects were exaggerated. For instance, one participant claimed “The government and mainstream media needs to admit it’s not as deadly as they are portraying it to be and stop lying to the world. It’s about government control. Not the care and concern of the human race.” Another participant stated, “Don’t trust the app or the government implementation.”

Belief in the existence of the pandemic and fear of oneself or others contracting COVID-19 was found to be a motivating factor in users of the app. One participant stated, “I know someone who died from COVID-19 and want to do everything I can to stop the spread, so it doesn’t happen to someone else.” This is similar to results by Jansen-Kosterink, et al. (2021) who found that fear of contracting COVID-19 was a key factor in using a contact tracing app.

Trust in the government and assurances of privacy

Almost half of participants expressed concerns surrounding the privacy of the data collected by the app. This is similar to a number of other studies that also found privacy to be a major factor (such as Cho, et al., 2020; Klar and Lanzerath, 2020; Masoodi, et al., 2020; Philips, et al., 2021; Seto, et al., 2021; World Health Organization, 2020). Participants indicated that they need to be able to trust that the government and the app makers are not sharing private information, such as users health status, location and contacts with others. As well, they need to trust that the app makers are not storing data in an unsafe manner. Many participants expressed that they did not trust the current government in Alberta and that they did not believe government assurances of the safety of their data. This is similar to the study by Jerome, et al. (2020) which found that some doctors would not recommend the app because they mistrusted the Alberta government. One participant wrote, “I only have one [concern] and that is that I don’t trust the government and what they are doing with the information. They say it’s for one reason, and it will be deleted but I doubt that’s the case.” Another participant stated, “Government intrusion into life — I feel that letting the government having access to information like this — on purpose — is giving them an ‘in’ to intrude even more into our lives and giving them more control on what they can and cannot do with our personal information.”

Participants expressed concerns that they would be tracked by the government when using the app. Despite government assurances that the app was not tracking people’s locations, either people never knew or did not believe this. One participant explained that they did not want to use the app because, “I don’t want to be tracked.” Another said, “I don’t like the government following me around its just creepy (must be boring for them too!! LOL).” Another participant stated that they did not believe government assurances, “I know the app says they don’t track but we have a history of Canadian politicians lying terribly so we simply cannot blindly trust what they say.”
Privacy experts and pundits expressed concerns with contact tracing apps, and these concerns were spread on social media. While a number of these concerns were not applicable to ABTraceTogether due to the anonymity protections built into the app, it appears that privacy experts played a role in damaging the adoption rates of contact tracing apps. For instance, one participant said, “Privacy experts have concerns with the app. That is enough for me. I would rather listen to experts than Jason ‘Lyin’ Kenney [the provincial government leader].” Another participant noted that, “I want a promise that is legally binding that all data that is copied or received from my mobile is made available to me and at my discretion alone, be fully and completely removable from all databases which have had access.” Another participant worried that “I feel like my data is being stolen and sold to big companies.” This lack of trust for the government could be remedied by neutral third-party appraisals and monitoring, however, as this was not available it remains uncertain if this would suffice.

Although people must have trust in the government to be willing to download and use their app, only one participant mentioned this as a reason for using the app, noting “I have faith in the government to do this.”

Trust in security of personal data

Shortly before ABTraceTogether was introduced, it was widely reported in Canada that government agencies, including Canada’s tax agency, the Canada Revenue Agency (CRA), experienced breaches resulting in the exposure of sensitive individual data (Tunney, 2020). A number of participants expressed the concern that no government agency is safe from hacking, and they did not want their data to fall into the wrong hands. One participant stated they were concerned about “The CRA just had hackers get into their databases about people's financial information. The Alberta government could have a breach as well, giving out important medical information about people which invades privacy as well as could be used to affect the lives of the people whose accounts are breached .... Giving them access on purpose would not be a good thing.” Another participant said, “I don’t trust the government to handle data, especially after CRA was hacked.” Some participants expressed concerns about the data being misused by government or hackers, such as one participant who stated, “I am concerned about potential misuse of the information collected by the app, either by hackers or by government officials.”

Trust in the technical skills of developers

Although trust was mostly identified as an issue regarding the government’s capturing and use of data, some participants also expressed concern with the technical skills of developers of the app. The application was developed very quickly, and a number of participants had doubts in the ability of the developers to create a secure app. One participant stated that, “UCP hire[d] incompetent staff to create these concepts of apps.” Another participant expressed concern with “the government not having enough knowledge of what they’re doing with the app.” Although these comments might come across as venting against one’s government, it does reflect a need for establishing a credible level of trust in the process from the development of an app to the rollout and maintenance and storage of data. Overall, belief in the seriousness of the COVID-19 pandemic and trust in the government and app developers appears to play key roles for many individuals when deciding whether or not to use a contact tracing application.

Efficacy

Efficacy is defined here as a belief of that the ABTraceTogether app will work as intended and that the app will help in lowering the spread of COVID-19. As with the previous factor, we received participants’ responses that range from expressing a complete belief in the efficacy of the app to those who felt it was so flawed it did not merit their use. Overall, 32 percent of participants, both users and non-users, expressed concerns with the efficacy of the application. These concerns can be grouped into technical concerns with the app itself and those of a more human user nature, that is that people were not using it correctly or in sufficient numbers. Other participants shared their concerns with the overall ability of the app to actually help stop the spread of COVID-19 or did not believe in the effectiveness of contact tracing. For instance, one participant wrote, “Prove to me it works.” Another participant expressed a number of efficacy concerns
about the app, “I think if this is done right it could work but right now nobody sees the benefit ... I’m just confused how it would make a big difference especially if it doesn’t change behaviours or make people more careful ... please be more clear exactly how it could work.”

**Concerns that the app does not work**

Many participants stated a general, unspecified concern that the app would not work. For instance, one participant wondered, “Does it work everywhere. Will everyone use it, does it do anything?” Another wrote “I wonder if it works well ... sometimes apps work the wrong way, so I cannot trust it 100 percent.” A number of participants stated that the app is not accurate or helpful and that there is no proof that it works properly.

There appeared to be confusion among many users of the app about how it worked or whether it was working properly. One wrote, “I like the idea and am willing to use it, but it seems to not really work properly.” Another user of the app expressed the same concern that they had no idea of knowing whether the app is working or not, “Does it really work? I have been using the app in the City of Edmonton for quite some time now as I do have reason to be out and about. I’m rather surprised I have not been in contact with a single person who had COVID-19???? Seems odd considering case count in this city.” Another user wrote, “I have NO IDEA if it’s working or not. I’ve had it for months and haven’t been notified once of anything.”

Other participants expressed that they were unsure if it was worthwhile to use the app when they did not know if it worked properly. One participant stated they were, “Unsure if it works. Therefore, not confident I’m getting any value by giving out my personal information.” Another participant said, “How accurate is the app when I am in places like the grocery store? If I have my phone and the app is open do I need my phone unlocked? Not enough information on how it works to feel confident in its accuracy.”

Some users also questioned the reliability of the app in rural areas or whether the app works when a user has other apps open, “I have heard it doesn’t work in the background and this is concerning because many people will not have it open as the primary app because of other needs, like map, messages, camera etc.”

The ABTraceTogether app does not provide any messaging or indications to users that it is working, which appears to be a major concern, and could prove to be a factor in people deciding to discontinue their use of the app. It would be beneficial for the app sponsors to provide a feature on the application that lets people know that it is working. Perhaps it could provide a daily notification about the number of contacts made.

**Exposure duration concerns**

Some participants had efficacy concerns surrounding the duration of time an app user needs to be in contact with a person who has COVID-19 in order for the app to officially record the other person as a contact. The ABTraceTogether app requires a user to be in contact with a person diagnosed with COVID-19 for 15 minutes or more before the app will register the contact and many participants thought that this was too long. They expressed frustration that shorter contacts with individuals who tested positive for COVID-19 would not be registered on the app.

One participant wrote that, “I don’t think 15 minutes is necessary to track if a person has had or has COVID-19 (why can’t it be in less time than that in a 24-hour period ... why not within a few minutes?)” Another wrote that, “I understand that you have to be in contact with another app user for 15 minutes for the phones to sync, most contact with strangers do not last that long.” Another participant suggested that the government should “shorten contact time from 15 mins to 5 mins please.”

The 15-minute exposure duration was based on public health recommendations at the time that advised that contracting COVID-19 was likely if a person comes within six feet of an infected individual for 15 minutes or more (Centers for Disease Control and Prevention, 2022). However, it appears that this information was communicated ineffectively, which led to a lot of participant concerns about its usefulness. Better
Ineffective due to human issues

Participants also expressed concerns that the app lacks efficacy due to a variety of human issues. Some participants stated that a lot of people do not leave their phones on all day, so many contacts would be missed. One participant wrote, “I am rarely in close contact with others, however the one time I went to a diagnostic imaging appointment, and I mentioned that I was using it the tech said she had it on her phone too but couldn’t leave the app open all day in her pocket. I turned mine off.” Another participant indicated that she was told not to bring a phone to a medical appointment, which meant no contacts for her would be tracked that day. As well, there was a concern that some people do not have phones, so they cannot be tracked.

Other participants were concerned that the app relies on people to take the initiative to get tested when they have symptoms and then self-report the information on the app. Some participants pointed out that a number of people never get tested unless their symptoms are severe, so many positive cases will never be reported, thus diminishing the apps efficacy. One participant expressed their thoughts on the app, “Uselessness, there are people who are not getting tested for various reasons, so I’m unsure how accurate information will be due to human influences.” Another wrote, “My concern is a positive result will only be inputted once someone takes the initiative to get tested. If the infected residents decide to wait or stays home instead of getting tested the app has no way to know about this.” Concerns with asymptomatic carriers of COVID-19 were also expressed. Participants were concerned that there is no way for asymptomatic cases to be reported to the app. One participant noted, “I’m unsure of how accurate it would be due to people who are not being tested/asymptomatic people.”

Another major concern expressed by a number of participants was how contact tracing using the app will not be effective because of how it relies on users to be honest when self-reporting that they have COVID-19. Some participants were concerned that users might lie, “Not all people are honest — may provide fake information.” Others suggested that there needed to be legal accountability when using the app, “Add some type of accountability measure to this. I think the law may need to be involved, as in, if you lie on this app, you get fined or get jail time.”

Some participants were concerned about the excessive lag time between when people get exposed to COVID-19 and when they get positive test results and report the results on the app. They felt that this lag time could severely lessen the contact tracing benefits of the app because it would take so long for results to be reported. One participant questioned that the delay in being notified will be too long, “Is it going to take so long to get the statistics that we are all infected anyhow? How accurate is this really?”

Another participant wrote that they were concerned with “The bad lag between being in close contact with someone with COVID-19 and the time they develop symptoms, get tested and then alert the app.”

Again, it would be helpful for the government to address and acknowledge these very valid concerns. These apps do rely on the honesty and diligence of people to get tested and report that they are positive for COVID-19 as quickly as possible.

False positives

Concerns about the app’s design also led some participants to have concerns about using the app because they believed that it could generate false positives. Participants were fearful of false positives themselves as well as being concerned that they would then legally entail the inconvenience of unnecessary quarantining and testing. One participant wrote, “I am worried about a false positive scaring the daylights out of me.” Another stated that, “I think there are better ways of contact tracing without unnecessarily worrying people.”

Critical mass of users lacking
Participants expressed concerns that the app would not be effective because too many people were wary of using it and a critical mass of users could not be reached. There was a strong belief among some participants that very few people were using the app, and that it therefore would not be effective at all. One participant stated, “I don’t think enough people are using either provincial or federal apps for them to be useful.” Another noted, “I myself would not have any issue downloading or using the app, however I feel that it is only effective given the majority of the population utilizes it, otherwise it is useless in letting me know if I have been exposed in any way.”

There is also evidence that some participants used the app because they knew that a critical mass of users was needed for it to be effective, and they wanted to do their part. This also worked against the app, though, as some participants were discouraged when the media reported low app uptake numbers and then believed that it was not worth bothering to use the app. Public service campaigns advising people that some studies have shown as few as one percent of people using a contact tracing app can have a positive effect on decreasing cases (Wymant, et al., 2021) would be very beneficial.

Regional app vs. a national app

Several users were frustrated that the Alberta app did not operate with Canada’s national application, which would have allowed for coordinated contact tracing across the country. Some participants indicated they needed to cross provincial boundaries and more national or international coverage was needed. A participant suggested that the government of Alberta should “Make it compatible with the national app so that there isn’t a glaring hole in tracking exposures.” Another participant noted, “It doesn’t interact with the Federal app which limits its usability. You need universal Canadian coverage.”

Some felt it would work

Despite these concerns, a few participants indicated they believed the application worked well and was an effective way to combat the pandemic. One participant wrote, “I believe the right App could help stop the spread. Information is knowledge.” Another participant expressed their faith in the app, “I believe it can trace all people I had contact with” while another participant praised the app, saying, “I think it’s a great useful app”. News coverage of the effectiveness of contact tracing apps in other countries also appeared to have a positive influence on a participant’s belief in the efficacy of the app. One participant stated, “Contract tracing apps worked wonders in South Korea so I think that it could be helpful here too.”

While some concerns surrounding the efficacy of contact tracing apps are valid and difficult to overcome, such as the reliance on individual honesty and prompt self-reporting of a positive COVID-19 case, other concerns could be easily addressed with clear messaging and public service campaigns, such as the confusion surrounding the 15-minute exposure. Providing notifications on the app itself to assure users that it is working and to give them a sense of knowledge and control over the fact that they did not have any positive COVID-19 exposures that day, would also help to encourage confidence in the efficacy of the app.

Altruism and prosocial beliefs

As previous studies have shown (Kokkoris and Kamleitner, 2020; O’Callaghan, et al., 2020), a prosocial attitude can increase adoption rates of COVID-19 contact tracing applications. A prosocial attitude and altruism are the belief that personal actions can aid society or that personal efforts contribute to the greater good. In this study, 20 percent of participants expressed that their usage of the app was influenced by altruism. Participants expressed prosocial attitudes in three main ways: (1) a desire to help society in general; (2) a desire to help specific people; and (3) a desire to help the world get back to normal. One user expressed that, “We all have to do our part. Working together is the only way to go forward,” while another noted that using the app “improves my moral compass. I need to do my part.”

Self-centeredness

As with the other factors, we received participant responses that reflect a contradictory sentiment. Some
participants do not express any sense of civic responsibility or any concern for protecting the lives and health of others. Their attitude is individualistic and concerned only with what benefits them personally. Some participants expressed that they did not see any point in using the app because all the app does is tell them when they have already been exposed to COVID-19. It does not protect them from exposure and does not provide them with any direct health benefits, so they do not think it is worth using. This reflects the findings by Wagner, et al. (2021) who found that usage of contact tracing apps was driven primarily by the perception of receiving individual benefits and Fox, et al. (2021) who found that use was influenced by whether people perceived that it would provide health benefits to them.

Civic obligation

A number of users of the app expressed a desire or sense of duty to do their part as citizens to fight the COVID-19 pandemic. Several participants expressed that they wanted to “be a good citizen” or that their use of the app was for “the greater good.” One participant said that “It’s the right thing to do for the good of all” while another noted, “I feel a social responsibility to help reduce the spread of COVID-19.” Some participants indicated that using the app was a small thing they could do to help society, “Trying to be a good citizen and show I care for others. It isn’t difficult or very interruptive to my day, so it is easy to add to my life.” Another participant noted, “It is an easy thing I can do to help protect my community. Why not?”

Some participants acknowledged that this pandemic was so pervasive that it required help from everyone (not just a few) as seen by a participant saying, “Everyone has to help to solve COVID-19.” Some participants expressed concern that their government or community was not doing enough, so it was up to individuals to do their part to end COVID-19. One user wrote, “I feel like my community may not be working hard enough to stop the spread, so I want to do what I can. I don’t want this to go on forever.”

Some users who expressed a variety of concerns about using the app, still believed their civic obligations superseded these concerns. One participant wrote, “No risks that would ever stop me from using the app, everyone should be using it for the greater good.” One user noted they would not allow technical concerns to prevent them from using the app, “[the app results in] more battery use and a tiny bit more data use, but [it is] worth it.” A number of participants who had privacy concerns expressed that they would use the app anyway. One user stated, “I believe right now we have to risk some privacy to help with the pandemic.”

Another participant said, “I don’t like that people can get my information but also understand that we need this to help stop the spread.”

Some of the responses showed the impact of messaging by the media, politicians and public health officials to encourage the public to use the app and follow public health measures. Several participants referred to their desire to reduce transmission, protect others or to do their part to enhance “contact tracing”. Some participants expressed that they believed in the government and wanted to do what officials advised.

Desire to help the vulnerable

Belief in the importance of protecting the vulnerable in society, such as the elderly and those with a compromised immune system, were motivating factors for some users. One user stated, “I also use it because I know there are those out there with compromised immune systems who need us healthy people to do all they can to stop the spread so that they can be safe too.” Even some of the participants who thought that the seriousness of the COVID-19 pandemic was overblown believed that there was a need to use the app to protect the elderly and seriously ill. Unfortunately, some users had already experienced tragedy as a result of the pandemic and felt compelled to use the app. One participant wrote, “I know someone who died from COVID-19 and want to do everything I can to stop the spread, so it doesn’t happen to someone else.”

Desire to help specific people or communities

Concern for the health of specific people or groups of people, such as their friends, family, neighbours and coworkers/clients were a major motivating factor for some users of the app. Some users mentioned that they
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Desire for return to normalcy

Helping the world get back to participant’s view of normal was a motivating factor for users. Some participants mentioned their perceived importance of protecting the economy and to help the economy recover, believing that one way to do this was by using the app. Other participants said that using the app will help to end lockdowns. One user said that using it was, “Helping prevent the spread of COVID-19 so we can get back to a normal life.” Another participant wrote that they had, “Concern for the long-term effects of the pandemic on the economy and my future — I want to help the world become a safe place as soon as possible. I want for the world to be back to normal by the time I am done school.”

This study confirmed studies that also found altruism and prosocial beliefs are leading factors motivating people to use contact tracing apps. In particular, we found that participants expressed their altruism and prosocial beliefs in three ways, (1) a desire to help society in general; (2) a desire to help specific people; and (3) a desire to help the world return to normal.

Agency

Agency is the belief that using the app is something the individual can do to help stop the spread of COVID-19, either because it is personally meaningful or because it is meaningful for society. Although a small percentage of participants provided comments directly indicating the influence of a sense of agency, or lack thereof, this factor was raised indirectly by many other participants. Agency is a crucial factor as it can be seen to provide the impetus to take the action to download and continually use the app. Having a sense of agency can be associated with a belief that a person is able to have some control over what is happening to them, which is called having an internal locus of control. With regard to COVID-19, a person with an internal locus of control has “the belief that their actions influence the outcome of the pandemic. Hence, a strongly held internal locus of control might enhance emotional resilience and result in attitudes and behaviors that could potentially lessen the risk of becoming infected with or spreading the virus” (Lake, 2020). The four main factors that appeared to contribute to the participants having a sense of agency are (1) the value of knowledge; (2) the belief that one can make a difference; (3) the desire to do something and be proactive; and (4) having a sense of hope.

Value of knowledge

Some participants expressed a sense of agency informed by a belief that using the app made them more knowledgeable about COVID-19 and their own health status. This knowledge may have given them a sense of being more in control and having an internal sense of control over aspects of one’s health has been shown to contribute to more positive health outcomes (Lake, 2020). One user wrote, “I feel safer because I like to visit family and friends, but this makes me feel better about it. I can remind myself every day that I don’t have COVID-19 because of this app. I can always inform myself because this app is loaded with everything”. Other users expressed that, “Knowledge is power, makes me feel safer knowing what’s out there” and another participant stated a main reason for using the app was for “Knowledge — I feel empowered knowing whom I’ve come in contact to and if I am safe.”

Belief that one can make a difference

The belief that one’s individual actions could make a difference in the fight against COVID-19 was a motivating factor in adopting the app for some participants. Even though some participants acknowledged that their individual efforts would not stop the overall pandemic, they believed that their actions could have at least a small impact. For instance, one participant stated that they used the app because, “I want to help...
Another participant shared that, “it improves my moral compass. I need to do my part” while another stated that “it’s something more I can do besides doing my best to follow all recommendations [from public health officials].” Other participants expressed that using the app helps them play a part in ending the pandemic. One user said that “I want to do what I can. I don’t want this to go on forever so working now reduces work later. Help our future self.” Another noted that, “I want it to be over so if I can help that’s great.”

Desire to be proactive

Another aspect of a sense of agency is being proactive and doing whatever you can to avoid undesirable outcomes. Some users expressed that using the app helped them feel like they were doing something positive to combat COVID-19 and gave them a sense of control over the situation. One participant noted, “I want to be proactive: Being proactive is important because once you’ve caught COVID-19, it’s already too late.” Another user wrote, “Why take a risk [by not using the app] if something out there is available that can potentially help stop the spread. It [the app] is in place for a reason that is affecting all of us, so use it.” Another stated, “The app gives me another tool in the tool box to fight against Covid-19”. These results again shows that an internal locus of control can have a positive effect on making decisions that affect app usage.

Offering hope

One aspect of having a sense of agency is that it can provide a sense of “hope” for participants. Some participants expressed that the simple act of using the app was meaningful in helping them avoid feelings of despair and hopelessness about the situation. There appears to be value in an app that just makes people feel active and hopeful in the fight against COVID-19. Some participants acknowledged that their use of the app was not necessarily crucial in the big picture, yet their use was personally meaningful as can be seen by the participant who stated, “I want to help fight the virus, at least in this small way.” A sense of agency can be a motivating factor that contributes to the decision to use a contact tracing app. As one participant stated that using the app “gives me the sense of helping flatten the curve”. A few participants mentioned that using the app was something they could do to feel less powerless, as one noted they just wanted to be “actually doing anything”. Another stated, “it’s something more I can do”. These quotations indicate that even though participants acknowledged their individual efforts were not globally significant, but that there were nonetheless personally meaningful. The results show that having a sense of control over one’s health and feeling like one contributes towards fighting the pandemic appear to be contributing factors to the decision to use the contact tracing app.

Recommendations from participants

All of the participants were asked to provide recommendations regarding how to improve the app itself or how to improve adoption of the app. Many of the tips from participants were things already being done by the government, such as providing information about how the app works in various modalities and media. It is unclear whether participants were unfamiliar with government messaging, whether the messaging was insufficient or unclear, or whether these were excuses by people who did not want to use the app. Future studies could examine the type and extent of information they were looking for and analyze how the information provided and its format fell short of their expectations. Overall, the types of recommendations fell into the categories of design and usability, government tips, and marketing and promotion.

Design and usability

As previously noted, ABTraceTogether was launched quickly and may not have had the normal cycle of iterative design and user testing, which has been identified as a barrier to m-health app adoption (Ledderer,
et al., 2019). A number of participants thought that the design of the app should be improved. One suggested, “... brighter colours used for [the] app logo would catch my eye more on my phone and make me remember to use it.” Another noted that “I think it’s a good idea, just needs more thought and work” while another participant was blunter, “Make sure it works BEFORE you release the app.” Another participant suggested that the government should “continue listening to public concerns and further develop the app based on feedback.”

Participants offered many tips to improve their usability of the app, such as reducing the battery drain and eliminating the need to always have the app on due to resulting, perceived data costs. Some participants thought the app should include better or more tutorials on how to use it and clear information about what to do if you come in contact with an infected person. Some users thought the app should use geolocation instead of Bluetooth technology. One participant suggested, “Make it a game and people will play it, regardless of the data they have to give up.”

A number of users of the app expressed concern that they had no way of knowing whether the app was working properly or at all. For instance, one user suggested, “Give users a hint that it’s actually scanning and working.” Another thought that, “Perhaps a daily notification saying whether or not you have come in contact [with a positive case]. The re-assurance would be nice.” Other users suggested that the app should, “Notify me even if there is nothing to notify me of,” and “Perhaps having a daily notice of how many phones it connects with each day would give an indication of it working.”

Some users of the app expressed a desire for expanded functionality. Several participants thought the app should notify about virus hot zones or the number of active cases in their areas. One user wrote, “It might help if the map of active cases are shown in the app i.e.: if any establishments had employees/patrons who tested positive, maybe a 2 km. radius will be ‘flagged’ so I know to steer clear of that area if possible.” Another user said, “It would be nice to have a type of map with colors that would reflect the ‘risk’ of the area associated with the amount of active cases, it could be a type of traffic light thing that could give us a simple view when we visit an area.”

Providing health information and daily updates was also suggested by a number of users of the app. One participant suggested, “It’s not engaging for users unless contact has happened. What about including current stats and links to useful info in advance of a potential exposure?” Another user thought that it would be beneficial “If the app could also have a tab people using it can refer to for COVID-19 facts, information, guidance for how to protect themselves or limit the spread as well as, maybe some references to medical facilities near them if they need to find some. Perhaps approximate wait times at clinics near them, clinic information such as phone, name, GPS location and a fact sheet explaining what the virus is and how they can limit the spread and contraction of it.” Others suggested that mental health information and links should also be provided. One thought the app should provide information on “how to deal with anxiety on this topic.” Several users suggested that the app should include a live chat feature to help users as questions and get assistance.

Overall, users provided many suggestions to help improve the app. In particular, suggestions that the app should provide daily notifications addresses the concern raised by many that they did not think the app was working. Providing expanded content such as health information and links would also help people feel they were getting more value out of the app, which was found by Wagner, et al. (2021) and Fox, et al. (2021) to be a motivating factor for using a contact tracing app. This would also assist in increasing users’ knowledge and sense of control over their health, which could also lead to great motivation to use the app.

Advice for the government

A number of users recommended the government provide incentives for using the app. For instance, a participant recommended that, “If people are using the app take the charges off their data.” Another asked for the government to “give more incentive for people to use your app.” Munzert, et al. (2021) did find that financial incentives were an effective aid to improving adoption. Another participant suggested that the
government should “give me a prepaid phone with the app on it at your expense.”

A number of participants recommended government regulation of the use of the app. For instance, one participant thought that lawmakers should “make it a crime to lie on the app.” Other participants suggested that using the app should be mandatory. One noted, “I think it’s just not going to help unless it were mandatory.” Another wanted the government to “make it mandatory for all people testing positive for COVID19 to be registered on the app.” Another participant suggested the government should “make it mandatory for all public servants who use an employer provided phone to use the app.”

Other users wanted increased government transparency. One wondered, “Who is in charge of the app?” Would be a question to be answered.” Another suggested that the government should “be transparent about information sharing, data breaches and how the app is beneficial in tracking the spread.” Users also who wanted the government to prove that the app was effective. One wanted the government to, “Launch [a] campaign on benefits of the app and how it works” while another wanted the government to “show that it actually stopped someone from ... getting COVID.”

The recommendations that the government should provide incentives to use the app on the one hand, and that there should be regulations requiring use of the app show both a carrot and a stick approach to increasing uptake of contact tracing applications. Both approaches provide fodder for consideration and debate. The other recommendations that the government needs to prove the app works and provide more information about privacy protections again demonstrate that there was either insufficient government messaging about the efficacy and privacy of the contact tracing app or that the messaging was not reaching the public effectively.

**Marketing and promotion**

Participants had a number of suggestions regarding better marketing and promotion of the app. Several thought there should have been promotions for the app on a variety of social media platforms, such as TikTok and YouTube, as well ads in newspapers and on billboards. One participant thought that the government “should have worked with phone companies to push the app out to everyone.” Some participants thought that peer pressure plus endorsement by public figures would improve the uptake of the app. One stated that “peer pressure will make or break the app so provide a badge for people to display they have the app if they should choose to do so. Let the public know what percent of the cellphone population has the app rather than the entire population.” Another user thought that the “public needs celebrity endorsement of those using the app. Politicians, civil servants, medical professionals need to be seen to be using it. — Peer pressure.” Another thought the app should be marketed on social media, “It could be marketed better maybe through social media’s prominent local influencers.”

Other participants believed that more information needed to be provided to the public about the app. One suggested that the government should “try to make people understand the necessity of the app” while another wanted “more education about the app to show if it will actually work.” Another participant suggested that privacy and tech experts should explain the app to the public, rather than politicians, “Explain it to people better and have tech experts explain security features. No one wants to hear [Alberta Premier] Kenney explain anything.” Another participant thought the government should target misinformation about the app, “Perhaps you could try educating the misinformed population on why using the app is not as big of a privacy breech as they may believe, and how using the app is another step in ensuring people are able to know if they have been exposed, so they may see the app as a good thing and not a threat.”

The marketing and promotions recommendations show evidence of insufficient or inappropriate messaging surrounding the contact tracing app. Use of public health experts, independent privacy experts, and celebrities to promote a contact tracing app all appear to be viable recommendations.
Conclusion

In response to the increasing casualties of the pandemic, the government of Alberta rushed out their contact tracing application in an attempt to help mitigate the spread of COVID-19. Granted, it is understandable that the development and launch process was expedited due to the circumstances, but our results show a need for user and potential user feedback earlier in the development process and promotional phase. Additional time in development, testing, and focus groups would have undoubtedly aided in reducing the usability issues and adoption challenges of the app. However, the app sponsors felt speed was crucial, so the app was released quickly.

As the pandemic continues its global spread, and with a likelihood of future pandemics occurring, it is important for application developers, promoters and sponsors to not only consider how technology can make a meaningful contribution to stopping the spread or mitigating the damages caused by diseases as well as how to address the public’s concerns with privacy, security and trust. Despite some early criticism of the efficacy of these apps, contact tracing apps have been found to be an effective aid in curtailing the spread of COVID-19. Any such future apps will have the benefit of lessons learned regarding people’s adoption and usage concerns. Although identifying usability concerns is helpful to reduce usage barriers, our identification of trust, efficacy, altruism and agency position high-level factors that can be used to target promotional campaigns and educational efforts — as well as meriting further study on their impact individually or collectively. The adoption and user experience issues raised by participants in this article should be considered when developing any future apps to increase the likelihood of being seamlessly downloaded, installed and continually used.

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