



EXPLORING USER-UPTAKE OF DIGITAL CONTACT TRACING (D-CT) APPS

A PRACTITIONER GUIDE

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ABOUT OUR LAB

Our research aims to shed insight into the different ways digital technologies are used in disasters and emergencies, the challenges and risks, and benefits and opportunities associated with digital technology use. We seek to provide strategies for guidance, and support efficacy-focused, ethical, low-risk interventions around the world. Our research adopts systems and complex networked perspectives, where we creating understanding through interconnectivity. We engage experts and organizations, both academic and practitioner, across disciplines to evolve research at the intersection of systems to enhance context-driven understanding.

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EXPLORING USER-UPTAKE IN D-CT APPS

SPECIAL EDITION.

Case Study. Canada

Dyllan Goldstein, Alisha Gauhar, Rebecca Babcock,
Jennie Phillips

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D-CT Case Study **Canada**

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10.1. Study Overview

10.1.1 Background

At the onset of the COVID-19 pandemic, Digital Contact Tracing (D-CT) emerged as a complement to Manual Contact Tracing (M-CT) to help enhance the capacity of global health systems to track and control the rapid spread and impact of the virus. This innovative approach to contact tracing attracted global attention due to its immense potential to enable faster and more widespread tracing of the virus among symptomatic and asymptomatic infected populations, while also compensating for lower resource availability and physical distancing rules hindering face-to-face care. D-CT apps and interventions from eBracelets to QR codes surged around the world, in the hope that they would make a substantial impact on curbing the global spread of the virus.

To date however, little research exists demonstrating the true impact of these tools. Specifically, despite the widespread implementation of these tools, there is little evidence that shows that D-CT tools (most often apps) do more good than harm. Coupled with issues pertaining to human rights, privacy, efficacy, and digital inclusion, one of the major problems faced with D-CT interventions (mainly those that are voluntary) is the low level of user engagement in these apps – engagement meaning uptake of the app (download and registration), but also using and updating the app, reporting a positive diagnosis through the app, and reacting to an exposure alert received through the app (see our four-stage continuum of D-CT app engagement outlined in Module 1). Looking at uptake of D-CT apps alone, rates vary drastically across different contexts. Ireland and Iceland, for example, have the highest rates of countries studied at approximately 43% and 40% respectively, while places like Cyprus or South Africa fall below 1%. And, while many argue that any degree of uptake can make a difference,¹ the dominant perception is that all of these rates are insufficient to make a substantial impact on tracing and controlling the virus. In an effort to better characterize the relationship between user engagement and app effectiveness, taking into account there is currently no magic uptake number, research is needed to understand why user-uptake varies between countries.

Through a preliminary literature review and an interdisciplinary workshop, our research team found this problem can be partly attributed to the lack of recognition and understanding of the target users of these apps. Yet, little is known regarding what incentivizes versus inhibits people from downloading these apps around the world, how context plays a role, as well as the association of perceived benefits and risks with user engagement. As part of [The Digital Global Health and Humanitarianism \(DGHH\) Lab's](#) larger study on the factors impact user-engagement across the four-stage continuum, this study focuses specifically on trying to address this gap by exploring stage 1 – user-uptake of D-CT apps – across various countries.

¹ O'Neill, P. (2020, June 5). No, coronavirus apps don't need 60% adoption to be effective. MIT Technology Review. Retrieved from <https://www.technologyreview.com/2020/06/05/1002775/covid-apps-effective-at-less-than-60-percent-download/>

10.1.2 Methodology

This research asks the following research question:

Why is there higher user-uptake of D-CT apps in some countries over others?

This question is addressed with the following sub-questions:

- i. How does uptake vary across contexts?
- ii. What factors influence uptake across contexts?
- iii. How does risk-benefit perception influence uptake?

To answer these questions, we first established the scope of our research. Our focus is on user-uptake of D-CT apps (the most prevalent form of D-CT interventions worldwide) implemented by governments around the world at the national level, that are voluntary to download, and primarily decentralized in their data collection (a measure that mitigates privacy and human rights concerns that are widely recognized as a factor that deters app engagement).² Second, a multiple case study approach was used to generate country-specific understanding of user-uptake of D-CT apps and address our research questions. Cases selected include: Iceland, Cyprus, Ireland, Scotland, and South Africa, with a Special Edition Case Study being completed on Canada's D-CT app in early 2021 (after the initial research was completed and Practitioner Guide published). Data was collected through interdisciplinary workshops, interviews, and meta-analysis of existing peer-reviewed and grey literature. Research findings were analyzed through a systems-approach based on Bronfenbrenner's ecological systems theory to identify varied contextual factors that influence uptake (through a risk-benefit lens).³ Bronfenbrenner's theory aims to define user behaviour as a product of intrinsic and extrinsic interactions and influences with different levels in their surrounding system: individual (micro-level), community (meso-level), and system (macro-level). Research findings are presented through a series of modules (identified in Section 10.1.4 below) through an introduction to D-CT and user-uptake; case study; systems analysis of factors identified that influence uptake; and recommendations and future research. For a more detailed overview of our research approach, the please see the full methodology.

10.1.3 Overview of Cases & Factors Identified

As was shown through the five initial case studies, **eight factors** can explain uptake across the individual (micro), community (meso), and system (macro) level dimensions have been identified. The Canada case study also introduced a new factor that seemed to influence user-uptake for a total of **nine factors**. Each factor is explained below.

² Lomas, N. (2020, April 6). EU privacy experts push a decentralized approach to COVID-19 contacts tracing. TechCrunch. Retrieved from <https://techcrunch.com/2020/04/06/eu-privacy-experts-push-a-decentralized-approach-to-covid-19-contacts-tracing/>

³ Wikipedia Contributors. (2019, February 10). Ecological systems theory. Wikipedia; Wikimedia Foundation. Retrieved from https://en.wikipedia.org/wiki/Ecological_systems_theory

1. **Perceptions of Data Collection & Management** - how people perceive actual data collection and management as it relates to privacy and trust; and individual understanding of privacy and security (independent of actual privacy and security measures built into D-CT apps).
2. **Sense of Community** - the level of shared trust, shared identity, sense of duty, and/or communitarian values individuals have in relation to their community; and the strength of ties/connectedness individuals have with each other.
3. **Communications & Misinformation** - the timeliness, transparency, method, and nature of information provided to the nation alongside the prevalence, spread, and control of misinformation.
4. **Accessibility & Inclusion** - the degree to which D-CT apps are equally accessible to, usable for, and inclusive of, the entire population, as well as the level of discrimination and marginalization that results from interventions that fail to account for the digital divide or socially vulnerable populations.
5. **Trust in Public/Private Institutions** - the widespread level of trust and faith in public institutions (e.g. government, response agencies) and private institutions (e.g. internet corporations like Google, Apple, as well as the developers of D-CT apps).
6. **Policy & Governance** - the use of, and adherence to, policies and governance mechanisms that regulate the development, implementation, and use of the app.
7. **Response Infrastructure** - the ability of the health infrastructure alongside the first-line response and emergency management infrastructure to manage the COVID-19 pandemic (such as access to testing, and the capacity to respond to and treat the virus).
8. **Digital Capability** - the ability of D-CT apps to effectively and efficiently serve their purpose and facilitate the management of the pandemic.
9. **Provincial & Territorial Support** - the degree to which provinces and territories within Canada support the app through implementation and carrying out necessary public health measures to facilitate full user engagement with the app and enable app efficacy.

10.1.4 Practitioner Guide Outline

The findings of this study are presented through eleven modules including:

Module 00 - Executive Summary

Module 0 - Methodology

Module 1 - Digital Contact Tracing (D-CT) and User-Uptake: A Primer

Module 2 - Case Study: Iceland

Module 3 - Case Study: Cyprus

Module 4 - Case Study: Ireland

Module 5 - Case Study: Scotland

Module 6 - Case Study: South Africa

Module 7 - Analysis of User-Uptake Factors: Individual- & Community-Level Influences

Module 8 - Analysis of User-Uptake Factors: System-Level Influences

Module 9 - Recommendations & Future Research

Special Edition - Case Study: Canada

10.2. Module Overview

This module aims to explore Digital Contact Tracing (D-CT) developed and implemented in Canada for the COVID-19 response. Focus is on the country's D-CT app, *COVID Alert*, and understanding user-uptake. The case study begins with a brief overview of the country's overall response to COVID-19 and the impact of the virus on the country. Following, we explain Canada's app by describing, how it emerged, how it is designed and functions, how users engage with the app across the whole user-engagement process, and what user-uptake looks like in the country. The next section describes the main factors that emerged in our research for this country that suggest influencing user-uptake within the country's context. This section ends with a brief conclusion.

10.3. Case Study

10.3.1. COVID-19 in Canada

The first case of COVID-19 in Canada was confirmed on January 25th 2020.⁴ As of August 14 2021, the total number of positive cases nationwide is 1,450,992 with 26,701 deaths.⁵ After the first wave of cases, Prime Minister Justin Trudeau announced on September 23rd 2020 that the second, deadlier wave of the virus was hitting some provinces.⁶ During this second wave, the first vaccine – a dose of the Pfizer-BioNTech vaccine – was administered in Canada on December 14th 2020.⁷ In mid-March of 2021, there began to be a third rise of cases, prompting lockdowns in some provinces.⁸ Lockdown measures vary by province with Quebec implementing curfews and the Maritimes provinces creating an "Atlantic bubble" that permits travel between a select few provinces.⁹

Ontario and Quebec have had the largest case counts throughout the pandemic and have seen a rapid growth of cases with each wave. During the first wave, Ontario's highest case count was on April 24th with 620 cases but then saw 4249 cases on January 8th 2021 during the second wave and 4812 cases on April 16th 2021 during the third wave.¹⁰ Quebec, which was the first province to mandate a curfew, saw a first wave high of 1380 cases on April 10th 2020, a second wave high of 3832 cases on January 3rd 2021, and a third wave high of 1754 cases on April 10th 2021.¹¹

⁴ John Hopkins Coronavirus Resource Center. (2021). COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at John Hopkins University. John Hopkins University. Retrieved from <https://coronavirus.jhu.edu/map.html>

⁵ Government of Canada. (2021). COVID-19 daily epidemiology update. Government of Canada. Retrieved from <https://health-infobase.canada.ca/covid-19/epidemiological-summary-covid-19-cases.html>

⁶ Aiello, R. (2020). Second COVID-19 wave has already started: PM in address to nation. CTV News. Retrieved from <https://www.ctvnews.ca/politics/second-covid-19-wave-has-already-started-pm-in-address-to-nation-1.5117465>

⁷ Aiello, R., Forani, J. (2020). 'V-Day': First COVID-19 vaccines administered in Canada. CTV News. Retrieved from <https://www.ctvnews.ca/health/coronavirus/v-day-first-covid-19-vaccines-administered-in-canada-1.5230184>

⁸ Lowrie, M. (2021). Cases of COVID-19 variants on the rise in Canada, fueling concerns over third wave. CTV News. Retrieved from <https://www.ctvnews.ca/health/coronavirus/cases-of-covid-19-variants-on-the-rise-in-canada-fuelling-concerns-over-third-wave-1.5357592>

⁹ Mosleh, O. (2021). From Quebec curfews to the 'Atlantic Travel Bubble': Here's what an Oxford study learned from Canada's varied COVID-19 measures. Toronto.com. Retrieved from <https://www.toronto.com/news-story/10357717-from-quebec-curfews-to-the-atlantic-travel-bubble-here-s-what-an-oxford-study-learned-from-canada-s-varied-covid-19-measures/>

¹⁰ The Province of Ontario (2021). All Ontario: Case numbers and spread. Ontario.ca. Retrieved from <https://covid-19.ontario.ca/data>

¹¹ Bing Covid Tracker (2021). Covid Tracker Quebec Canada. Bing.com. Retrieved from https://bing.com/covid/local/quebec_canada

The third wave of the virus has significantly increased the number of patients hospitalized and in intensive care units (ICU), with a record number of hospital admissions.¹² Variants of the COVID-19 virus have increased significantly during the third wave, with over 241,199 variant cases in Canada as of July 8 2021.¹³ Although the B.1.1.7 variant which was first found in the UK is the most common variant across the provinces, British Columbia has the most cases of the P1 variant (Brazil strain) at 16,367.¹⁴ As of April 2021, four vaccines are authorized for use in Canada including Pfizer-BioNTech, AstraZeneca, Moderna and Janssen (Johnson and Johnson) vaccines.¹⁵

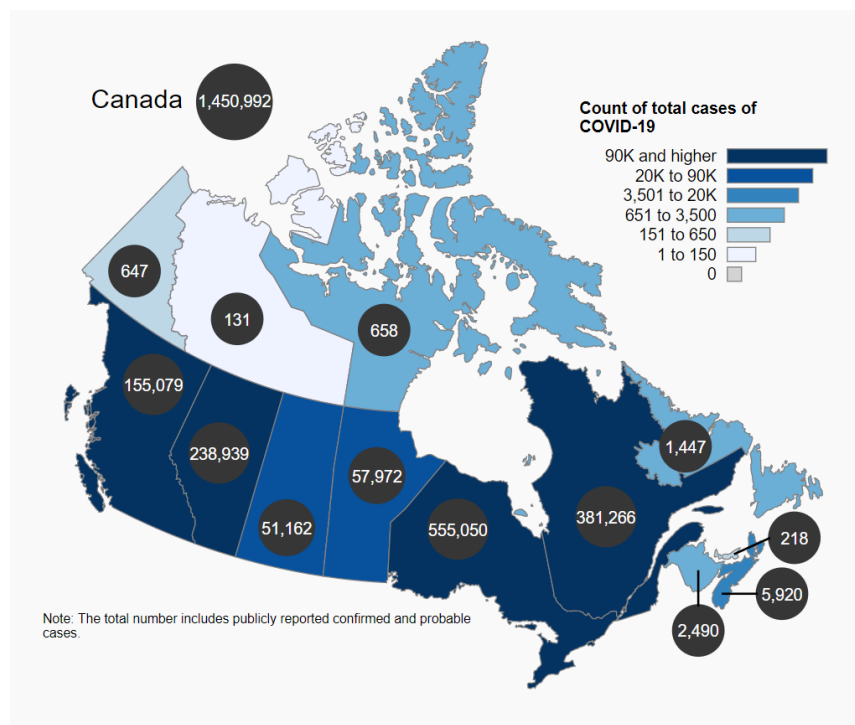


Figure 10.1.0: Map of COVID-19 cases in Canada as of August 14 2021¹⁶

10.3.2. Evolution of the Digital Contact Tracing App

It was during the middle of the first wave on May 1st 2020 that the Government of Alberta launched the *ABTraceTogether* app in the province of Alberta.¹⁷ Shortly afterwards, the federal government announced

¹² Bresge, A. (2021). ICUs across Canada see near record of COVID-19 patients as new variant cases multiply. The Globe and Mail. Retrieved from <https://www.theglobeandmail.com/canada/article-ic-us-across-canada-see-near-record-of-covid-19-patients-as-new-variant/>

¹³ National Collaborating Centre for Infectious Diseases. (2021). Updates on COVID-19 Variants of Concern. National Collaborating Centre for Infectious Diseases. Retrieved from <https://nccid.ca/covid-19-variants/>

¹⁴ Ibid.

¹⁵ Government of Canada. (2021). Vaccines for COVID-19: Authorized vaccines. Government of Canada. Retrieved from <https://www.canada.ca/en/health-canada/services/drugs-health-products/covid19-industry/drugs-vaccines-treatments/vaccines.html>

¹⁶ Government of Canada. (2021). Interactive data visualizations of COVID-19. Government of Canada. Retrieved from <https://health-infobase.canada.ca/covid-19/?stat=num&measure=total#a2>

¹⁷ CTV News Edmonton. (2020). ABTraceTogether: Alberta unveils new COVID-19 contact tracing app. CTV News. Retrieved from <https://edmonton.ctvnews.ca/abtrace-together-alberta-unveils-new-covid-19-contact-tracing-app-1.4920621>

the introduction of the *COVID Alert* app. Prior to the development of the app, a series of studies were done to ensure that the app itself would be accessible and usable by a wide range of audiences; the intent was to build the app based off of user research.¹⁸ While identified as a national app, *COVID Alert* was initially launched in Ontario on July 31st 2020 so the app could be piloted before rolling it out nation-wide.¹⁹ Since then, the app has been adopted by nine of Canada's 13 provinces and territories. Out of these nine regions, initially only a few of the regions offered one-time keys to report positive COVID-19 diagnoses. As of August 2021, all nine regions now have this capability. While Alberta, British Columbia (B.C.), Yukon, and Nunavut are not officially using the app, residents of these provinces and territories can use the app to get exposure notifications but are unable to receive one-time keys to enter a positive COVID-19 diagnosis. B.C. states that activating the app would be too difficult for the health system and Yukon had similar issues, while Nunavut reportedly has inequitable technological access which makes app use difficult.²⁰ Alberta, on the other hand, rejected adopting *COVID Alert* and claimed that *ABTraceTogether* was a superior app.²¹

As of August 2021, there are reportedly more than 6.6 million downloads and 34,256 users have entered in one-time keys to indicate their positive diagnosis (which amounts to about 0.5% of *COVID Alert* users have used the app to indicate a positive diagnosis).²² That being said, it is reported that 80% of those who actually receive a one-time key input them into the app.²³

10.3.3. How the app works/design

Table 10.1.0: COVID Alert Details

	Canada
Name of the App	COVID Alert
Developer(s)	Health Canada; Innovation, Science and Economic Development Canada; Canadian Digital Service; Ontario Digital Service; Shopify Inc.; and Linux Foundation Public Health
Decentralized or Centralized Data Collection	Decentralized ²⁴
Bluetooth, GPS, Both, Other	Bluetooth ²⁵

¹⁸ Personal communications, 2-5-21

¹⁹ CTV News. (2021). *ABTraceTogether: Alberta unveils new COVID-19 contact tracing app*. CTV News. Retrieved from <https://edmonton.ctvnews.ca/abtracetogogether-alberta-unveils-new-covid-19-contact-tracing-app-1.4920621?cache=%3Fclipl>

²⁰ Hill, B., Pazzano, J. (2021). 96% of Canadians who test positive for coronavirus aren't using COVID Alert app properly. Global News. Retrieved from <https://globalnews.ca/news/7697781/covid-alert-app-data-effectiveness/>

²¹ Tait, C. (2020). Alberta's contact tracing app used to track COVID-19 exposures just 19 times. The Globe and Mail. Retrieved from <https://www.theglobeandmail.com/canada/alberta/article-albertas-contact-tracing-app-used-to-track-covid-19-exposures-just-1/>

²² Personal communications, 18-5-21; Government of Canada. (2021). Download COVID Alert today. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert.html>

²³ Personal communications, 18-5-21;

²⁴ Seto E, Challa P, Ware P. Adoption of COVID-19 Contact Tracing Apps: A Balance Between Privacy and Effectiveness. *J Med Internet Res*. 2021;23(3):e25726. Published 2021 Mar 4. doi:10.2196/25726.

²⁵ Ibid.

Type of App: GAEN or Other	Google-Apple Exposure Notification API ²⁶
Mobile Requirements: e.g. iOS, Android, version	iOS 12.5, 13.5 or higher and Android version 6 and up ²⁷
Alternate functionality?	N/A
Data Collected By App	<ul style="list-style-type: none"> • Random codes from your phones and other phones for 14 days • Number of active users per province or territory • Number of users who changed their status to “exposed” • Number of users who enter a one-time key after receiving a diagnosis • Technical performance metrics²⁸
Data Collected By Government	<ul style="list-style-type: none"> • Random codes from your phones and other phones for 14 days (user has to consent to providing this information) • Number of active users per province or territory • Number of users who changed their status to “exposed” • Number of users who entered a one-time key after receiving a diagnosis • IP address in certain situations
Data Collection permission	Voluntary
Data Deletion period	15 days for the random codes 3 months for IP addresses ²⁹

As shown in Table 10.1.0, the *COVID Alert* app was a collaborative initiative between Health Canada; Innovation, Science and Economic Development Canada; Canadian Digital Service; Ontario Digital Service; Shopify Inc.; and Linux Foundation Public Health.³⁰ A security audit was completed by the volunteer team from Blackberry as well as by The Canadian Center for Cyber Security.³¹ There was also a privacy review completed by the Privacy Commissioner of Canada and the code for the app was made open source.³² The COVID-19 Exposure Notification App Advisory Council oversees the app to ensure it meets privacy, public health, and technological standards.

²⁶ Gold, R. (2020). Canadian COVID Alert App — Apple-Google API. The Stem Group. Retrieved from https://medium.com/@bulk_5592/canadian-covid-alert-app-apple-google-api-f55066d37f8f

²⁷ Government of Canada. (2021). Help for COVID Alert. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert/help.html>

²⁸ Government of Canada. (2021). COVID Alert: COVID-19 Exposure Notification Application Privacy Assessment. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert/privacy-policy/assessment.html#a8>

²⁹ Canadian Digital Service. (2021). COVID Alert Privacy Notice (Exposure Notification). Government of Canada. Retrieved from <https://digital.canada.ca/exposure-notification-app-privacy-policy/>

³⁰ Health Canada. (2020). COVID Alert app updated to serve Canadians better. Government of Canada. Retrieved from <https://www.canada.ca/en/health-canada/news/2020/12/covid-alert-app-updated-to-serve-canadians-better.html>

³¹ Ibid.

³² Government of Canada. (2021). COVID Alert: COVID-19 Exposure Notification Application Privacy Assessment. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert/privacy-policy/assessment.html#a8>; OSTIF. (2021). The Linux Foundation Public Health Initiative Sponsored the Audit of COVID Exposure Notification Apps. Here Are The Results. Open Source Technology Improvement Fund. Retrieved from <https://ostif.org/the-linux-foundation-public-health-initiative-sponsored-the-audit-of-covid-exposure-notification-apps-here-are-the-results/>

The app uses the Google-Apple Exposure Notification (GAEN) Application Programming Interface (API), Bluetooth technology to share random codes between phones, and a decentralized data collection and storage method.³³ The app is only functional on smartphones with iOS 12.5 or 13.5 and higher as well as Android version 6 and up.³⁴ There is no alternative function of the *COVID Alert* app.

Once the app is downloaded, the app and the government collects data regarding: 1) number of active users per province or territory; 2) number of users who changed their status to “exposed;” 3) number of users who entered a one-time key after receiving a diagnosis; 4) and technical performance data.³⁵ The app also collects and stores random codes from your phones and other phones for 14 days and will be deleted after 15 days.³⁶ These codes are only shared if the user enters a one-time key after receiving a positive diagnosis and agrees to share their codes.³⁷ When uploaded, the codes are kept on the server for 14 days and the database back-up information is kept for up to an additional 7 days, for up to 21 days.³⁸ This data is held by Health Canada.³⁹

10.3.3.1. The App Engagement Process

Phase One: Downloading and Setup

The app can be downloaded on both the Apple store and Google Play and is available in English and French. The app requires 52MB of space to download. Upon first downloading the app, the user is asked to select their language of choice and are then given information about the app’s privacy policy. The app reiterates that *COVID Alert* does not use GPS or track the user’s location and asks permission to allow the app to send the user notifications. If the device’s Bluetooth is not on, the app reminds the user to enable Bluetooth. The app then asks what province the user is from, although this information is optional to input.

³³ Gold, R. (2020). Canadian COVID Alert App — Apple-Google API. The Stem Group. Retrieved from https://medium.com/@bulk_5592/canadian-covid-alert-app-apple-google-api-f55066d37f8f

³⁴ Government of Canada. (2021). Help for COVID Alert. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert/help.html>

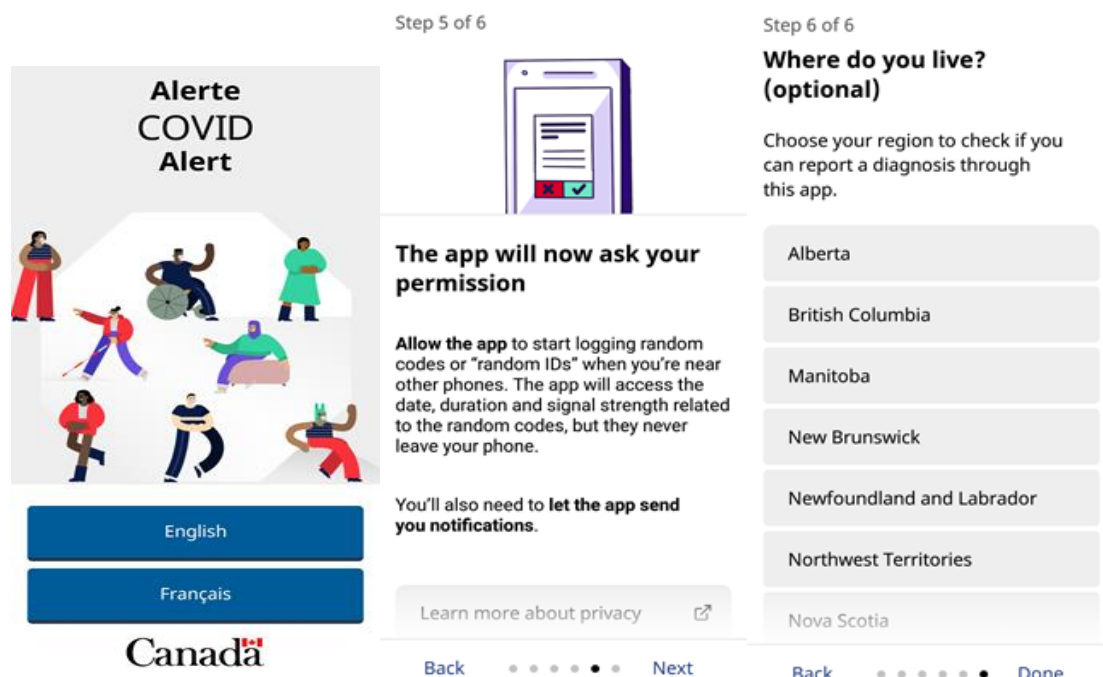
³⁵ Government of Canada. (2021). COVID Alert: COVID-19 Exposure Notification Application Privacy Assessment. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert/privacy-policy/assessment.html#a8>

³⁶ Canadian Digital Service. (2021). COVID Alert Privacy Notice (Exposure Notification). Government of Canada. Retrieved from <https://digital.canada.ca/exposure-notification-app-privacy-policy/>

³⁷ Government of Canada. (2021). COVID Alert: COVID-19 Exposure Notification Application Privacy Assessment. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert/privacy-policy/assessment.html#a8>

³⁸ Government of Canada. (2021) COVID Alert: COVID-19 Exposure Notification Application Privacy Assessment. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert/privacy-policy/assessment.html>

³⁹ Personal communication 2-5-21



Figure

10.2.0: Screenshots of the *COVID Alert* app when first downloaded

Phase Two: Usage

Once the app is ready to use, the screen will display a thumbs up as shown in Figure 10.3.0 below. Via the menu, users have the option to enter a one-time key if the user tests positive as well as the option to turn off the app in the app's settings. The app also provides information about where to receive a one-time key from public health agencies as well as instructions regarding what to do if a user is exposed to COVID-19. Users can also change their province or territory through a menu option. Although providing this information is optional, selecting a province or territory will allow the external links of the specific region's COVID-19 guidelines to be available through the app.

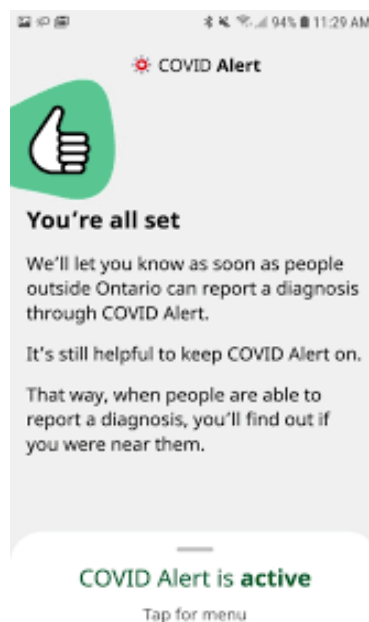


Figure 10.3.0: Screenshot of the *COVID Alert* app once set-up⁴⁰

Phase Three: Reporting

If the user tests positive for COVID-19, they can select the “get a one-time key” option on the menu of the app and follow the instructions to get a key from the COVID-19 test results website. Once the user has entered the key, the app will request permission to share the random, anonymous code associated with the user’s device with other users that they have been in contact with.

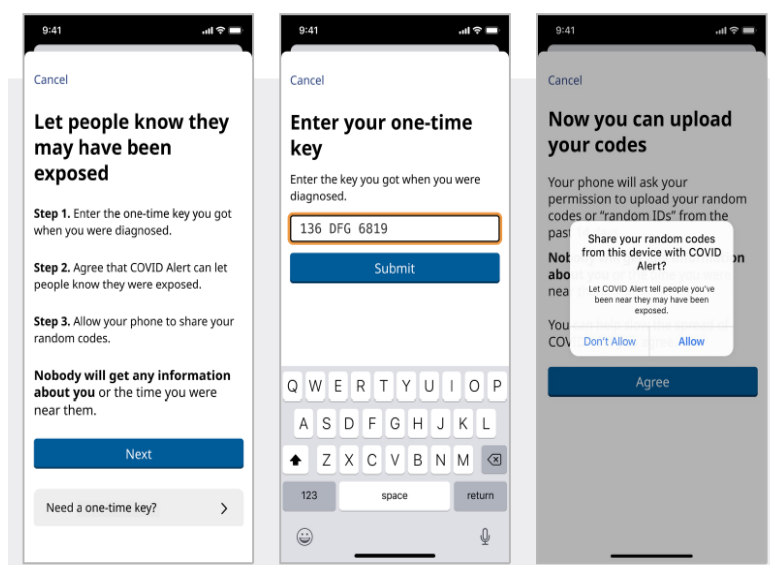


Figure 10.4.0: Screenshots of the *COVID Alert* app when a user tests positive⁴¹

⁴⁰ TTC. (2020). COVID AlertApp User Guide. Toronto Transit Commission. Retrieved from <http://www.ttc.ca/PDF/COVID%20Alert%20User%20Guide.pdf>

⁴¹ Aiello, R. (2020). COVID-19 exposure notification app now available. CTV News. Retrieved from <https://www.ctvnews.ca/health/coronavirus/covid-19-exposure-notification-app-now-available-1.5046868>

Part Four: Reacting

If someone tests positive for COVID-19 and enters their one-time key into the app, a notification like the one shown in Figure 10.5.0 will be sent to users who have exchanged codes with the COVID-19 positive user. This notification will be displayed as soon as the app is opened on a user's device. For those that are not actively opening the app, a notification will be displayed on the user's home screen, alerting the user of an exposure. The user can then select the "What next?" option to learn about self-isolating practices and determine if they need to get tested.

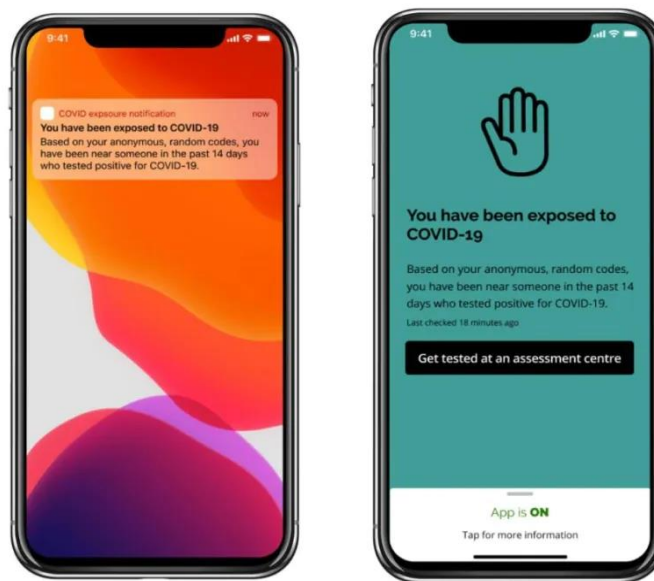


Figure 10.5.0: Screenshot of the *COVID Alert* app when a user has been exposed⁴²

⁴² Government of Ontario. (2021). Download the COVID Alert mobile app to protect yourself and your community. Government of Ontario. Retrieved from <https://covid-19.ontario.ca/covidalert>

10.3.4. App-Uptake

10.3.4.1. Uptake Summary

Table 2: COVID Alert Uptake Summary

	Canada
Uptake (#downloads)	6,628,835 (As of August 12 2021) ⁴³
Uptake (active users)	To be released by the Government of Canada in "Spring 2021" ⁴⁴
Uptake in provinces with access (counting only provinces that can actually use the app)	23.5% ^{45*}
General Uptake (# of downloads / general population)	17.6% ^{46*}
Age Appropriate Uptake (# of downloads / people over age allowed to download)	N/A
Digital Uptake (# of downloads / connected population)	19.2% ^{47*}
Digital Capability Uptake (# of downloads / app-compatible population)	21.6% ^{48*}

⁴³ Government of Canada. (2021). Download COVID Alert today. Government of Canada. Retrieved from <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/covid-alert.htm>

⁴⁴ Government of Canada. (2021). COVID Alert updated to help evaluate its effectiveness in reducing the spread of COVID-19 . Government of Canada. Retrieved from <https://www.canada.ca/en/health-canada/news/2021/02/covid-alert-updated-to-help-evaluate-its-effectiveness-in-reducing-the-spread-of-covid-19.html>

⁴⁵ Wikipedia. (2021). Population of Canada by province and territory. Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Population_of_Canada_by_province_and_territory

* Around 75% of Canada's population lives in the 9 provinces and territories using COVID Alert (28192500)

⁴⁶ Data Commons. (2019). Canada. Data Commons. Retrieved from <https://datacommons.org/place/country/CAN?topic=Demographics#Population>

* Canada has a population of around 37.59 million

⁴⁷ Statista. (2021). Number of internet users in Canada from 2000 to 2019. Statista. Retrieved from <https://www.statista.com/statistics/243808/number-of-internet-users-in-canada/#:~:text=In%202019%2C%20Canada%20had%20an,96%20percent%20of%20the%20population>

* An estimated 34.56 million people in Canada are 'connected' to the internet

⁴⁸ Statista. (2021). Number of internet users in Canada from 2000 to 2019. Statista. Retrieved from <https://www.statista.com/statistics/243808/number-of-internet-users-in-canada/#:~:text=In%202019%2C%20Canada%20had%20an,96%20percent%20of%20the%20population>

*An estimated 30.74 million people in Canada have phones with the digital capability to use COVID Alert

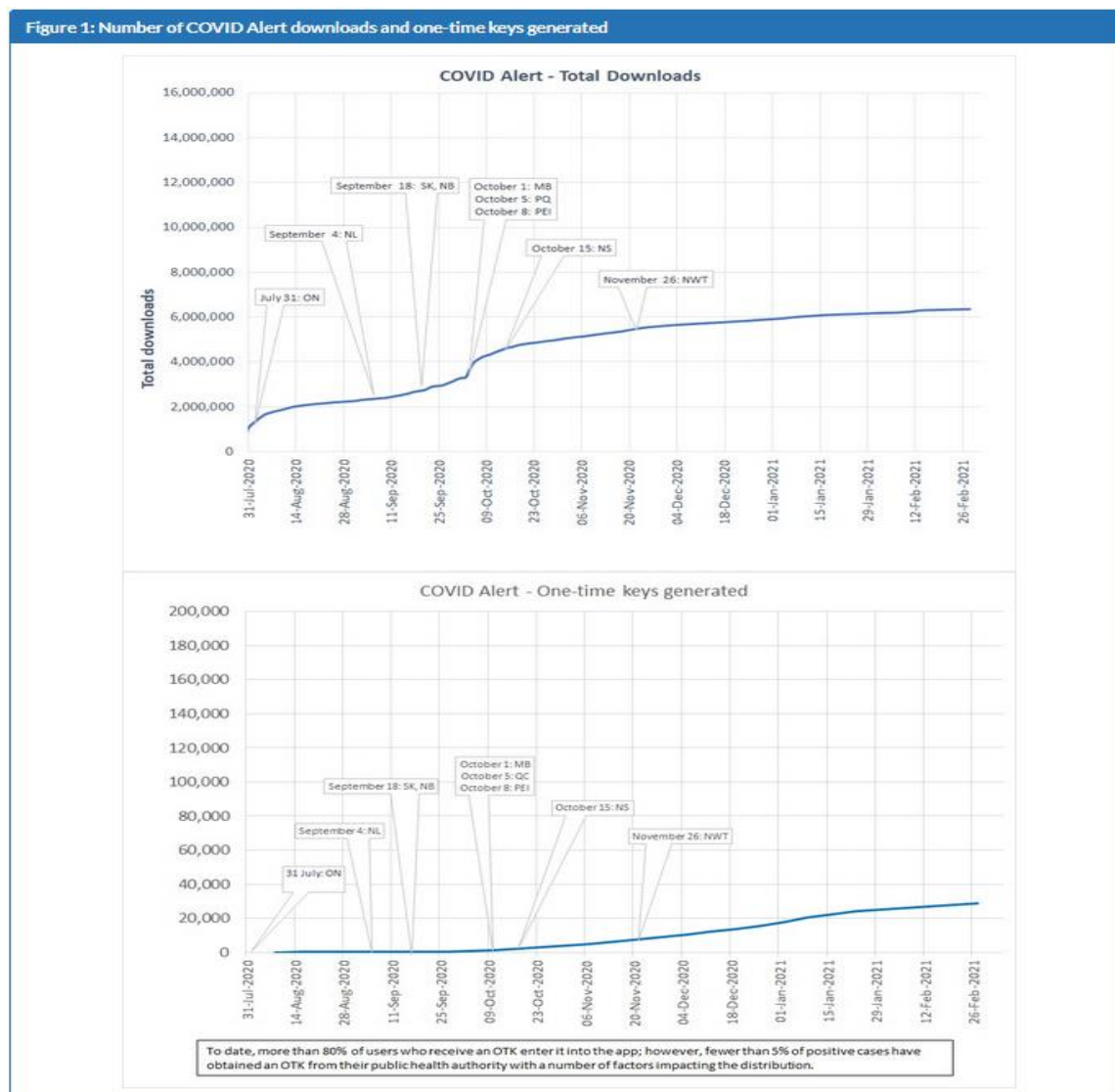


Figure 5: Summary of the number of downloads of the *COVID Alert* app as of April 14th 2021⁴⁹

10.3.4.2. Uptake Description

As of August 12 2021, there have been over 6.6 million downloads of the app which is about 17.6% of the general population of Canada and 23.5% of the population that are in provinces with access to the app. Although the app was downloaded about 2 million times within the first month of its launch, the number of downloads has increased steadily since. If we take into consideration the amount of the population that has internet access, there is about 19.2% app-uptake. With an estimated 11% of the population owning phones with incompatible operating systems, there is about a 21.6% uptake of the app within the population that owns phones that meet *COVID Alert's* technical requirements. There is currently no data on the number of active users of the app as this was a new metric that was added Feb 9th 2021 and data

⁴⁹ Government of Ontario. (2021). Download the COVID Alert mobile app to protect yourself and your community. Government of Ontario. Retrieved from <https://covid-19.ontario.ca/covidalert#covid-alert-impact>

on this metric is said to not be released until Spring 2021.⁵⁰ The app does not seem to have any age restrictions with Google Play services listing the app as 4+ for use. This is unlike other countries like Scotland who require the app to be downloaded by those 16+ so the user is over the age of consent to agree with the app's privacy policy. It was reported that ~0.5% of all Canadians who have tested positive for COVID-19 have used the app to inform others by entering the one-time key.⁵¹

10.2.1. Summary of Uptake Factors

Table 3: Summary of Uptake Factors in Canada

Factor	Micro, Meso, and/or Macro	Brief Description
Perceptions of Data Collection & Management	Micro	The Government of Canada worked extensively to create a privacy preserving app and transparently communicated to the general public about how the app does not collect personal information to encourage app-uptake. Yet, distorted perceptions about privacy exist and negatively impact user-uptake; this factor is interconnected with distrust towards the government.
Sense of Community	Micro	Sense of community does not seem to be a significant factor impacting user-uptake in Canada.
Communication & Misinformation	Meso	A comprehensive approach was taken in communicating to the country's residents about <i>COVID Alert</i> which likely positively influenced uptake. However, having figures that are trusted by Canadians (rather than politicians and media outlets) communicate these messages may more effectively encourage users to download the app. Concerns regarding information overload and unclear communications alongside misinformation and negative perceptions surrounding the app may have negatively impacted user-uptake.
Accessibility & Inclusion	Meso-macro	Accessibility and inclusion have been a key focus for the government in implementing the app. More than 90 changes to the app have occurred to ensure that those with disabilities can fully engage with the app. Other actions have been taken to encourage app-uptake in vulnerable and marginalized communities. Unfortunately, the app is only available in two languages, app availability is exclusive to newer phones, and there exist digital and app literacy issues which create barriers for users, potentially dissuading or preventing them from using the app.
Trust in Public/Private Institutions	Macro	Declining trust in the government broadly speaking, low levels of trust towards the government related to <i>COVID Alert</i> , and low levels of trust towards private companies are significant obstacles in encouraging users to download the app alongside combatting misinformation.
Policy & Governance	Macro	<i>COVID Alert</i> received a glowing review from the Office of the Privacy Commissioner regarding the privacy components of the app, but there remain issues relating to policy and governance broadly. It is uncertain whether legal amendments have been made to adequately protect users' privacy and, at the very least, no specific legislation has been enacted outlining and enforcing the purpose and time limitations of the app. There also appears to be no age limit

⁵⁰ Government of Canada. (2021). COVID Alert updated to help evaluate its effectiveness in reducing the spread of COVID-19 . Government of Canada. <https://www.canada.ca/en/health-canada/news/2021/02/covid-alert-updated-to-help-evaluate-its-effectiveness-in-reducing-the-spread-of-covid-19.html>

⁵¹ personal communication 18-5-21

		which may present legal and ethical issues. This lack of legal or policy-based framework can dissuade potential users from downloading the app.
Response Infrastructure	Macro	The capacity to facilitate necessary public health measures related to the app vary between provinces and territories, with some regions citing resource limitations or overburdening health services as their reason for not implementing the app. Relatedly, amongst the regions that have implemented the app, the one-time key provision rate is concerningly low. This occurs for a variety of reasons but impacts the effectiveness or perceived effectiveness of the app and likely negatively impacts user-uptake. It is vital to align the one-time key distribution to help encourage app-uptake.
Digital Capability	Macro	<i>COVID Alert</i> faces the same digital challenges as all GAEN apps which has shown to impact some regions in implementing the app as well as impact users from downloading or continuing to use the app. Continuing to take steps to encourage inclusivity and accessibility of the app alongside determining how to measure app effectiveness and subsequently relaying that to the public (to combat misperceptions around efficacy) will be important steps to encourage app-uptake. In saying that, the government has taken a number of steps to improve the app's digital capability which should not go unnoticed in promoting individuals to download the app.
Provincial & Territorial Support	Macro	Having other provinces and territories implement <i>COVID Alert</i> (after the Ontario pilot) was a slow and piece-meal process. With some regions not implementing the app and other regions changing its mind, there is a lack of unified engagement across the country that has potentially exacerbated existing barriers as well as generated unique obstacles relating to user-uptake. There also remain questions about breadth of app-uptake versus density of app-uptake and what objective the country should be aiming for so that the app can be most effective.

2.2. Factor Descriptions

In April 2021, the DGHH Lab released an 11-module Practitioner Guide on user-uptake of D-CT apps. This consisted of a primer on D-CT apps (Module 1); 5 case study modules (Modules 2-6) where we explored the D-CT apps and factors impacting user-uptake in five countries; an analysis of the identified individual, community, and system factors impacting user-uptake (Modules 7 & 8); recommendations to improve user-uptake and future research directions (Module 9); and a methodology and executive summary (Module 0 & 00).

In Modules 2-6, we explored the top three to six factors impacting user-uptake in Cyprus, Iceland, Ireland, Scotland, and South Africa. In comparison, for this special edition case study on Canada, we will briefly look at each of the eight factors identified across the five case studies: Perceptions of Data Collection & Management, Sense of Community, Communications & Misinformation, Accessibility & Inclusion, Trust in Public/Private Institutions, Policy & Governance, Response Infrastructure, and Digital Capability. Many of these factors have been initially identified and explored in the Government of Canada's [First Interim report of the COVID-19 Exposure Notification App Advisory Council](#) (Advisory Council's Interim Report) which explores the social and economic determinants of app adoption, retention, and use.⁵² The analysis of these factors will pull from the Interim Report where applicable as well as provide additional insight

⁵² Innovation, Science and Economic Development Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use. Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

from our research. After, we will then explore one new factor that we have identified as impacting user-uptake of *COVID Alert*: Provincial & Territorial Support.

2.2.1. Perceptions of Data Collection & Management

Privacy was an early key consideration in the development of the *COVID Alert* app and was a prominent theme in the Advisory Council's Interim Report. Early on in app development, the federal government chose to work closely with the Office of the Privacy Commissioner (OPC)⁵³ to ensure that the app design and roll out adhered to the principles of user privacy as determined by federal, provincial, and territorial authorities.⁵⁴ The government also established a time period within which to conduct a joint OPC-Health Canada audit. Once the app was developed, its source code was made open source in partnership with the Linux Foundation for Public Health, allowing for easy access to the code for those interested in aiding in its development, performing security audits, or participating in maintenance.⁵⁵

Despite the concerted efforts of the Canadian government to dissuade potential users from the idea that the app is a security risk, over 52% of respondents to a Leger Survey did not believe the government's claims that the app would not collect personal information or geolocate users.⁵⁶ This likely contributed to the 46% of respondents stating that they were not going to download the app, as well as the 20% of respondents that were unsure if they would download the app. These numbers should be taken critically however, as nearly a quarter of respondents (after weighting) lived in Alberta and British Columbia, neither of which use the *COVID Alert* app. Regardless, these distorted perceptions likely negatively influence app-uptake and seem to be fueled by a mistrust in government and even potentially a lack of understanding of *COVID Alert* and how it works. The mistrust in government follows a seeming global trend – where potential users remain critical of government claims as to how privacy centric the app is – and will be explored further in Section 10.2.2.5. The lack of *COVID Alert* digital literacy will be discussed throughout a number of the Sections.

2.2.2. Sense of Community

Despite a proclaimed strong sense of Canadian values in personal and institutional sense of community, in practice, Canadians are in the middle of the spectrum with neither a strong or weak sense of community.⁵⁷ The Advisory Council's Interim Report never highlighted community as an important factor and the DGHH lab's research found nothing to suggest that Canada's sense of community has played a role in user-uptake. One component to note however, is that *COVID Alert* messaging from government bodies does try to leverage communitarian values to encourage individuals to download the app (i.e. "download the

⁵³ Office of the Privacy Commissioner of Canada. (2020). Privacy review of the COVID Alert exposure notification application. Office of the Privacy Commissioner of Canada. Retrieved from https://www.priv.gc.ca/en/privacy-topics/health-genetic-and-other-body-information/health-emergencies/rev_covid-app/#fn2

⁵⁴ Office of the Privacy Commissioner of Canada. (2020). Supporting public health, building public trust: Privacy principles for contact tracing and similar apps. Privacy Commissioner of Canada. Retrieved from https://www.priv.gc.ca/en/opc-news/speeches/2020/s-d_20200507/

⁵⁵ DLF Public Health. (2020). Projects. DLF Public Health. Retrieved from <https://www.lfph.io/join/projects/>

⁵⁶ Leger. (2020). Leger's Weekly Survey. Association for Canadian Studies. Retrieved from <https://leger360.com/wp-content/uploads/2020/08/Legers-Weekly-Survey-August-10th-2020-1.pdf>

⁵⁷ GLOBE 2020. (2020). Canada. Global Leadership and Organizational Behavior Effectiveness. Retrieved from <https://www.globeproject.com/results/countries/CAN?menu=list#list>

COVID Alert mobile app to protect yourself and your community”).⁵⁸ It is possible that leveraging other values that resonate more strongly with Canadians may be more effective at increasing app-uptake. Furthermore, it is important to note that ‘sense of community’ as described here is a general trend across Canada, but is different

2.2.3. Communication and Misinformation

While the Interim Report does not specifically address communication and misinformation as its own section(s), it does mention some communications-related thoughts and suggestions. From these notes as well as the DGHH Lab’s research, it appears that the Government of Canada took a comprehensive approach in communicating to the country’s residents about *COVID Alert*. In fact, more than ten million dollars was spent marketing the app.⁵⁹ This included ads for television, radio, and public spaces, as well as targeted outreach into key communities via social media. For instance, the government partnered with First Nations social media influencers to encourage Indigenous persons to download the app.⁶⁰ The government also partnered with private sector brands such as the Toronto Raptors, the Toronto Maple Leafs, Bell Canada, CIBC, Toronto Star, and many more.⁶¹ This varied and extensive communications strategy would seem to potentially positively influence uptake. For instance, some of this outreach, specifically that done by Prime Minister Justin Trudeau in his public addresses, were followed by small spikes in downloads.⁶² At the very least, these spikes support some level of connection between outreach/marketing and user-uptake. Interestingly, while politicians and journalists were highly vocal on the subject, both groups rank very low on the list of figures trusted by Canadians.⁶³ Therefore, there also may be a relationship between the specific communicators used in marketing campaigns and user-uptake. This area requires further exploration and understanding as it may be possible to make communications campaigns more effective through facilitating conversation through highly trusted individuals and groups. This may be the reasoning behind the *COVID Alert* Advisory Council’s recommendation to pilot a ‘community animator’ initiative for established leaders in specific at-risk community to develop rapport and trust with community members and share messaging about downloading and using *COVID Alert*.⁶⁴

The lack of app-uptake also may be related to the information overload that has resulted during the COVID-19 pandemic where, in Canada, a person could be receiving directions from federal, provincial, and municipal authorities at any given time. Navigating all these messages and how they relate to the *COVID Alert* app, alongside being potentially bombarded with *COVID Alert*-specific marketing and trying to

⁵⁸ Government of Ontario. (2021). Download the COVID Alert mobile app to protect yourself and your community. Government of Ontario. Retrieved from <https://covid-19.ontario.ca/covidalert>

⁵⁹ Saba, R. (2021). Is the COVID Alert app a failure? The Toronto Star. Retrieved from <https://www.thestar.com/business/2021/04/06/is-the-covid-alert-app-a-failure.html>

⁶⁰ Innovation, Science and Economic Development Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use. Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

⁶¹ Trapunski, R. (2020). Ontario is pushing the COVID Alert app big time. But is it working?. Now Toronto. Retrieved from <https://nowtoronto.com/news/ontario-is-making-a-big-push-for-the-covid-alert-app-is-it-working>

⁶² Turnbull, S. (2020). COVID Alert app nears 3 million users, but only 514 positive test reports. CTV News. Retrieved from <https://www.ctvnews.ca/health/coronavirus/covid-alert-app-nears-3-million-users-but-only-514-positive-test-reports-1.5125256>

⁶³ Proof Strategies. (2021). The Proof Strategies 2021 CanTrust Index. Proof Strategies. Retrieved from <https://getproof.com/what-we-do/cantrust/>

⁶⁴ Innovation, Science and Economic Development Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use. Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

navigate *COVID Alert* documents, may just lead to confusion and/or desensitization. Unlike Iceland, who put significant efforts into making their privacy policies easily digestible for their general population, Canada's *COVID Alert* privacy policy can be confusing for individuals without an expert-level grasp of privacy. In saying that, the Canadian Digital Service tried to avoid information overload when designing its *COVID Alert* informational messaging to help people understand the app.⁶⁵ Yet, it is inconclusive on how effective these efforts were at mitigating information overload.

Finally, like many of the countries studied, misinformation and negative perceptions of *COVID Alert* have been abundant since its release.⁶⁶ As highlighted in Section 10.2.2.1, there are misperceptions and misinformation in relation to privacy and whether the government is collecting other information than claimed as well as tracking people. These rumors of government surveillance appear to persist regardless of the actual state of security offered by the app. Furthermore, there is some apprehension in terms of whether the app will "function as advertised" (i.e. concerns about whether the app even works).⁶⁷ This concern and misperception on effectiveness (and how effectiveness is defined) will be further discussed in 10.2.2.8. These negative narratives likely contribute to lower user-uptake and it has been suggested by experts to do targeted campaigns to clear up misconceptions.⁶⁸

Overall, while a lot of money was spent on marketing *COVID Alert*, the issues highlighted above seem to point to the need of a unified and a simplified communications campaign that is communicated by trusted leaders and directly combats common misperceptions and app knowledge issues to encourage more users to download *COVID Alert*. Ultimately clearly written supplementary materials that transparently share information and answer individuals' questions (while not getting bogged down in an abundance of detail as is currently the approach) is also required to improve app-uptake.

2.2.4. Accessibility & Inclusion

Accessibility & Inclusion has been a key focus for the COVID-19 Exposure Notification App Advisory Council and there have been efforts to ensure that the app is widely available to Canadians.⁶⁹ The app is compatible with screen readers, and is 95% compliant with Web Content Accessibility Guidelines. This, along with inclusive design reviews that have led to 90 changes to the app, helps ensure that those with disabilities can fully engage with the app.⁷⁰ There are continued efforts to make the app more accessible and to encourage uptake from all communities, with a focus on marginalized and vulnerable communities.⁷¹ As described in Section 10.2.2.3, the government leveraged social media influencers from

⁶⁵ Wilhelm, K. (2020). Just enough detail: how we designed content for the COVID Alert app. Canadian Digital Service. Retrieved from <https://digital.canada.ca/2020/11/18/just-enough-detail-how-we-designed-content-for-the-covid-alert-app/>

⁶⁶ Daigle, T. (2020). Misconceptions persist about effectiveness and privacy of Canada's COVID Alert app. CBC. Retrieved from <https://www.cbc.ca/news/science/covid-19-alert-app-myths-privacy-1.5684089>

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Government of Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use.

Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

⁷⁰ Canadian Digital Service. (2021). Accessibility report for COVID Alert (exposure notification mobile app). GitHub. Retrieved from <https://github.com/cds-snc/covid-alert-documentation/blob/main/AccessibilityReport.md>

⁷¹ Personal communication, 5-18-21

Indigenous communities to promote the app and the Advisory Council advised the government to launch a 'community animator' pilot program in communities that have been inequitably impacted by COVID-19.

Despite this demonstrated awareness of the barriers surrounding accessibility, there remain several unresolved issues that likely negatively influenced user-uptake of *COVID Alert*. These include: the app is only available in two languages, app availability is exclusive to newer phones (discussed in Section 10.2.2.8), digital and app literacy issues (discussed throughout Section 10.2.2), amongst others.⁷² Digital literacy is particularly problematic with the elderly population and it appears as though no clear action has been taken to make the app – or a similar digital tool – available to this extremely vulnerable group. Another issue revolves around the issue of personal security in relation to these apps. While many vulnerable and marginalized communities have been targeted with specific messaging and initiatives to encourage these persons to download the app, further steps may be required to mitigate or prevent the impacts of D-CT apps that are unique to these specific vulnerable and marginalized communities, such as those that have historically faced surveillance and subsequent discrimination from governmental operations or those that experience systemic racism. Please see Module 9 from the DGHH Lab's Practitioner Guide on User-Uptake of D-CT apps.

2.2.5. Trust in Public/Private Institutions

Trust in public/private Institutions was not discussed in the Interim Report, yet remains a key factor seemingly impacting user-uptake of D-CT apps across the DGHH Lab's case studies. In the context of Canada, according to the 2021 CanTrust index, public trust in government has seen a decline since 2016.⁷³ In tandem with the recent Leger report indicating a general lack of faith in the Canadian government's privacy claims regarding *COVID Alert* – where 52% of respondents believe the government is geolocating users or collecting personal information – it may not be a surprise that many users are reluctant to adopt the app.⁷⁴ This can be seen reflected in reports that the government struggled to reach reluctant users.⁷⁵ Extremely low levels of corporate trust likely compound this issue, as the app development from a government/private partnership alongside using private companies to market the app may place the app under high levels of scrutiny.⁷⁶ As mentioned previously in Section 10.2.2.3, the types of communicators used in a given campaign can be important to success – dwindling trust in politicians and the media may have prevented Canadians from fully accepting the information being disseminated, despite the government's efforts at transparency. Elevating the voices of trusted figures such as the medical community and subject matter experts may be crucial in future health emergencies in ensuring that the information disseminated is believed and that misperceptions are reduced as much as possible. In saying that, the Canadian government's highly privacy-centric attitude in the development of their app and the

⁷² Government of Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use. Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

⁷³ Proof Strategies. (2021). The Proof Strategies 2021 CanTrust Index. Proof Strategies. Retrieved from <https://getproof.com/what-we-do/cantrust/>

⁷⁴ Daigle, T. (2020). Misconceptions persist about effectiveness and privacy of Canada's COVID Alert app. CBC. Retrieved from <https://www.cbc.ca/news/science/covid-19-alert-app-myths-privacy-1.5684089>

⁷⁵ Personal communication, 2-5-21

⁷⁶ Proof Strategies. (2021). The COVID Effect: Canadians Trust Doctors and Scientists while Politicians and Employers Lose Ground. CISION. Retrieved from <https://www.newswire.ca/news-releases/the-covid-effect-canadians-trust-doctors-and-scientists-while-politicians-and-employers-lose-ground-810405062.html>

subsequent positive reporting on the app's privacy features⁷⁷ may have helped build some public trust towards the government and *COVID Alert*, thus contributing towards app-uptake.

2.2.6. Policy and Governance

Another factor seemingly not addressed in the Interim Report is Policy and Governance. There are however, a few apparent policy-related issues regarding *COVID Alert*. First, while the app was designed with privacy in mind, there seems to be potential tensions between the app and current privacy laws. In response to the Government of Canada's claim that the app is "not subject to its privacy laws," the Office of the Privacy Commissioner (OPC) stated that there need to be legal amendments to adequately protect users.⁷⁸ Another issue raised – again by the OPC – is that there is limited clarity on whether entities could seek information stored by the app as a condition of employment or service. Yet, the OPC did not consider this a great concern, they simply suggested that legal amendments occur and provided *COVID Alert* with a glowing privacy review.

Another potential concern is that there is no specific legislation outlining and protecting the purpose-limitations and time-limitations of the app – which some countries (Australia, Switzerland) have done. Therefore, while *COVID Alert*'s privacy policy has outlined the purpose-limitations and stated that the app will be shut down within 30 days of the Chief Public Health Officer of Canada's declaration that the pandemic is over, the OPC did recommend that federal law be amended appropriately to protect individuals. This question has also brought to light the need to clarify and strengthen Canadian privacy laws so as to better protect the end users of a service.

Finally, there appears to be a gap in the privacy policy as it relates to age limits, i.e. there is no age limit to download and use the app. In contrast, many countries have created an age limit to use the app that correlates with the law. This may present interesting legal dilemmas – unless Canadian law allows apps to be downloaded by anyone of any age – and at the very least presents ethical issues, such as informed consent (to use the app, to share health information).

Not providing a strong legal and policy-based framework in which to protect users – as exhibited in the examples above – likely dissuades users from downloading *COVID Alert*. It should be noted however, that the Interim Report acknowledged the Government of Canada's policy-focused efforts to introduce measures and amend existing policies so that Canadians can self-isolate without fear of losing income when faced with a positive test result or potential exposure to the virus. These policy-focused actions may have positively influence user-uptake, and providing reassurance and protection through implementing more policy is likely to continue to encourage uptake.⁷⁹

⁷⁷ Jones M, A. (2020). Canadian privacy watchdogs support COVID-19 exposure app. CTV News. Retrieved from <https://www.ctvnews.ca/health/coronavirus/canadian-privacy-watchdogs-support-covid-19-exposure-app-1.5049847>; Dehaas, J. (2020). Josh Dehaas: COVID Alert protects our privacy — but should still concern us. The National Post. Retrieved from <https://nationalpost.com/opinion/josh-dehaas-covid-alert-protects-our-privacy-but-should-still-concern-us>

⁷⁸ Office of the Privacy Commissioner of Canada. (2020). Privacy review of the COVID Alert exposure notification application. Office of the Privacy Commissioner of Canada. Retrieved from https://www.priv.gc.ca/en/privacy-topics/health-genetic-and-other-body-information/health-emergencies/rev_covid-app/#fn2

⁷⁹ Innovation, Science and Economic Development Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use. Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

2.2.7. Response infrastructure

Response infrastructure was a focal point of the Interim Report as the app is ultimately reliant upon each individual province's existing health and emergency response infrastructure. For a user to fully engage with *COVID Alert* (see Module 1 of the DGHH Lab's Practitioner Guide for a detailed explanation of the four-stage continuum of user engagement: uptake, use, report, react), the province or territory's health system must take specific actions. For instance, for a person to report a positive COVID-19 diagnosis on the app, they must not only get tested, but be provided with a one-time key to enter into the app. To be effective, healthcare systems must have the necessary technology, resources, and capacity to facilitate these measures – particularly providing a one-time key. Out of the four provinces and territories that currently do not use *COVID Alert*, some have cited that their reason for not participating is directly related to resource limitations and fears that the app will further stress health services.⁸⁰ For instance, Yukon's resistance to the app stems from the risk of overloading healthcare systems due to the app's inability to distinguish between high and low risk exposures.⁸¹

Even amongst the provinces and territories that use the app and provide one-time codes, the one-time key provision rate remains particularly concerning. Fewer than 5% of positive cases have obtained a one-time key from their public health authority.⁸² There are multiple reasons as to why so few one-time keys have been provided/obtained, including lack of resources (mentioned above), burdening healthcare workers, etc. The Interim Report notes that a significant factor impacting one-time key provision is that each province and territory have different processes for acquiring a one-time key. These processes may not be intuitive for users and the onus is often placed on the individual to actively request a one-time key. Ultimately, there are a variety of reasons to explain why, even during spikes of COVID-19, one-time key delivery remains consistent (and low).⁸³ Regardless, not providing one-time keys to all of the COVID-19 positive cases dramatically reduces the amount of people getting potential exposure notifications and ultimately impacts the app's effectiveness – or perceived effectiveness – thereby further impacting people's opinion of the app's efficacy and prompting negative narratives surrounding the app. Inevitably, this will negatively impact user-uptake.

Interestingly, 80% of individuals who receive a one-time key input it into the app.⁸⁴ This would suggest that if health authorities provided more one-time keys, the majority of people would enter one-time keys into *COVID Alert* and more people would be notified of a potential exposure. This may improve the effectiveness of the app and combat the negative narrative or perceptions around efficacy (discussed in Section 10.2.2.1 & 10.2.2.3), thereby positively influencing app-uptake. This also likely explains the Interim

⁸⁰ Tait, C., Xu, X. (2020). Why B.C and Alberta aren't signing on to the federal COVID app. The Globe and Mail. Retrieved from <https://www.theglobeandmail.com/canada/british-columbia/article-why-bc-and-alberta-arent-signing-on-to-the-federal-covid-app/>

⁸¹ Howells, L. (2020). Yukon will 'wait and see' on COVID Alert app, says top doctor. CBC News. Retrieved from <https://www.cbc.ca/news/canada/north/yukon-federal-funding-hospitals-shelters-1.5754361>

⁸² Innovation, Science and Economic Development Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use. Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

⁸³ Personal communication, 5-18-21

⁸⁴ Innovation, Science and Economic Development Canada. (2021). Interim report on social and economic determinants of app adoption, retention and use. Government of Canada. Retrieved from <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/07716.html>

Report's suggestion to "align Federal, Provincial and Territorial efforts in optimizing the distribution of [one-time keys]." ⁸⁵

2.2.8. Digital Capability

Digital capability was another key factor identified in the Interim Report. *COVID Alert* faces the same challenges as all other Google Apple Exposure Notification (GAEN) apps across the globe: accuracy limitations from the Bluetooth technology, dated core algorithms that determine exposure risk, occasional app malfunctions, amongst others. As noted in Section 10.2.2.7, Yukon was concerned about the app's ability to distinguish high and low risk exposures which amounts to a digital capability issue. And, last November, a bug left some users without exposure checks for two weeks. Upon learning of this, the developers were quick to address this issue. Unfortunately, users were not immediately warned that a malfunction had occurred. ⁸⁶ These sorts of issues will likely negatively influence app-uptake.

There also remain phone-specific obstacles barring individuals from using the app, such as not having a smartphone, multiple users per phone, and a lack of access to the internet. The Interim Report suggests that individuals who are unable to use the app directly can still benefit from other people using it. Arguably, the government might want to consider taking the next step which is to implement other digital tools (like the tokens used in Singapore) that are accessible for those that experience these technological barriers. Taking steps to be more inclusive of the country's entire population will likely encourage user-uptake.

As also highlighted in Sections 10.2.2.3 and 10.2.2.7, there have been concerns around the efficacy of the app. Current users appear to worry about the app's efficacy due to low uptake, the app not performing as designed due to the user not receiving exposure notifications, confusion as to how the app works, and technical issues like decreased battery life when using the app. These worries/obstacles have led to some users uninstalling or de-activating the app. Negative media coverage of the app has likely exacerbated these concerns and the subsequent uninstallation/de-activation of the app. Many of these perceptions are a result of low app literacy and do not reflect the reality of the app, how it works, and how to define efficacy. Nonetheless, these perceptions act as a significant barrier to success. Health Canada does appear cognizant of these issues, and will hopefully address them in the near future. This will require not only fixing the technical issues, but also taking further steps to improve inclusivity as well as creating targeted communications about these concerns around efficacy and the app's digital capability (as described in Section 10.2.2.3). The Interim Report suggested establishing a baseline number of app downloads to appropriately measure the effectiveness of the app. This is potentially problematic as the number of downloads may not be the most appropriate measurement to express app effectiveness. In saying that, establishing a way to determine effectiveness and communicate that with Canada's residents will likely assist with improving the efficacy narrative and improving app-uptake.

⁸⁵ Ibid.

⁸⁶ Daigle, T. (2020). Federal COVID Alert app wasn't working for some users for much of November. CBC News. Retrieved from <https://www.cbc.ca/news/science/covid-app-alert-vulnerability-1.5826808>

Despite the issues identified above, the Government of Canada has seemingly taken numerous steps to improve the digital capability of the app which may improve user-uptake of *COVID Alert*. The GAEN framework was updated to make the app available on iOS 12.5 which has allowed almost 98% of phones in Canada to run *COVID Alert*. Users also can now ‘clear’ the exposed status on the app (which appears when they have been exposed to someone with COVID-19) following a negative test result. This allows users to receive new exposure notifications. Users can also voluntarily enter symptom onset or test date to narrow the exposure notification window to periods when a COVID-positive user was the most infectious. The government is also looking at how to extend *COVID Alert* beyond a government services tool towards “a tool that will also support Canadians and businesses in our economic, social and mental health recovery and restoration.” While the DGHH Lab is unsure what this means or what this tool could look like, the lab’s research has suggested that creating alternate functionality for D-CT apps may improve app-uptake.

2.2.9. Provincial & Territorial Support

One factor that the DGHH Lab identified as a factor potentially influencing app-uptake that was partially considered by the Advisory Council is Provincial & Territorial support. While Ontario was the province that piloted the app, when it was time for other provinces and territories to adopt the app, it was a slow, piecemeal process. Some provinces, such as Quebec, initially rejected the app, only to accept it later on.⁸⁷ Alberta on the other hand, appeared to initially accept the app, only to decide months later that they intended to remain focused on their own developed app.⁸⁸ As mentioned above in Section 10.2.2.7, four provinces currently have declined to use the app. The lack of unified engagement across the country likely exacerbated many of the other extant barriers described above as well as generated barriers unique to the context. For instance, since the first stage of adoption took place slowly, sporadically, or not at all, many provinces and territories likely were unable to capitalize on the core of the communications campaigns and subsequent user engagement. It is also possible that the lack of unified engagement has reinforced skepticism towards the app. Interestingly, while the government continues to encourage that all provinces and territories adopt the app, one may question as to whether the ‘damage has been done’ – if another province or territory were to adopt the app, would the uptake even be significant?

Related to that point, while widespread uptake across Canada is important, dense uptake is equally, if not more, critical. Even if all downloads were to have occurred in Ontario, the resultant ~48% uptake⁸⁹ would still be below the aspirational 50% target announced as a goal by Prime Minister Trudeau. Actual Ontario uptake is likely within the 2.5-3.5 million user range, representing only 18.5-26% of the province. This rate in itself is not a particularly desirable given that 38.2% of Canada’s COVID-19 cases are from Ontario. Even

⁸⁷ Belewett, T. (2020). Quebec rejects COVID-19 exposure notification app (for now), prompting concern, disappointment in Ontario. Ottawa Citizen. Retrieved from <https://ottawacitizen.com/news/local-news/quebec-rejects-covid-19-exposure-notification-app-for-now-prompting-concern-disappointment-in-ontario>; Montpetit, J. (2020). Quebec abandons opposition to federal COVID app as province is swamped with new cases. CBC News. Retrieved from <https://www.cbc.ca/news/canada/montreal/quebec-covid-alert-contact-tracing-app-1.5743287>

⁸⁸ Herring, J. (2020). Kenney rejects federal COVID Alert app, urges Albertans to download provincial version. Calgary Herald. Retrieved from <https://calgaryherald.com/news/local-news/kenney-rejects-federal-covid-alert-app-urges-albertans-to-download-provincial-version>

⁸⁹ Based on the 2016 census data for Ontario’s population. Actual number would likely be lower due to growth in the last five-year period.

if Ontario's download rate appropriately reflects the percentage of cases in Ontario, there is a difference between app downloads being concentrated in hot spot areas where the app would arguably be more effective and app downloads spread across rural communities where COVID-19 cases are low. It is important that efforts to increase app-uptake seek to not only increase engagement across the whole of Canada, but also to ensure that uptake is high enough to be useful within specific provinces, regions within certain provinces, and certain communities within those regions. Ultimately, bringing Alberta into the app may not be as impactful as focusing resources on increasing uptake within 'hot-spot' areas that have already chosen to participate.

5. Conclusion

The work completed in developing and releasing the *COVID Alert* app is impressive and valuable; it likely saved many Canadian lives. As highlighted across the nine factors identified above, a lot of work went into sharing information about *COVID Alert*, encouraging uptake across diverse communities, protecting privacy, improving the digital capability of the app, and more. Yet, there is still much work to be done. From combatting misperceptions about the app to providing legal protection from personal data use to making the app available in more languages to improving the provision of one-time keys to figuring out how to gain app-uptake broadly across Canada as well as deeply within specific regions, there are a lot of factors likely dissuading users from downloading the app and impacting the app's effectiveness. While the DGHH Lab's work on user-uptake identifies potential factors influencing user-uptake and recommendations on how to elevate the positives and reducing the risks of downloading the app, more research is required to garner deeper understanding as to why the majority of Canadians are not downloading the app as well as what barriers and positive influencers exist across the other stages of user engagement. The less-than-ideal uptake of *COVID Alert* should act as a wake-up call for the Canadian government to continue pursuing this research so that future public health digital tools are as effective as possible.