

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

**A PRACTITIONER
GUIDE**

METHODOLOGY



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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0.1. Methodology Overview

This supplementary document provides a detailed overview of the methodology used to guide the Digital Health and Humanitarian Lab's (DGHH Lab) study on user-uptake of Digital Contact Tracing (D-CT) apps during COVID-19. First, the guiding research questions and scope of research are identified. Second, our research approach is described through four phases: 1) Workshop/Focus Group; 2) Meta-Analysis; 3) Multiple Case Study & Interviews; and 4) Systems Analysis. Third, the structure of our research findings is outlined, which encompasses a series of modules that compose this practitioner guide. Finally, study constraints and limitations are provided.

0.2. Research Questions

This study asks the following research question:

Why is there higher user-uptake of Digital Contact Tracing (D-CT) apps in some countries over others?

Research is guided by the following sub-questions:

1. How does uptake vary across contexts?
2. What factors influence uptake across contexts?
3. How does risk-benefit perception influence uptake?

0.3. Scope of Research

To address our research questions, we established the scope of our research.

0.3.1. A focus on D-CT Apps Only

Our research focuses solely on **D-CT apps**, (the most prevalent form of D-CT interventions worldwide) that are **voluntary** for download (users have the freedom to download these apps) 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).

0.3.2. A focus on User-Uptake on D-CT Apps

In order to study engagement with D-CT apps, we first characterized engagement as a four stage process (see Figure 1).



Figure 1. Continuum of User Engagement in Digital Contact Tracing Apps

Each stage is described below:

1. **Uptake** - App users download, install, and register on the app
2. **Use** - App users ensure the app is running and up-to-date on their phone
3. **Report** - App users, identified as positive for COVID-19, report their status in the app so that others they may have had contact with get an exposure alert
4. **React** - App users that have received an exposure notification get tested and/or follow local quarantine protocol

As the need has been identified to garner deeper understanding of all stages of engagement, both through the literature (see Module 1) and a preliminary workshop/focus group (explained below) this study focuses on **uptake** as part of a larger study researching the other stages of engagement.

0.4. Research Approach

Research is conducted using qualitative methods through four phases including: initial focus group/workshop, qualitative meta-analysis, multiple case study & interviews, and systems analysis. Each of these phases are described below.

0.4.1. Phase 1. Workshop/Focus Group

On July 23rd, 2020, The DGHH Lab held an International, Interdisciplinary, Academic-Practitioner Workshop that focused on current challenges faced with Digital Contact Tracing (D-CT). The purpose of the workshop was to:

- Gather interdisciplinary insights on high level challenges currently associated with D-CT, key contextual factors that dictate the nature and outcomes of these challenges, and inform the development of the final product of the research
- Facilitate partnership-building across disciplines, academia, and practitioners across the globe to initiate building a global interdisciplinary academic-practitioner network to act as a source of knowledge exchange

The workshop was held remotely with 25 participants with expertise in areas including: Humanitarian Work, Manual Contact Tracing, Medical Service Delivery, Epidemiology, Emergency Management, Government Application Development and Policy, Big Tech / Innovation, Law, Privacy and Human Rights, Surveillance, NGOs and Marginalized Groups, Digital Contact Tracing, and Ethics & Governance.

Participants came from all over the world from countries including Canada, the United States, the United Kingdom, Switzerland, Greece, South Korea, and Japan. Participants were sampled using both purposeful and snowball sampling methods. For purposeful sampling, we searched for individuals who were experts in the above areas by exploring news outlet content, reviewing scholarly literature, conducting internet searches, joining virtual groups that housed academics and practitioners conducting related work, and reaching out to pre-existing contacts. After identifying these individuals and gauging their interest, we also requested the provision of other contacts that may be interested in participating in the workshop.

At the workshop, participants were divided into interdisciplinary groups to discuss digital contact tracing from the perspective of 1) the individual (i.e. individual people using or not using D-CT apps); 2) communities (i.e. communities that do or do not use D-CT apps, such as the elderly, refugees, employees, etc.); 3) implementers (i.e. those implementing the app such as the government, public health agencies, and private companies); and developers (i.e. those developing D-CT apps such as big tech companies). Within each group, discussion was led by the participants with some prompting from the DGHH Lab team on the following topics: identifying the main challenges associated with D-CT, main benefits and risks associated with D-CT, and the contextual factors that can increase risk or increase benefit associated with D-CT. With permission from participants, all data was collected through note-taking and audio transcription.

Qualitative analysis of the notes and audio transcription was used to identify main themes in need of deeper research. One of the primary findings identified in this workshop was the need to focus on the user perspective of D-CT initiatives, specifically incentives to engagement from a risk-benefit perspective. This finding established the foundation of our study.

0.4.2. Phase 2. Meta-Analysis

Initial focus group findings were combined with a literature review that focused on 1) the risks and benefits of D-CT apps; and 2) D-CT apps within specific contexts (i.e. within countries, regions, and communities around the world) in order to define the user-uptake problem, and identify existing knowledge and gaps in need of research (Module 1). Using these findings, a multiple-case study approach was designed to gather further insight on user-uptake with D-CT apps.

0.4.3. Phase 3. Multiple Case Study & Interviews

Five case studies were selected to generate in-depth, qualitative insight into reasons why some individuals download D-CT apps over others. The study aimed to characterize the evolution of D-CT apps by country, detail the nature of the D-CT app (i.e. how it is developed and implemented), describe user uptake in that country, identify themes that help to explain user-uptake of D-CT apps (from a risk or benefit to the user perspective), and interventions used that have led to higher or lower uptake.

0.4.3.1. Case Selection

The criteria used to identify cases for study included:

- Use of a decentralized D-CT app
- Voluntary uptake
- Uptake rate similarity and variation
- Population size similarity and variation
- Regional similarity and regional variation (e.g. Scotland versus Ireland, developing versus developed world)

The final case studies selected include: Iceland, Cyprus, Ireland, Scotland, and South Africa.¹

0.4.3.2. Data collection

Data was collected using a combination of qualitative meta-analysis and individual interviews.

Qualitative analysis consisted of a secondary literature review of peer-reviewed literature combined with grey literature specific to the countries being studied. Topics researched included a country's response to COVID-19, COVID-19's impact on the country, and about the country's D-CT app (how it works, how people use it, how many people downloaded it, and factors seemingly impacting uptake). Given this is a novel area of study, little published materials were available specific to the subject matter. Subsequently, research relied heavily on grey literature including media reports, non-peer reviewed academic work, op-eds, and social media, among other materials. Social media was studied in part through Twitter scraping. Three samples of Twitter conversations on the subject of a country's contact tracing app were taken (two in October and one in November). The sample was taken via a scraper using the Twitter API. The primary library used for the script was Tweepy². As an example, keywords for Ireland's twitter scraping included "Contact Tracer Ireland", "Irish", "Ireland", "Contact Tracing", and "app". Samples covered October 10 - October 30 and November 24 - December 1.

Individual interviews also were conducted to gain deeper insight into some of the areas where literature was lacking. Participants were identified based on a) involvement with design and implementation of D-CT apps in the respective case study countries, or b) subject-matter expertise as it relates to user-uptake of D-CT apps, digital contact tracing, and the broader digital response. Participants were selected using purposeful and convenience sampling and contacted via e-mail. Due to the need to provide timely outputs, the timeframe in which interviews could be conducted was short, and as a result, only five of those contacted were able to participate in an interview (which were conducted in October 2020). Four interviewees spoke in relation to Ireland's D-CT app and one interviewee addressed Iceland's D-CT app.

Interview protocol questions spanned context-specific and subject matter expert questions, aimed to gather further insight on uptake in the target country, challenges associated with uptake, existing incentives, perceptions of the participants country performance in comparison to other countries, and measures that have been taken to account for risk/benefit of D-CT apps. Data was collected using note

¹ Initial study also included Argentina to encourage regional variation, but this country was removed from the study given insufficient available data within project timelines. See discussion on *constraints and limitations* for further information.

² Tweepy. (n.d.). Tweepy: An easy-to-use Python library for accessing the Twitter API. Tweepy. Retrieved from <https://www.tweepy.org/>

taking, audio recording, and transcription. Data was analyzed through qualitative coding strategies. In the Practitioner Guide Modules, interviewees are either identified by name or are anonymous and cited as 'personal communication' depending on what interviewees agreed to via the consent process.

0.4.4. Phase 4. Systems Analysis

Research findings were analyzed using a systems approach to identify key uptake factors that contribute to user-uptake. Bronfenbrenner's ecological systems theory is used as a foundation for systems analysis.³ His theory defines user behaviour as a product of intrinsic and extrinsic interactions and influences with different levels of their surrounding system. Specifically the user is understood by identifying the internal factors that influence their motivations and behaviours (micro-level system); external factors that influence them and they have influence on (meso-level system), like their community and family; and/or factors that directly influence them only (macro-level system) like socio-cultural, political, technological, and economic systems. By looking at these different levels of the system, one can gather insight on the different spheres that influence behaviour. In the context of D-CT engagement, this approach lends insight on the intrinsic factors that may lead individuals to download D-CT apps, while also explore the influences of community and social networks, as well as the broader political structures, health system capabilities, digital and educational capacities, social norms, and so forth.

0.5. Research Findings

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

0.6. Constraints & Limitations

Over the course of study, a series of research constraints and limitations were experienced.

First, given the novel nature of this area of research, there was a **lack of available data** to draw from. This lack of data spanned peer-reviewed literature and grey literature specific to user-uptake as well as user-

³ Bronfenbrenner, U. (1992). Ecological systems theory. Jessica Kingsley Publishers.

uptake measurements and the effectiveness of D-CT apps, especially specific to the case studies. Some interviews were conducted to fill research gaps, but even interviews revealed a lack of data to date that could fully characterize the impact of digital contact tracing and behaviours around the associated D-CT interventions. While the lack of available data was a limitation, the team was as resourceful as possible to fill in the gaps and gain an understanding of user-uptake -- particularly surrounding app download data - across the case studies.

Second, to accommodate the growing need for information in a fast-moving, high-risk pandemic, this study prioritized timely outputs over longer-term, in-depth study. As such, **time constraints** hindered the ability to explore themes that emerged in more depth.

Third, **some case studies were cancelled**. Additional countries were initially included in the research design to help diversify cross-comparison of countries. Given previous constraints (lack of data, time) some cases selected were deemed insufficient for study given insufficient data was available and/or their D-CT apps were unclearly defined.

Relatedly, fourth, **variable D-CT app release dates** made it difficult to effectively compare uptake along a shared time continuum. This study hoped to plot uptake over time, for example, and evaluate variability in uptake curves as a means to identify factors that influence uptake. Yet, insufficient data was available given these variable release dates.

Fifth, in the late stages of the study, researchers faced challenges with **standardizing user-uptake statistics**. While most countries report D-CT user-uptake in terms of downloads, interviews with D-CT app developers revealed that standards were changing for uptake measurement. Specifically, that reporting on downloads was an inaccurate measure and that user registrations provide a better indicator. Because of the differences in available data, the only case study for which more detailed uptake percentages were found (beyond aggregate downloads) was Ireland. The decision was made, given data and time constraints, to report on data available for each country. For those countries with only downloads available, downloads were reported. Consensus was that downloads still provide valuable insight into user-uptake.

Finally, this study is **unable to characterize the level of influence** of factors identified because this was a qualitative study with the aim to identify recurrent themes associated with uptake (with plans for future quantitative study given more time and resources available). Without quantitative study, this study is limited in its ability to evaluate the extent each of factors influenced user-uptake. For a detailed explanation of how some of these limitations could be addressed in future study, e.g. the need for quantitative research, see *Module 9 - Future Research*.