

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

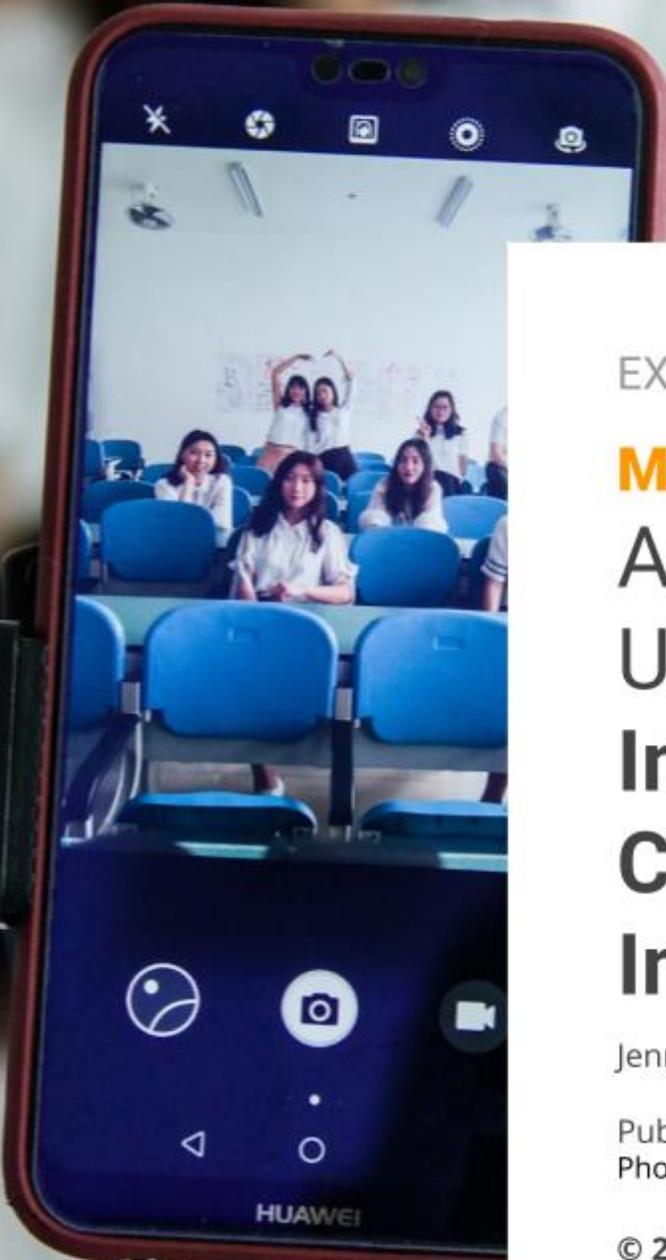
**A PRACTITIONER
GUIDE**

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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

MODULE 7.

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

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7.1. Study Overview

7.1.1 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.

¹O'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/>

7.1.2 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. 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 7.1.4 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, please see the full methodology.

7.1.3 Overview of Cases & Factors Identified

As will be shown through the five case studies, **eight factors** that can explain uptake across the individual (micro), community (meso), and system (macro) level dimensions have been identified. Each factor is explained below.

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).

²Lomas, 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

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.

7.1.4 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

7.2. Module Overview

This module aims to explore the individual- and community-level factors identified in our research in more depth through comparative analysis across case studies. We explore three factors – 1) Perceptions of Data Collection & Management; 2) Sense of Community; and 3) Communications & Misinformation –

identified as potential influencers of app-uptake at the individual (micro) and community (meso) levels as well as at the intersection of the community-system (meso-macro) levels. Discussion will begin with a brief summary of user-uptake across case studies to provide context. We then briefly describe how each factor fits within each level of analysis before exploring the research findings across the five case studies. We then situate these findings within the global scope (i.e. what these factors look like beyond the case studies) alongside broader discussion and emerging research on D-CT uptake in relation to risk and benefit perception.

7.3. Summary of Uptake Across Case Studies

User-uptake varied considerably across our five case studies (Iceland, Ireland, Scotland, Cyprus, and South Africa). The following is an overview of each of these case studies in terms of uptake rates,⁴ the name, description, design, and implementation approach of their apps (see Table 1.0 for a summary).

Uptake rates for each country were determined by using a combination of media outlet statements on D-CT app download numbers and/or uptake rates alongside manual calculations based on a country's estimated population. Ireland's *COVID Tracker Ireland* had the highest uptake rate at 43%⁵ (although if considering just active users that percentage drops to 28% of the population or 34% of the adult population),⁶ followed by Iceland's *Rakning C-19* at 40%.⁷ Scotland's *Protect Scotland* had 27.5%⁸ user-uptake, meanwhile South Africa's *COVID Alert SA*⁹ and Cyprus' *CovTracer* hovered around 1%.¹⁰ All apps were implemented by the national government and developed through collaborative partnerships between the government and public, private, and/or academic organizations. Ireland, Scotland, and South Africa use a Bluetooth-based approach to D-CT as required when using the Google Apple Exposure Notification (GAEN) Application Programming Interface (API). Meanwhile, Iceland uses an open-source GPS-based app and Cyprus uses a combination of Bluetooth and GPS for their app which is based on MIT's free, open-source SafePaths Platform. The mobile operating system requirements for these apps span iOS 9.0 and up for Cyprus and Iceland to iOS 13.0 and up for Scotland to iOS 13.5 and up for Ireland

⁴ Uptake rates are framed as a percentage representing the number of app downloads for the national population size in this section of the study. In case studies, uptake rates also are described as active users over downloads (as this measure is deemed to more accurately represent uptake) where data exists. Uptake rates also are situated in different populations including: the population that meet the age requirements to download the app (age appropriate uptake); the population that uses the internet on mobile phones (digital uptake); and the population that have Android or iOS smartphones (digital capability uptake).

⁵ Hawkins, L. (2020, September 25). NearForm's privacy-first contact tracing app has high uptake. Healthcare Global. Retrieved January 27, 2021 from <https://www.healthcareglobal.com/telehealth-and-covid-19/nearforms-privacy-first-covid-tracking-app-has-high-uptake>

⁶ Department of Health. (2020, October 21). Ireland is one of the first countries to link contact tracing apps with other EU Member States. Government of Ireland. Retrieved from <https://www.gov.ie/en/press-release/2dc55-ireland-is-one-of-the-first-countries-to-link-contact-tracing-apps-with-other-eu-member-states/>

⁷ Johnson, B. (2020, May 11). Nearly 40% of Icelanders are using a covid app—and it hasn't helped much. MIT Technology Review. Retrieved from <https://www.technologyreview.com/2020/05/11/1001541/iceland-rakning-c19-covid-contact-tracing>

⁸ Scottish Government. (2020, November 5). Protect Scotland app compatible with English and Welsh app. Scottish Government. Retrieved from <https://www.gov.scot/news/protect-scotland-app-compatible-with-english-and-welsh-app/>

⁹ Nortier, C. (2020, October 13). COVID Alert SA app: The fine balance between public health, privacy, and the power of the people. Maverick Citizen. Retrieved from <https://www.dailymaverick.co.za/article/2020-10-13-covid-alert-sa-app-the-fine-balance-between-public-health-privacy-and-the-power-of-the-people/>

¹⁰ Financial Mirror. (2020, April 7). COVID19: Thousands download Cyprus COVTRACER app. Financial Mirror: Cyprus: Life & Style. <https://www.financialmirror.com/2020/04/07/covid19-thousands-download-cyprus-covtracer-app/>

and South Africa. For Android users in Cyprus and Iceland, the OS must be 5.0 and up whereas in Ireland, Scotland, and South Africa the OS must be 6.0 and up.

Table 7.1.0: D-CT App Overview Across Case Studies¹¹

	Cyprus	Iceland	Ireland	Scotland	South Africa
Name of the App	CovTracer	Rakning C-19	COVID Tracker Ireland	Protect Scotland	COVID Alert SA
Developer(s)	Cyprus' Deputy Ministry of Research, Innovation and Digital Policy; the Research Centre of Excellence on Information and Communication Technologies in Cyprus; the Massachusetts Institute of Technology, XM.com, Prountzos & Prountzos LLC	Department of Civil Protection and Emergency Management; the Directorate of Health	Nearform	Nearform; NHS Scotland	Developer: Discovery Health SA Publisher: South African National Department of Health
Bluetooth, GPS, Both, Other	Both: GPS and Bluetooth	GPS-based	Bluetooth	Bluetooth	Bluetooth
Type of App: GAEN or Other	Other: MIT's free, open-source SafePaths platform	Other: GPS-based, open-source app	Google Apple Exposure Notification API	Google Apple Exposure Notification API	Google Apple Exposure Notification API
Mobile Requirements: e.g. iOS, Android, version	iOS 9.0 and up Android 5.0 and up	iOS 9.0 and up Android 5.0 and up	iOS 13.5 and up Android 6.0 and up	iOS 13 and up Android 6.0 and up Mobile phones must be 2015 or newer	iOS 13.5 or later Android 6.0 or later
Alternate functionality?	Symptoms checker. news function	Chat features for users to speak to public health officials additional information for tourists	Provides users with Irish COVID statistics; optional daily health check-in for users	N/A	N/A
Data Deletion period	1 year	14 days for data on user's phone 14 days for data uploaded (with consent) to a centralized database	14 days for diagnosis keys, and exposure notification service identifiers; 28 days for daily symptom check-in	72 hours for submitted data to Gov.UK; 14 days for diagnostic keys (on mobile phone)	14 days

¹¹ Please note that data collected by the app and by third parties is not shown in this summarizing table. Please see individual case studies (Modules 2-6) for more specifics.

While the apps across the case studies use a decentralized method of data storage, once a user is positively diagnosed with COVID-19, all apps provide the opportunity for the user to upload the data collected by the app to a centralized source for epidemiological follow-up, manual contact tracing, and/or sending out exposure notifications. Across four of the countries (Iceland, Ireland, Scotland, and South Africa), data is stored on the app for 14 days. The exception in Ireland is the symptom check-in data which is stored for 28 days. Meanwhile, Cyprus' app stores its data for one year. In terms of the data collected by the centralized database (should a user upload their data), the period before data is deleted is typically the 14 days except for Scotland where the data is deleted after a 72-hour period. Only some apps offer alternate functionality beyond contact tracing. For example, Iceland's app provides a chat feature that enables users to speak with public health officials; there is also additional information for tourists. Ireland provides users with COVID-19 statistics as well as the option for daily health diagnostic check-ins. Similarly, Cyprus offers symptom checker functionality with their app.

7.4. Micro Analysis

7.74.1. Factor 1: Perceptions of Data Collection & Management

One factor that appears to strongly influence uptake is individual perceptions and comprehension of the management and use of user data in relation to privacy – such as what data is collected, how it is managed, and how it is used. This factor is considered to exist at the individual (micro) level since it is the intrinsic beliefs around the data management process and understanding of privacy that influence behaviour.

Across case studies, five main themes were identified that may explain the link between perceptions of data collection & management and uptake of D-CT apps. The first theme identified is the **level of trust** in government and private institutions during, or at least prior to, the pandemic, which varies in line with uptake rates.¹² Iceland, Scotland, and Ireland – countries with higher uptake – have generally demonstrated a high level of trust. The Icelandic population, for example, is reported to have high trust in government officials including the Directorate of Health and the Department of Civil Protection and Emergency Management, both of which have been crucial in coordinating the government response to the COVID-19 pandemic.¹³ Before the pandemic, Scotland conducted a social attitudes survey prior to lockdown. In contrast with UK perceptions, 61% of the population trusted the government to work in their best interests (versus 15% in the UK) and 73% were in favour of the government having the most influence over how the country was run (versus 15% in the UK).¹⁴ Similarly, Ireland reportedly has one of the highest levels of pre-pandemic trust in its health care system compared to the pre-pandemic trust in the EU in general.¹⁵ Meanwhile, countries with lower uptake, such as South Africa and Cyprus, have shown

¹² Note, reporting on public trust for all case studies during the pandemic due to limited information available

¹³ NPR Weekend Edition Sunday. (2020, May 17). How Iceland handles contact tracing [Audio recording]. <https://perma.cc/EBW8-2QQZ>

¹⁴ Government of Scotland. (2020, September 29). Survey shows high levels of trust in Scottish government. Government of Scotland. Retrieved from <https://www.gov.scot/news/survey-shows-high-levels-of-trust-in-scottish-government/>

¹⁵ Eurofound. (2016). European Quality of Life Survey 2016 - Data visualisation. Retrieved from <https://www.eurofound.europa.eu/data/european-quality-of-life-survey>

a lower sense of public trust. In South Africa, trust in the government is particularly low, with only 33% of South Africans having claimed they trust their legislature 'a lot' or 'somewhat.'¹⁶ In Cyprus, prior to the pandemic, people were largely pessimistic about their country's government, parliament, and political parties, with 66% revealing that they "distrust the government", 63% reporting lack of trust in parliament, and 87% of Cypriots stating that they do not "trust political parties."¹⁷

Extent of user input in the development, implementation, and regulation of D-CT apps – as well as throughout the entire user engagement process – is the second theme identified in the research. Research indicates that people's willingness to adopt and engage with apps is influenced by whether the app "seeks user input before delivering personalized services."¹⁸ Apps that consult users before harvesting and mining their personal data are viewed more favourably than apps that do so "covert[ly]."¹⁹ Furthermore, users are more likely to trust apps that prioritize total transparency and high user control and "the more they trust it, the greater their involvement in the app and the more positive attitudes."²⁰ In other words, high transparency creates incentives for app-uptake and engagement. Iceland, for example, has very clear privacy policies that are accessible to the general public in terms of what data is being collected and the limited purposes the data is being used for. Similarly, Ireland's app process gives the user a significant amount of control in what specific data is shared with both the app and the government. Cyprus' *CovTracer* also seems to focus on user input by explaining the purpose of each tracking feature and consulting users at every stage of the data collection process.

The **extent and nature of data collected** – the third identified theme – is also anticipated to have an impact on uptake. Across case studies, the scale and scope of data collected varied quite substantially. In Iceland, for example, data collected includes a user's location data and telephone number. Furthermore, the app explicitly states that data will not be shared with Iceland's contact tracing team unless actively shared by the user which they can do by entering their national ID number into the app. Meanwhile, the Cyprus app collects the most data among cases studied. As it uses both GPS and Bluetooth-based proximity tracing, the data collected by *CovTracer* about user behaviour extends well beyond others. Furthermore, the manual input data required during user registration – personal information about the account holder, health history and current health status, travel history, movement purposes (i.e. why an individual is leaving their home), and various phone-related data (location, memory, contacts, browser settings, etc.) – is extensive. The Cypriot government claims however, that all data is decentralized and that this data is stored on the user's phone unless actively supplied to health providers (like Iceland's app). Yet, when the broad data collection is combined with more sensitive user data, this report speculates that

¹⁶ Devermont, J., & Mukulu, T. (2020, May 12). South Africa's Bold Response to the Covid-19 Pandemic. Center for Strategic and International Studies. Retrieved from <https://www.csis.org/analysis/south-africas-bold-response-covid-19-pandemic>

¹⁷ Hadjioannou, B. (2020, February 20). Eurobarometer: Cypriots distrust political parties, tend to trust the army more than other institutions. In-Cyprus.Com. <https://in-cyprus.philenews.com/eurobarometer-cypriots-distrust-political-parties-tend-to-trust-the-army-more-than-other-institutions/>; Financial Mirror. (2020, February 20). Cypriots trust the army more than politicians. Retrieved from <https://www.financialmirror.com/2020/02/20/cypriots-trust-the-army-more-than-politicians/>; Cymar. (2018, March 22). Trust and satisfaction with Institutions in Cyprus. Cymar. <https://www.cymar.com.cy/en-gb/results/cyprus-institutions/>

¹⁸ Swayne, M. (2018, April 24). User control and transparency are key to trusting personalized mobile apps. Scienmag. Retrieved from <https://scienmag.com/user-control-and-transparency-are-key-to-trusting-personalized-mobile-apps/>

¹⁹ Ibid.

²⁰ Ibid.

the sheer amount of data shared is a deterrent to app-uptake and participation. One of the reasons Ireland may have more uptake than other countries may be linked to the point made above regarding how the Ireland app provides significant user control in what data is shared: users provide consent to share data and the data shared is not only determined by the user, but is minimal.

The fourth identified theme – **risk of poor data management**, i.e. the risk of data breach – is also a major factor of consideration for user-uptake. In Scotland, for example, there were incidents of women providing their contact details offline in bars and private establishments later being contacted and harassed by the staff of those establishments.²¹ This breach of privacy could work both in favour of, or against, app-uptake. For instance, in comparison to the physical data collected at restaurants, anonymized data collected via the D-CT app may be perceived as more secure. Alternatively, the breach of privacy seen with physical data may cause individuals to be skeptical of any personal data collection, digital or otherwise. Furthermore, there is the issue that the digital collection of data has its own set of perceived and actual risks.²² Also in Scotland, the use of Amazon Web Services in relation to the country's app has raised flags among citizens and residents about the potential collection of personal information associated with using this service.²³ While NHS Scotland, assures that all data is encrypted and anonymized and states that this process adheres to NHS Scotland and GDPR data and privacy standards, the history of Amazon sharing data²⁴ may give reason for concern.

The final theme identified in relation to perceptions of data collection & management is **misunderstandings or misinterpretations that exist in relation to privacy**. Across the case studies and broader research, miscalculations of risk – both around general privacy protections and specifically how privacy varies between apps – may also play a role in influencing user-uptake. In Ireland, the subject matter expert interviews conducted by the DGHH Lab's team highlighted that many of the privacy concerns seemed to be disconnected from the reality of risks posed by the app. For example, as of Android 6.0 and up, location services must be turned on for the app's Bluetooth functionality to work.²⁵ Yet, concerned users may perceive the app requesting access to location data to be an indication of the app providing the government with personal location information and media outlets and privacy experts have had to stress that this is not the case. Therefore, the users of apps that use strictly Bluetooth – Ireland, Scotland, and South Africa – may be impacted by this misconception. Indeed, some South Africans are claiming that the *COVID Alert SA* app "is just another case of the government trying to track

²¹ Culliford, G. (2020). Scots bombarded with creepy texts after giving numbers out for Test and Protect. *The Scottish Sun*. Retrieved from <https://www.thescottishsun.co.uk/news/6141337/nhs-scotland-test-protect-track-trace-coronavirus-data/>

²² Plutora. (2020, November 12). Digital Risk: What It Is And How to Manage It in Your Org. Retrieved from <https://www.oecd-ilibrary.org/docserver/5jlwt49ccklt-en.pdf?expires=1613502651&id=id&accname=guest&checksum=C2CC72B43E05A3AEB3C9C4E1AE1FA932>

²³ Williams, M. (2020). "Only NHS has access": Ministers insist Amazon is not getting data from a million users of Scotland's Test and Protect app. *The Herald*. Retrieved from <https://www.heraldscotland.com/news/18734001.only-nhs-access-snp-insists-amazon-not-getting-data-million-users-scotlands-test-protect-app/>

²⁴ Daws, R. (2020, January 28). Amazon's Ring causes further concerns over third-party data-sharing. Internet of Things News. Retrieved from <https://iottechnews.com/news/2020/jan/28/amazon-ring-concerns-third-party-data-sharing/>; Peters, J. (2020, April 23). Amazon reportedly accessed third-party seller data to develop private-label products. *The Verge*. Retrieved from <https://www.theverge.com/2020/4/23/21233121/amazon-employees-seller-data-private-label-products>

²⁵ Android. (n.d.). Bluetooth Overview. Retrieved from <https://developer.android.com/guide/topics/connectivity/bluetooth>

and control us, farm our data, and other similar concerns.”²⁶ Further interviews revealed that this disconnect poses a major challenge in terms of encouraging uptake. Ultimately, despite *Covid Tracker Ireland’s* affiliation with the Linux Foundation Public Health (LFPH) (an open-source initiative) and extensive security audits, the app’s developers have not had a clear pathway for accurate information relating to privacy to reach end users.

Beyond case studies, broader research reinforces the perception that trust in government has a substantial impact of D-CT app-uptake. In the US, for example, trust has been so low in government that even manual contact tracing methods have been ineffective.²⁷ By contrast, roughly 75% of Singaporeans trust the government and other authorities²⁸ in how they manage personal data which may explain why the country’s app, *TraceTogether*, has a claimed 4.2 million downloads (as of February 2021).²⁹ Other apps, like Canada’s *COVID Alert* app, have been widely lauded for its privacy-by-design approach. Even with privacy watchdogs in support of the app,³⁰ uptake rates (in terms of downloads) in Canada lie around 16% (as of February 15 2021).³¹ Beyond the actual privacy-preserving measures embedded in D-CT apps, our research suggests that, in many cases, privacy perceptions may have a stronger influence on app-uptake than the extent privacy is actually accounted for in these apps. That being said, people’s fears regarding sharing data and potentially having their identity exposed have been substantiated, with cases like the breach of Dr. Ngolo’s health status in New Brunswick, Canada leading to public shaming and removal from his place of work.³² Similarly, in the Philippines, *COVID-KAYA*, a platform used by frontline healthcare workers to collect and share COVID-19 cases with their department of health, was found to have vulnerabilities that enabled unauthorized users to access and exploit this private health data.³³ In many contexts, the risk of exposing one’s health status may be higher than the risk of contracting the virus itself, including potential ramifications for future health insurance apps, or when dealing with sensitive data of marginalized communities that require stricter data sharing protocols (including women escaping domestic violence, refugees and migrants, minors, the LGBTQ2+ community, and others). Furthermore, as will be discussed in Section 7.6.1, malicious actors spreading misinformation can help perpetuate an individual’s misperceptions, or alternatively actualize their fears, relating to data collection, management, and privacy – thereby influencing user-uptake.

²⁶ Stone, J. (2020, September 21). What Security Experts Say About Downloading The “COVID Alert SA” App. 2oceansvibe News. Retrieved from <https://www.2oceansvibe.com/2020/09/21/what-security-experts-say-about-downloading-the-covid-alert-sa-app/#ixzz6eCF0uVtu>

²⁷ Khazan, O. (2020, August 31). The Most American COVID-19 Failure Yet. *The Atlantic*. Retrieved from <https://www.theatlantic.com/politics/archive/2020/08/contact-tracing-hr-6666-working-us/615637/>

²⁸ Pierson, D. (2020, March 25). Singapore says its coronavirus app helps the public. Critics say it’s government surveillance. *The Los Angeles Times*. Retrieved from <https://www.latimes.com/world-nation/story/2020-03-24/coronavirus-singapore-trace-together>

²⁹ Trace Together. (n.d.a.). TraceTogether, safer together. Retrieved from <https://www.tracetogogether.gov.sg/>

³⁰ Laurencio, D. (2020, August 3). Canadian privacy watchdogs support COVID-19 exposure app. *CTVNews*. Retrieved from <https://www.ctvnews.ca/health/coronavirus/canadian-privacy-watchdogs-support-covid-19-exposure-app-1.5049847>

³¹ Based on population of 37,742,154 (from Worldometer.info) and 6,286,807 downloads (from Canada.ca) as of Feb 15, 2021.

³² Trinh, J. (2020, September 2). Tracing N.B. doctor’s steps and contacts casts doubt on whether he was source of spring COVID-19 outbreak. *CBC*. Retrieved from <https://www.cbc.ca/news/canada/new-brunswick/doubt-ngola-family-doctor-source-outbreak-campbellton-new-brunswick-1.5706918>

³³ Lin, P., Knockel, J., Senft, A., Poetranto, I., Tran, S., & Delbert, R. (2020, November 10). Unmasked: COVID-KAYA and the Exposure of Healthcare Worker Data in the Philippines. The Citizen Lab. Retrieved from <https://citizenlab.ca/2020/11/unmasked-covid-kaya-and-the-exposure-of-healthcare-worker-data-in-the-philippines/>

7.5. Meso Analysis

7.5.1. Factor 2: Sense of Community (e.g. Trust in Community, Shared Trust, Shared sense of community, Communitarian)

Beliefs surrounding app engagement as a shared responsibility appear to have a noticeable effect on user-uptake of D-CT apps. Sense of community is considered community (meso) level because it is constructed through the mutual influence of the individual on community and the community on the individual.

Across case studies, countries with higher uptake rates (mainly Iceland and Ireland) showed strong **communitarian values**, the only prominent theme identified in relation to a sense of community. In Ireland, for example, the subject matter experts the DGHH Lab interviewed framed using the app as a duty similar to washing your hands or wearing a mask. The Irish commitment to community is supported by early behavioral studies undertaken by the Irish Health Service Executive (HSE), where communitarian messaging tested better among respondents than did messaging reflecting a more individualistic mindset.³⁴ As such, communications relating to the app refer to “the success of the app [being] founded on the solidarity of the Irish people in [their] aim to suppress the spread of COVID-19. This is a testament to the efforts of the Irish public...”.³⁵ Similarly, in a survey looking at attitudes associated with COVID-19 digital contact tracing, O’Callaghan *et al.*, (2020) found that protection of family and friends ranked higher than protection of self as a reason to install the app, as well as a general willingness to download the app (82% acceptance) prior to the release of the app itself.³⁶ Value rankings by the GLOBE³⁷ further reinforce the idea that commitment to community may stem from a national predisposition to communitarian values. Similarly, as a small island nation, Iceland is considered to be a country with strong social networks, with high levels of shared trust and social interaction.³⁸ The national approach to limiting the spread of COVID-19 has been described as a “collaborative model” that prioritizes faith in citizens and residents to follow public health measures over fines and regulations.³⁹ In other words, Iceland’s model emphasizes cooperation and coordination.⁴⁰ Iceland’s government also uses communitarian messaging,

³⁴ Personal Communication, October 27, 2020

³⁵ Government of Ireland. (2020). Minister for Health welcomes launch of contact tracing apps in New York and New Jersey based on the Irish contact tracing app. Retrieved from <https://www.gov.ie/en/press-release/02080-minister-for-health-welcomes-launch-of-contact-tracing-apps-in-new-york-and-new-jersey-based-on-the-irish-contact-tracing-app/>

³⁶ O’Callaghan, M. E., Buckley, J., Fitzgerald, B., Johnson, K., Laffey, J., McNicholas, B., ... Glynn, L. (2020). A national survey of attitudes to COVID-19 digital contact tracing in the Republic of Ireland. *Irish Journal of Medical Science*. <https://doi.org/10.1007/s11845-020-02389-y>

³⁷ GLOBE Project. (2020). Results - Ireland GLOBE Project. GLOBE project. Retrieved from <https://www.globeproject.com/results/countries/IRL?menu=list>; For critiques detailing contradictory measurement systems see: Allik, J., & Realo, A. (2004). Individualism-Collectivism and Social Capital. *Journal of Cross-Cultural Psychology*, 35(1), 29–49. <https://doi.org/10.1177/0022022103260381>

³⁸ Hjelmgaard, K. (2020, April 10). Iceland has tested more of its population for coronavirus than anywhere else. Here's what it learned. *USA Today*. Retrieved from <https://www.usatoday.com/story/news/world/2020/04/10/coronavirus-covid-19-small-nations-iceland-big-data/2959797001/>

³⁹ Johnson, B. (2020, May 11). Nearly 40% of Icelanders are using a covid app—and it hasn’t helped much. MIT Technology Review. Retrieved from <https://www.technologyreview.com/2020/05/11/1001541/iceland-rakning-c19-covid-contact-tracing/>

⁴⁰ Anttiroiko, A. V. Successful Government Responses to the Pandemic: Contextualizing National and Urban Responses to the COVID-19 Outbreak in East and West. *International Journal of E-Planning Research (IJEPR)*, 10(2), 1-17.

such as asking people to “be a strong link in the chain,”⁴¹ once again highlighting the focus on strong social connections and civic responsibility. Interestingly, the South African government also invokes communitarian values in its *COVID Alert SA* app marketing. Yet, sources suggest that South Africans have very low trust beyond their most immediate family and neighbours, particularly if those people/communities are of different cultural or religious backgrounds, speak a different language, or are a part of the LGBTQ2S+ community.⁴² The disconnect between the people’s lack of communitarian values and the government trying to invoke those values likely results in an ineffective communications campaign. Both ineffective messaging and the lack of connection to helping others may be some reasons why uptake has been low in the country.

Beyond cases studied, other aspects of shared community that influence uptake were identified in our research. Complementary potential factors are population size and an island nation’s “powerful sense of community.”⁴³ As mentioned above, Singapore’s *TraceTogether* contact tracing app has roughly 4.2 million downloads of a population of 5.639 million (74% uptake as of February 15 2021).⁴⁴ New Zealand’s contact tracing app called *NZ COVID Tracer* has over 2,591,784 downloads as of February 16 2021.⁴⁵ With a population of 4.886 million, New Zealand’s app has a 53% uptake.⁴⁶ Like Iceland, both countries have smaller populations, are island nations, and their COVID-19 responses have been well received and effective. These attributes may explain high app-uptake.

Another factor that may impact the sense of community is **inequality**. In South Africa, systemic inequality – such as between black and white, rich and poor, amongst others – likely contributes to the lack of trust (see Module 8, Section 8.4.2: Factor 5) and sense of community. Many of these contact tracing apps have highlighted existing health and socio-economic inequalities in various nations, such as Australia,⁴⁷ the UK,⁴⁸ the United States,⁴⁹ amongst others. For instance, in Canada, Katie Crocker, Chief Executive Officer of the Affiliation of Multicultural Societies and Service Agencies of British Columbia, stated that “a pandemic exaggerates the inequities that already exist” alongside “folks who don’t speak English, who are racialized,

⁴¹ Government of Iceland. (2020). Tracing app Rakning C-19. Retrieved from <https://www.covid.is/app/en>

⁴² Moosa, M. (n.d.). South Africa’s Trust Deficit and Covid-19. IJR. Retrieved from <https://www.ijr.org.za/2020/06/30/south-africas-trust-deficit-and-covid-19/>

⁴³ Burholt, V., Scharf, T., & Walsh, K. (2013). Imagery and imaginary of islander identity: Older people and migration in Irish small-island communities. *Journal of Rural Studies*, 31, 1–12. <https://doi.org/10.1016/j.jrurstud.2013.01.007>

⁴⁴ Trace Together. (n.d.b.). TraceTogether, safer together. Retrieved from <https://www.tracetgether.gov.sg/>

⁴⁵ New Zealand Government Ministry of Health. (2021). COVID-19: NZ COVID Tracer app data. Retrieved from <https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-data-and-statistics/covid-19-nz-covid-tracer-app-data>

⁴⁶ Blake-Persen, N. (2020, September 2). 2.1 million download Covid Tracer app, but who is signing in? RNZ. Retrieved from <https://www.rnz.co.nz/national/programmes/checkpoint/audio/2018762292/2-point-1-million-download-covid-tracer-app-but-who-is-signing-in>

⁴⁷ Ladders, A., & Paterson, J. M. (2020). Scrutinising COVIDSafe: Frameworks for evaluating digital contact tracing technologies. *Alternative Law Journal*, 45(3), 1037969X2094826. <https://doi.org/10.1177/1037969x20948262>

⁴⁸ Gann, B. (2020). Combating Digital Health Inequality in the Time of Coronavirus. *Journal of Consumer Health on the Internet*, 24(3), 278–284. <https://doi.org/10.1080/15398285.2020.1791670>

⁴⁹ Toh, A., & Brown, D. (2020, June 4). How Digital Contact Tracing for COVID-19 Could Worsen Inequality. Human Rights Watch. Retrieved from <https://www.hrw.org/news/2020/06/04/how-digital-contact-tracing-covid-19-could-worsen-inequality>

who are working on the front lines, who may not have digital access are being impacted.”⁵⁰ When some communities are included in the development and implementation of the app and some communities are not, it seems as though there is an inevitable degradation of sense of community which can impact uptake.

Other considerations related to a strong or weak sense of community and app-uptake are as follows. First, high communitarian values may imply higher shared trust which can mitigate the perceived risk of stigmatization in the event an app user is infected and potentially identified. Second, communities that prioritize the “stronger together” mentality (as emphasized by Kropotkin)⁵¹ over survival of the fittest (as emphasized by Darwin)⁵² may be more likely to engage in initiatives like COVID-19 D-CT apps that require community collaboration. As argued by Slim (2020), surviving a pandemic is not just about human rights but also human duty, i.e. “we have to give up some of our rights – to freedom of movement, to family life, and to economic entitlements – in order to protect others.”⁵³ For instance, in countries that have been described as having an “individualistic culture” – like the United States – people may be less inclined to help others which may explain the low uptake seen across the country’s many D-CT apps.⁵⁴ In comparison, India – a country that has been described as collectivistic⁵⁵ – has a singular app that has over 160 million downloads.⁵⁶ Despite being only roughly a 12% uptake rate in a country of an estimated 1.353 billion, the sheer amount of downloads is potentially representative of the country’s communitarian values and desire to protect others. Third, communities with high communitarian values may perceive that the risk is lower and benefit is higher with engagement in a contact tracing app and vice versa (there is higher risk and lower benefit to not participating).

7.6. Meso-Macro Analysis

7.6.1. Factor 3: Communications & Misinformation

Communications between media, responders (government, response agencies), and communities/individuals, as well as the management of misinformation around D-CT apps, appear to influence uptake. This factor is considered to exist at the intersection of the community (meso) and system (macro) levels because the nature and spread of information constructed and shared is believed to

⁵⁰ Lum, Z.-A. (2020, August 3). HuffPost Canada: COVID Alert App Is A Glaring Reminder Of Health Inequality In Canada – AMSSA. AMSSA. Retrieved from <https://www.amssa.org/about/media/huffpost-canada-covid-alert-app-is-a-glaring-reminder-of-health-inequality-in-canada/>

⁵¹ Kropotkin, P. A. (1908). *Mutual aid: A factor of evolution*. London: Heinemann.

⁵² University of Cambridge. (n.d.) Survival of the fittest. Retrieved from <https://www.darwinproject.ac.uk/commentary/survival-fittest>

⁵³ Slim, H. (2020, March 18). This age of COVID-19 demands new emergency ethics. *The New Humanitarian*. Retrieved from <https://www.thenewhumanitarian.org/opinion/2020/03/18/coronavirus-pandemic-emergency-ethics>

⁵⁴ Cherry, K. (2020, December 11). How Do Individualistic Cultures Influence Behavior? *Verywell Mind*. Retrieved from <https://www.verywellmind.com/what-are-individualistic-cultures-2795273#:~:text=A%20few%20countries%20that%20are>

⁵⁵ Ibid.

⁵⁶ Hariharan, S. (2020, September 25). Aarogya Setu downloads drops 90% since launch - Times of India. *The Times of India*. Retrieved from <https://timesofindia.indiatimes.com/business/india-business/aarogya-setu-downloads-drops-90-since-launch/articleshow/78304259.cmshttps://timesofindia.indiatimes.com/business/india-business/aarogya-setu-downloads-drops-90-since-launch/articleshow/78304259.cms>

be a product of individual interactions with immediate communities, but also as an external influence coming from broader socio-political systems beyond an individual's immediate network.

Across case studies, three main themes were identified that may explain the link between communications and misinformation and uptake of D-CT apps. The first theme identified within the Communications & Misinformation factor is the **influence of positive and negative narratives**. In Ireland, the DGHH Lab's social media scraping of Twitter⁵⁷ (sampled in October 2020) show that narratives relating to the app were often positive from the individual-driven perspective. People expressed that the *COVID Tracker Ireland* app is a symbol of national pride in comparison to the D-CT app in the United Kingdom. These positive narratives may relate to increased uptake. Scraping also revealed however, that global concerns regarding D-CT apps expressed online are easily spread and eventually reach the local Irish population. Discussion with app developers explained that the mix of narratives built up around the app are not completely understood and that the developers lack the capacity to thoroughly monitor dialogue around the app. These conflicting narratives and the lack of management around the narratives could potentially lead to decreased uptake of the app. Similarly in Scotland, there were both positive and negative narratives being shared by groups with an authoritative presence, who citizens and residents would likely listen to and look towards for accurate information. For instance, the Scottish government alongside the Scottish Police Federation has been promoting use of the app and has been sharing accurate information. Yet, Police Scotland's health and safety group have labeled the app "haphazard, unreliable and inaccurate."⁵⁸ Conflicting messaging and narratives, particularly from bodies of authority (the importance of who is sharing app-related information will be discussed in more detail in the third theme identified below), may result in confusion as to whether people should or should not download and use the app. Referring back to Section 7.5.1, Iceland and Ireland were able to establish positive narratives through their app communications campaigns by invoking pre-existing communitarian values that define their respective societies. Meanwhile, South Africa's government tried to leverage the same communitarian values – which are not strong in the nation – thereby potentially creating a negative narrative (or at the very least a non-persuasive/neutral narrative).

Malicious actors and the spread of misinformation is the second theme that seems to influence user-uptake. In Scotland, app-uptake may have been hindered due to the spread of scams and government warnings about scams and malicious actors associated with their *Protect Scotland* app. The government reported that malicious actors were engaging in cash scams⁵⁹ by impersonating officials representing the country's D-CT app and requesting personal information like passwords, bank details, and medical history.⁶⁰ Banking information was frequently requested in these scams under the pretense that tests were not free of charge.⁶¹ This is an egregious privacy violation and may negatively influence user-uptake.

⁵⁷ Twitter scraping consisted of looking at Twitter posts in October containing six sets of COVID app related keywords

⁵⁸ Morrison, H. (2020). Officers urged to use NHS app-despite senior Police Scotland personnel calling it 'unreliable'. *Glasgow Times*. Retrieved from <https://www.glasgowtimes.co.uk/news/18784386.cops-urged-use-nhs-app---despite-top-cops-calling-unreliable/>

⁵⁹ Coronavirus (COVID-19): Contact Tracing. (2020). NHS Inform. Retrieved from <https://www.nhsinform.scot/illnesses-and-conditions/infections-and-poisoning/coronavirus-covid-19/test-and-protect/coronavirus-covid-19-contact-tracing>

⁶⁰ Scam warning issued after launch of Scottish coronavirus app. (2020). The Orcadian. Retrieved from <https://www.orcadian.co.uk/scam-warning-issued-after-launch-of-scottish-coronavirus-app/>

⁶¹ Contact Tracing Scams. (2020). Trading Standard Scotland. Retrieved from <https://www.tsscot.co.uk/contact-tracing-scams/>

Furthermore, reports also highlighted that the elderly population were most vulnerable to these scams, thereby disproportionately impacting an already vulnerable community. This increased vulnerability may lower uptake from this specific elderly demographic. Similarly in South Africa, misinformation plagued the launch of *COVID Alert SA*. One of the more notable cases was when a famous musician – David Scott from The Kiffness – satirically suggested that the app collects credit card information.⁶² The dissemination of this false information likely contributed to the ongoing lack of trust towards *COVID Alert SA*.

Meanwhile, the third theme identified – **who is communicating contact tracing app information** - is an important theme that can both positively and negatively impact uptake. For instance, in South Africa, the lack of trust in government likely means that, despite consistent, communitarian messaging that highlights the privacy-preserving components of *COVID Alert SA*, the general public may not trust what is being claimed because it is coming from an untrusted source. Contrastingly, as mentioned in above, the fact that Police Scotland’s health and safety group negatively reviewed the app also has a negative impact on app-uptake as citizens and residents may look towards this trusted authority for guidance in complex crises. Meanwhile in Ireland and Iceland, individuals generally trust their government and the messaging has been consistent across these countries and amongst relevant organizations, likely assisting with increased uptake. Similarly, in Scotland, where there seems to be a high level of trust towards the government, malicious scammers leveraged that trust and pretended to be government officials in order to collect people’s personal information. Finally, there must be consideration when celebrities voice their opinions because they can influence their followers’ opinions towards public health measures like a contact tracing app. As mentioned above, a South African celebrity musician satirically stated inaccurate information about the country’s contact tracing app to his thousands of followers. While some citizens and/or residents reported this act of spreading misinformation on a national platform designed to receive such reports, these events also can easily reinforce and instill negative connotations and inaccurate perceptions towards the app for others.

Beyond the cases studied, in the United States, the combination of inaccurate messaging and generally negative narratives relating to COVID-19⁶³ by the country’s president may play a role in why a survey from Avira found that more than 71% of Americans would not download a contact tracing app.⁶⁴ Furthermore, researchers found that the battle to control misinformation is a global phenomenon, with inaccurate information relating to COVID-19 being found in 25 languages in 87 countries.⁶⁵ Our research also found that other communication factors may impact uptake. First, the language used to describe D-CT apps appears to be high priority among public institutions. Over the course of the research, D-CT apps were increasingly re-labelled as exposure notification tools. Canada, for example, is very clear their app is an

⁶² Smith, T. (2020, September 20). OP-ED: Disinformation in a time of Covid-19: Weekly trends in South Africa (W. Bird, Ed.). *Daily Maverick*. Retrieved from <https://www.dailymaverick.co.za/article/2020-09-20-disinformation-in-a-time-of-covid-19-weekly-trends-in-south-africa-10/>

⁶³ United States Congressman Lloyd Doggett. (2021, January 21). Timeline of Trump’s Coronavirus Responses. Retrieved from <https://doggett.house.gov/media-center/blog-posts/timeline-trump-s-coronavirus-responses>

⁶⁴ Cousins, B. (2020, June 18). 4 takeaways from contact tracing apps in other countries. *CTV News*. Retrieved from <https://www.ctvnews.ca/health/coronavirus/4-takeaways-from-contact-tracing-apps-in-other-countries-1.4990497>

⁶⁵ Howard, J. (2020, August 10). Covid-19 misinformation is spreading in 25 different languages, study finds. *CNN*. Retrieved from <https://www.cnn.com/2020/08/10/health/covid-misinformation-spread-study-wellness/index.html>

exposure notification not a contact tracing tool. This reframing of the tools appears to stem from the perception that using the word “tracing” in the branding of D-CT apps created a higher apprehension of being surveilled than the notion of exposure. Second, the laws and policies surrounding communications and misinformation is a particularly interesting factor that can indirectly impact uptake. For instance, South Africa implemented a regulation mandating that businesses remove misinformation and that those spreading misinformation can be prosecuted.⁶⁶ On the one hand, if more accurate information about contact tracing apps is reaching the public and less inaccurate information is being shared, then uptake may increase. Yet, the restrictions being placed on free speech, and other human rights considerations relating to prosecution, may discourage uptake. South Africa is not the only country to take these steps. Hungary and Bolivia for instance, also made it illegal to spread misinformation.⁶⁷ Interestingly, in India, the Prime Minister has demanded that journalists only publish “official” information (i.e. information relayed by the government) regarding COVID-19 and the country’s response.⁶⁸ Once again, these actions may promote accurate information – including information relating to India’s contact tracing app – being shared with the country’s people, yet there are significant concerns that these steps are being taken to ultimately control the press and manipulate the narrative.⁶⁹ Third, as mentioned throughout this section, consistency of messaging also seems to be an important consideration that may impact uptake. Again, using South Africa as an example, the country has had three ‘contact tracing initiatives’ which may result in confusion, frustration, and distrust (particularly because the first initiative was very invasive in terms of data collected. In contrast, Iceland implemented one app early into the pandemic with consistent messaging and app-uptake was relatively high.

7.7. Conclusion

Module 7 provided an overview of the individual (micro) and community (meso) level factors as well as the community-system (meso-macro) level factors identified in our research. The first factor identified was Perceptions of Data Collection & Management, an individual (micro) level factor. Level of trust, extent of user input, extent and nature of data collected, risk of poor data management, and misunderstandings or misinterpretations that exist in relation to privacy were the five main themes identified in relation to the first factor. The second factor identified was Sense of Community, a community (meso) level factor. The main theme associated with this factor was communitarian values. Finally, the third factor identified was Communications & Misinformation, a community-system (meso-macro) level factor. The influence of positive and negative narratives, malicious actors and the spread of misinformation, and who is communicating information were the main factors associated with the third factor. For an overview of the system-level (macro) factors influencing user-uptake, see Module 8.

⁶⁶ COVID-19 South African Online Portal. (2020, March 30). COVID-19 Fake News Reporting. COVID-19 South African Online Portal. Retrieved from <https://sacoronavirus.co.za/2020/03/30/covid-19-fake-news-reporting/>; South African Government. (n.d.). Fake news - Coronavirus COVID-19 | South African Government. Republic of South Africa. Retrieved from <https://www.gov.za/covid-19/resources/fake-news-coronavirus-covid-19>

⁶⁷ Walker, S. (2020, April 3). Hungarian journalists fear coronavirus law may be used to jail them. *The Guardian*. Retrieved from <https://www.theguardian.com/world/2020/apr/03/hungarian-journalists-fear-coronavirus-law-may-be-used-to-jail-them>

⁶⁸ Goel, V., Gettleman, J., & Khandelwal, S. (2020, April 2). Under Modi, India’s Press Is Not So Free Anymore. *The New York Times*. Retrieved from <https://www.nytimes.com/2020/04/02/world/asia/modi-india-press-media.html>

⁶⁹ Ibid.