



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 5.

Case Study. Scotland

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5.1. Study Overview

5.1.1 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 some of the highest rates of the 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/>

5.1.2 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 Bronfennbrenner's ecological systems theory to identify varied contextual factors that influence uptake (through a risk-benefit lens).³ Bronfennbrenner'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 5.1.4 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.

5.1.3 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.

5.1.4 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

5.2. Module Overview

This module aims to explore Digital Contact Tracing (D-CT) developed and implemented in Scotland for the COVID-19 response. Focus is on their D-CT app, *Protect Scotland*, 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 Scotland'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.

5.3. Case Study

5.3.1. COVID-19 in Scotland

The first case of COVID-19 was confirmed on 1 March 2020⁴ and as of 9 February 2021, the total number of positive COVID-19 cases is 187,542 people with 6,501 deaths.⁵ On 13 October 2020, during the daily national COVID-19 updates, First Minister Nicola Sturgeon urged caution as a second wave of COVID-19 cases swept across Europe and cases began to rise again.⁶ During this time, Scotland was seeing a rise in positive cases among younger individuals aged 15 to 24.⁷ While case numbers decreased in mid-November, there was a spike of cases at the end of December 2020 and early January 2021.⁸ Currently cases are on a downward trajectory.⁹ Levels of restrictions vary across council areas and currently vary from Level 1 to Level 3; no areas are currently in Level 4 or 5 – the most restrictive levels.¹⁰

In response to the pandemic the Scottish government and the country's Ministry of Health, NHS Scotland, launched an initiative called Test and Protect. Test and Protect aims to prevent community spread through vigorous manual contact tracing, public education about risk and prevention as well as supporting those who are asked to self-isolate.¹¹ Part of this campaign was the release of the exposure notification app *Protect Scotland*.

⁴ Mcsherry, M. (2020). Coronavirus: First Case is Confirmed in Scotland. Scottish Financial Review. Retrieved from <https://scottishfinancialreview.com/2020/03/01/coronavirus-first-case-is-confirmed-in-scotland/>

⁵ Google News. (2021). Coronavirus (Covid-19): Scotland. Retrieved from <https://news.google.com/covid19/map?hl=en-CA&mid=%2Fm%2F06q1r&gl=CA&ceid=CA%3Aen>

⁶ Scottish Government. (2020, October 13). Coronavirus (Covid-19) update: First Minister's speech 13 October 2020. Scottish Government. Retrieved from <https://www.gov.scot/publications/coronavirus-covid-19-update-first-ministers-speech-13-october-2020/>

⁷ Sleight, C. (2020). Covid-19 in Scotland: Five numbers to watch. BBC News. Retrieved from <https://www.bbc.com/news/uk-scotland-54535938>

⁸ Google News. (2021). Coronavirus (Covid-19): Scotland. Retrieved from <https://news.google.com/covid19/map?hl=en-CA&mid=%2Fm%2F06q1r&gl=CA&ceid=CA%3Aen>

⁹ Ibid.

¹⁰ Scottish Government. (2020, November 10). Changes to COVID-19 protection levels. Scottish Government. Retrieved from <https://www.gov.scot/news/changes-to-covid-19-protection-levels/>

¹¹ Test and Protect. (2020a). NHS Inform. Retrieved from <https://www.nhsinform.scot/campaigns/test-and-protect>

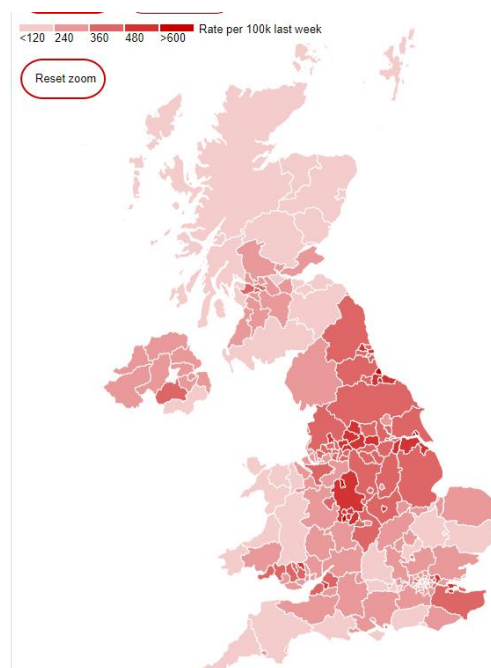


Figure 5.1.0. A heat map of COVID-19 Cases in the UK, by region¹² as of November 23rd 2020

5.3.2. Evolution of the Digital Contact Tracing App

The *Protect Scotland* app was launched on 10 September 2020¹³ as an additional safeguard to curve the spread of COVID-19.¹⁴ Key organizations involved in developing and implementing the GAEN-based app include: the Scottish Government (collects and controls app data), Public Health Scotland (determines app's effectiveness), NES Digital Service, an organization set up by the Scottish government to aid in Scotland's digital health and care strategy¹⁵ (data processor and provides Amazon Web Services cloud account), NearForm (Developer), Amazon Web Services, NHS National Services Scotland (operate case management), and Gov.UK which is the UK Government.¹⁶

Although Scotland was initially working with the NHS England's digital contact tracing team, they announced on 31 July 2020 that they would be developing their own app based on Ireland's Bluetooth-based exposure notification system app.¹⁷ This change in strategy was in part due to England's centralised model which raised privacy concerns.¹⁸

¹² Covid cases and deaths today: coronavirus UK map. (2020). *The Guardian*. Retrieved from <https://www.theguardian.com/world/2021/jan/20/coronavirus-uk-covid-cases-deaths-vaccinations-today>

¹³ Scottish Government. (2020a). *Protect Scotland App Launches*. Retrieved from <https://www.gov.scot/news/protect-scotland-app-launches/#:~:text=Test%20and%20Protect%20was%20rolled%20out%20across%20Scotland%20on%2028%20May%202020>

¹⁴ Protect Scotland. (2020a). *Protect Scotland*. Retrieved from <https://protect.scot/>

¹⁵ Digital Scotland. (2020). *The NES Digital Service- A Platform approach for building a unified digital health and care service for Scotland*. *Digital Scotland*. Retrieved from <https://digitalscot.net/national-digital-platform/>

¹⁶ Protect Scotland. (2020b). *How we use your data*. Retrieved from <https://protect.scot/how-we-use-your-data#scotgov>

¹⁷ Wise, J. (2020). Covid-19: Scotland launches contact tracing app with England and Wales to follow. *BMJ*, (8260), m3566. <https://doi.org/10.1136/bmj.m3566>

¹⁸ Lomas, N. (2020). England's long-delayed COVID-19 contacts-tracing app to launch on September 24. *Tech Crunch*. Retrieved from <https://techcrunch.com/2020/09/11/englands-long-delayed-covid-19-contacts-tracing-app-to-launch-on-september-24/>

QR codes are another digital tool being leveraged in some locations across Scotland as a means to aid in contact tracing, although this is not via the *Protect Scotland* app.¹⁹ These QR codes are a part of the Test and Protect initiative however, as a tool businesses can use to ensure customer information is collected for public health purposes securely.²⁰ For example, the University of Stirling²¹ and the University of St. Andrews²² are using QR codes to track who has entered certain buildings and teaching facilities on campus. There also are plans to begin trials of a health passport with passengers traveling from the UK to the US.²³

5.3.3. How the app works/design

Table 5.1.0: *Protect Scotland* Details

	Scotland
Name of the App	Protect Scotland
Developer(s)	<ul style="list-style-type: none"> ❖ Nearform ❖ NHS Scotland
Decentralized or Centralized Data Collection	Decentralized
Bluetooth, GPS, Both, Other	Bluetooth
Type of App: GAEN or Other	Google Apple Exposure Notification API
Mobile Requirements: e.g. iOS, Android, version	iOS 13 and up Android 6.0 and up Mobile phones must be 2015 or newer
Alternate functionality?	N/A
Data Collected (Voluntarily) By App	<ul style="list-style-type: none"> ❖ Mobile number ❖ Estimated date of infection ❖ Authorization code that they receive if they receive a positive diagnosis ❖ IP address ❖ Diagnosis keys that are randomized ID codes from the devices of other people a user has come into contact with ❖ Confirmation of app use²⁴
Data Collected (Voluntarily) By Government	<ul style="list-style-type: none"> ❖ Confirmation of app use ❖ Metric data on the number of people

¹⁹ Test and Protect. (2020b). Dundee and Angus Chamber of Commerce. Retrieved from https://www.dundeeandanguschamber.co.uk/203_TestProtect.html

²⁰ Scottish Government. (2020b). Protect Scotland App Launches. Retrieved from <https://www.gov.scot/news/protect-scotland-app-launches/#:~:text=Test%20and%20Protect%20was%20rolled%20out%20across%20Scotland%20on%2028%20May%202020>

²¹ University of Stirling. (2020). Check in to buildings, locations and teaching rooms. Retrieved from <https://www.stir.ac.uk/coronavirus/changes-at-stirling-for-2020/making-campus-safer/scan-in-to-buildings-on-arrival/>

²² University of St. Andrews. (2020). Current students. Retrieved from <https://www.st-andrews.ac.uk/coronavirus/students/>

²³ Staines, R. (2020). UK trials digital "health passport" to help borders reopen. Pharmaphorum. Retrieved from <https://pharmaphorum.com/news/uk-trials-digital-health-passport-to-help-borders-reopen/>

²⁴ Protect Scotland. (2020c). How we use your data. Retrieved from <https://protect.scot/how-we-use-your-data#nhs-nss>

	infected
❖	Metric data on the number of people who downloaded the app
Data Collection permission	Voluntary
Data Deletion period	72 hours for submitted data to Gov.UK 14 days for diagnostic keys (on mobile phone)

Protect Scotland is a decentralized, Bluetooth-based exposure notification app built by Nearform and NHS Scotland off of the Google Apple Exposure Notification API (GAEN API).²⁵ It is a privacy-preserving app that securely collects user mobile information, date of infection, positive diagnosis code, IP addresses, and diagnostic keys from other devices the user has come into contact with.²⁶ The user agrees to share this information with the app and the government when the app's terms and conditions are accepted prior to active tracing. The user also can consent to sharing the approximate date of infection and the user's positive COVID-19 diagnosis by uploading the code the user receives from the NHS. NHS Scotland collects metric data to create reports on the efficiency and trends in regards to app usage and COVID-19 in conjunction with the data collected from Test and Protect.²⁷ The data uploaded to the government is kept for 72 hours whereas data on the phone is deleted after 14 days.²⁸ It can be voluntarily downloaded but users must have iOS 13 and up or Android 6.0 and up.²⁹ The app has no alternate functionality.

5.3.3.1. The App Engagement Process

Phase One: Downloading and Setup

The *Protect Scotland* app can be downloaded from Google Play and the Apple Store. After the download process is complete, the app verifies if the user is over the age of 16 and living in Scotland. *Protect Scotland* then displays information about the benefits of using the app, how the app works, how user privacy is protected, and the app's privacy notice. Finally the app is ready to use after the user accepts the app's terms and conditions.

²⁵ Wise, J. (2020). Covid-19: Scotland launches contact tracing app with England and Wales to follow. *BMJ*, (8260), m3566. <https://doi.org/10.1136/bmj.m3566>

²⁶ Protect Scotland. (2020d). Privacy Notice for the Protect Scotland app. Retrieved from <https://protect.scot/privacy-policy-app>

²⁷ Protect Scotland. (2020e). Terms & Conditions for the Protect-Scotland app. Retrieved from <https://protect.scot/terms-and-conditions>

²⁸ Protect Scotland. (2020f). How we use your data. Retrieved from <https://protect.scot/how-we-use-your-data#scotgov>

²⁹ Frequently asked questions. (2020). Protect Scotland. Retrieved from <https://protect.scot/faq>

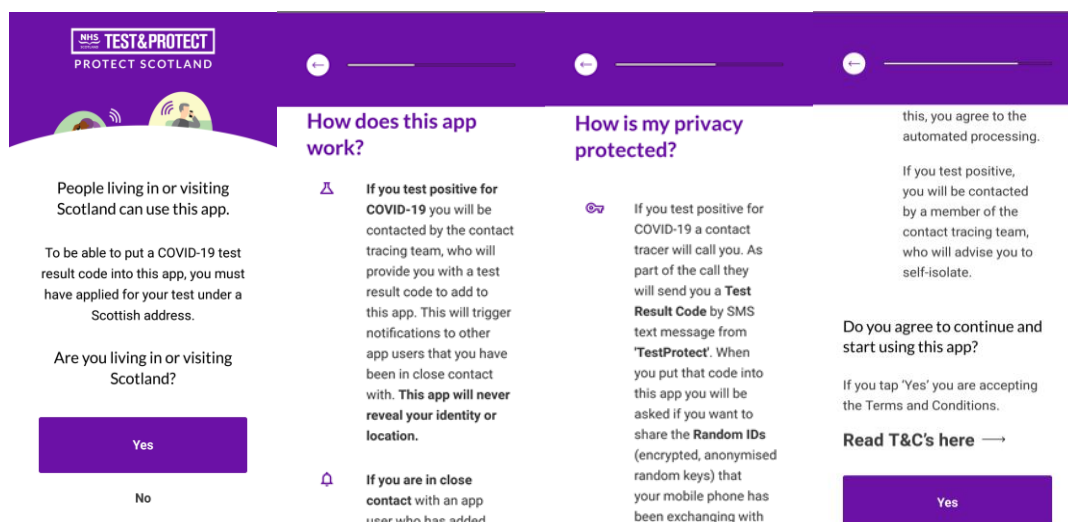


Figure 5.2.0. Screenshots of *Protect Scotland* when User is First Activating the App.³⁰

Phase Two: Usage

In order to begin active tracing, the app requires Bluetooth to be enabled. Permission to trace is included in the terms and conditions and can be stopped according to the user's discretion by turning off the user's phone, disabling the exposure notification option in your phone's settings, or disabling Bluetooth.³¹ The image on the left in Figure 5.4.0 depicts what a user's screen will display once tracing is active.

Phase Three: Reporting

If the user has tested positive, they will receive a code from NHS's Test and Protect via "text, email or phone" outside of the *Protect Scotland* app,³² which they can enter into the app under 'Add Test Result.' This process allows the user to voluntarily agree to share their positive COVID-19 result as well as the approximate date of infection. The app will then anonymously inform the user's close contacts (who also have the app) that they have been exposed to COVID-19.³³

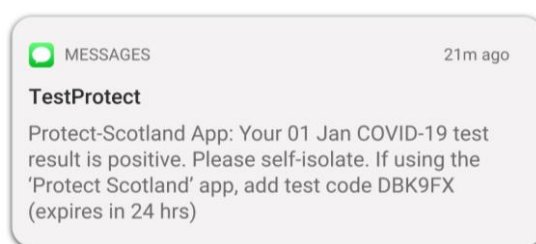


Figure 5.3.0. Example Text Message from Test and Protect Informing a User they have Tested Positive for COVID-19 and Next Steps To Take.³⁴

³⁰Google Play. (2020). Protect Scotland (1.04). NHS Education for Scotland.

https://play.google.com/store/apps/details?id=gov.scot.covidtracker&hl=en_GB

³¹ Protect Scotland. (2020g). Frequently asked questions. Retrieved from <https://protect.scot/faq>

³² Protect Scotland. (2020h). How it works. Retrieved from <https://protect.scot/how-it-works>

³³ Ibid.

³⁴ Ibid.

Part Four: Reacting

When a user has come into close contact with someone who has tested positive, they receive a notification on their mobile phone's locked screen as shown below. The user can then open up the app and will be met with recommendations on what to do next which can include getting tested if showing symptoms or begin self-isolating. The center and right images shown in Figure 4 depicts the user's lock screen requires action as they have come into contact with a positive user as well as how the app looks if a user has been in close contact with a positive individual.

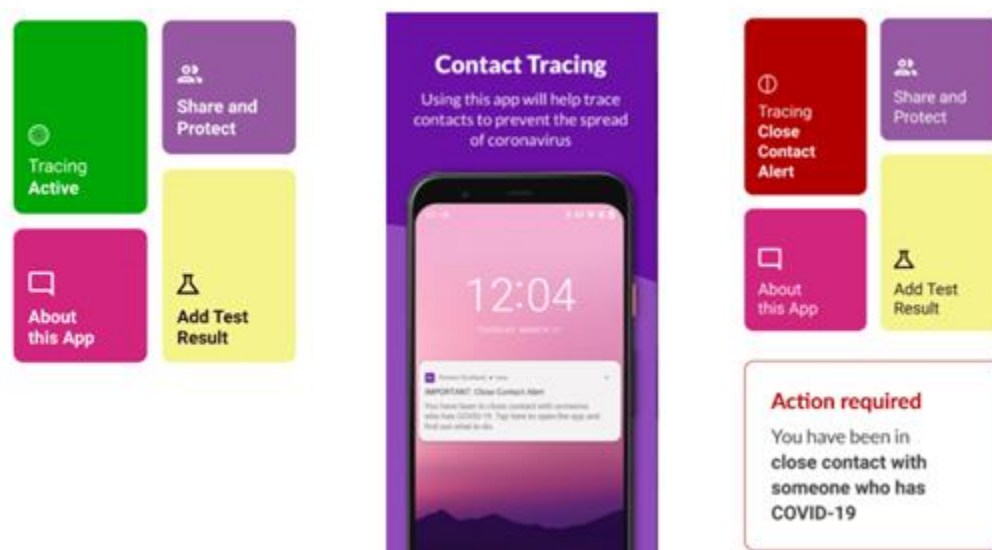


Figure 5.4.0. (Left) *Protect Scotland* when the app is active and tracing (Phase 3). (Center) A *Protect Scotland* Notification on a User's Lock Screen Indicating Action is Required Because the User has been Exposed to COVID-19 (Phase Four). (Right) *Protect Scotland* Indicating Action is Required Because the User has been Exposed to COVID-19 (Phase 4).³⁵

³⁵ Protect Scotland. (2020i). Google Play. Retrieved from https://play.google.com/store/apps/details?id=gov.scot.covidtracker&hl=en_GB; Protect Scotland. (2020j). Frequently asked questions. Retrieved from <https://protect.scot/faq>

5.3.4. App-Uptake

5.3.4.1. Uptake Summary

Table 5.2.0: *Protect Scotland* Uptake Summary

	Scotland
Uptake (#downloads)	~1,500,000 ³⁶
Uptake (active users)	Data could not be found
General Uptake (# of downloads / general population)	~27.5%
Age Appropriate Uptake (# of downloads / people over age allowed to download)	~ 33% ³⁷
Digital Uptake (# of downloads / connected population)	~48.25%
Digital Capability Uptake (# of downloads / app-compatible population)	~27.5%

5.3.4.2. Uptake Description

With over 1.5 million downloads, about 27.5% of the entire Scottish population (5,454,000 million) has downloaded the app. Yet, it is important to consider that only users above the age of consent, 16, can use the app which means 33% of the eligible Scottish population (4, 526,820 people)³⁸ have downloaded the app. In terms of uptake within the connected population, in 2017, 57% of individuals used the internet through a mobile phone which could suggest that there is an uptake percentage of 48.25% amongst the connected population.³⁹ It is challenging to determine the number of app-compatible smartphones due to lack of data on residents who have iOS 13.0 and up or Android 6.0 and up. Furthermore, with available data only representing the mobile operating system market share in the United Kingdom, rather than in Scotland specifically, it further complicates estimating app-compatible smartphones. Although if one was to assume that, like the UK, 99.79% of the Scottish population was using Android or iOS operating systems, that could mean that 27.5% of users with app compatible smartphones have downloaded the app. It is important to note that, as mentioned in Module 1, Section 1.5, there are significant issues with determining app success via uptake percentages.

³⁶ Scottish Government. (2020c). Coronavirus (COVID-19): Scotland's Strategic Framework. Retrieved from <https://www.gov.scot/publications/covid-19-scotlands-strategic-framework/pages/4/>

³⁷ Swindon, P. (2020). 5,000 told to self-isolate by Scots app since launch as creators quash fears over privacy. *The Sunday Post*. Retrieved from <https://www.sundaypost.com/fp/5000-told-to-self-isolate-by-scots-app-since-launch-as-creators-quash-fears-over-privacy/>

³⁸ Ibid.

³⁹ Office of Communications. (2016). The Communications Market: Internet and online content. Retrieved from https://www.ofcom.org.uk/_data/assets/pdf_file/0013/105142/scotland-internet-online.pdf

5.4. Uptake Factors

5.4.1. Summary of Uptake Factors

Table 5.3.0: Summary of Uptake Factors in Scotland

Factor	Micro, Meso, and/or Macro	Brief Description
Perceptions of Data Collection & Management	Micro	From misuse of physical data at Scottish bars and restaurants to preconceived notions about data privacy, surrounding Amazon Web Services involvement in the app for instance, people's perceptions surrounding data collected and managed via the app may positively or negatively impact uptake.
Communications & Misinformation	Meso-Macro	Malicious actors are scamming residents and potentially decreasing uptake of the app yet adequate action by the government and other organizations may be an incentive to download the app. Alternatively, varied messaging may cause confusion or lack of trust relating to the app, thereby becoming a barrier to uptake.
Accessibility & Inclusion	Macro	While forcing university students to download the app may initially increase uptake amongst this population, it can lead to discrimination of this population. The associated legal and ethical concerns may also further lead to decreased uptake more broadly.
Trust in Public/ Private Institutions	Macro	While trust in the government is high in Scotland and the government is taking action to continually increase that trust, particularly in relation to the <i>Protect Scotland</i> app, the sharing of Test and Protect data with police has caused fear of discrimination and decreased trust amongst police authorities, potentially creating a barrier to uptake.
Digital Capability	Macro	The <i>Protect Scotland</i> app is now interoperable throughout the UK and can be used on trains and planes for commuters. This interoperability and increased digital capability has potentially minimized some barriers to accessing and using the app.

5.4.2. Factor Descriptions

5.4.2.1. Perceptions of Data Collection & Management

In Scotland, ensuring data is protected and privacy is upheld is of utmost importance to Scottish people, especially in a digital context. Yet, due to some measures put in place for the COVID-19 pandemic, some situations arise that may increase the risk of privacy breaches. For instance, people in Scotland are still required to sign in with hospitality services like restaurants and pubs even if they have *Protect Scotland*.⁴⁰ Yet, some individuals are misusing physically collected personal information at bars and other hospitality venues meant to be used to aid physical contact tracing efforts and to be given to the NHS as part of Test and Protect. Many women are claiming they have received “creepy” texts from men where they had left

⁴⁰ Protect Scotland. (2020k). Frequently asked questions. Retrieved from <https://protect.scot/faq>

their personal information.⁴¹ Incidents such as this may be affecting the confidence these women have in the privacy and security of the physical information collected for Test and Protect. Whether this incentivizes or disincentivizes these women to download and use the app remains to be seen. On the one hand, anonymous data collected electronically may be perceived as more secure than physical data. Alternatively, the digital collection of data has its own set of risks (perceived or real).

For instance, some individuals perceive that there are privacy risks due to Amazon collecting personal information from users.⁴² According to an article by FutureScot, some encrypted data is received by an Amazon Web Services cloud account which is owned by NHS Education for Scotland.⁴³ Yet, this data cannot be linked to someone's personal information. Furthermore, the Scottish Government assures that the data collection "complies to all NHS Scotland and GDPR (General Data Protection Regulation) data standards....Users' mobile number, test code (and the relevant date) and IP address are not stored by the app and they are not made visible by the app to anyone, including AWS."⁴⁴ Despite the government reiterating *Protect Scotland's* privacy-centric approach, people's perceptions surrounding privacy risks may not reflect reality, negatively influencing a user's willingness to download the app.

5.4.2.2. Communications & Misinformation

Misinformation surrounding the app may dissuade residents from using the app and as reported by the Government of Scotland, there have been reports of cash scams and malicious actors relating to the app.⁴⁵ These actors have been requesting personal information like passwords, bank details, and medical history from users, claiming this information was needed to access the app.⁴⁶ Other malicious actors claimed that COVID-19 tests were not free of charge and therefore banking information was needed.⁴⁷ In reaction to these scams, NHS Scotland has stressed that they will only use one national number (0800 030 8012) should they contact users who have tested positive. NHS Scotland also has reiterated that they will never ask for personal information during these calls.⁴⁸ This information is especially relevant to targeted populations who are more at risk to be targeted for cash scams like the elderly. These scams, and the subsequent response from the government and other organizations such as Age Scotland,⁴⁹ may positively or negatively influence residents' willingness to download the app. On the one hand, the country's residents may be more willing to download and use the app if they feel as if the proper

⁴¹ 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/>

⁴² 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/>

⁴³ O'Sullivan, K. (2020). 'We can't even see your data', government insists, after contact tracing app privacy fears. *FutureScot*. Retrieved from <https://futurescot.com/we-cant-even-see-your-data-government-insists-after-contact-tracing-app-privacy-fears/>

⁴⁴ Ibid.

⁴⁵ NHS Inform. (2020a). Coronavirus (COVID-19): Contact Tracing. Retrieved from <https://www.nhsinform.scot/illnesses-and-conditions/infections-and-poisoning/coronavirus-covid-19/test-and-protect/coronavirus-covid-19-contact-tracing>

⁴⁶ 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/>

⁴⁷ Trading Standard Scotland. (2020). Contact Tracing Scams. Retrieved from <https://www.tsscot.co.uk/contact-tracing-scams/>

⁴⁸ NHS Inform. (2020b). Coronavirus (COVID-19): Contact Tracing. Retrieved from <https://www.nhsinform.scot/illnesses-and-conditions/infections-and-poisoning/coronavirus-covid-19/test-and-protect/coronavirus-covid-19-contact-tracing>

⁴⁹ 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/>

measures are being taken to prevent scams. Alternatively, residents may feel less inclined to use the app if they feel like they are at increased risk of scams, such as the elderly.

Alongside malicious actors, there also has been some misinformation and inconsistent messaging relating to the app, specifically from police authorities. While the Scottish Police Federation has encouraged the use of the *Protect Scotland* app, senior personnel in Police Scotland's health and safety group have allegedly labeled the app as "haphazard, unreliable and inaccurate."⁵⁰ Such conflicting messaging may cause confusion amongst residents who are looking for guidance as to what steps to take to mitigate the spread of the disease. Furthermore, when messages come from a seemingly trustworthy body, the trust people have in the app may start to decrease. In both cases, users may be deterred from committing to downloading and using the app as a result of poor, inconsistent communications.

5.4.2.3. Accessibility & Inclusion

Protect Scotland's accessibility refers to the ease and accommodations the app has in place to ensure as many Scottish people as possible are downloading and using the app. Due to the recent spike in cases among university aged students and outbreaks in at least 11 universities in Scotland, Universities Scotland, an organization that acts as "the representative body of Scotland's 19 higher education institutions"⁵¹ says that they will require students to download the *Protect Scotland* app. The First Minister insisted it is not mandatory for students to download the app but universities say they will "take a strict 'Yellow Card/Red Card' approach to breaches of student discipline."⁵² Richard Leonard, the leader of the Scottish Labour Party claims the downloading requirement should be questioned, saying "students [are] being required to download test and protect app-unlike any other group in society."⁵³ He also lists the severity of the enforcement of these new measures as one of his seven areas of concern and has asked the Scottish Human Rights Commission to look into possible violations of student's human rights.⁵⁴ Although the uptake among the student population will increase as a result of this mandate, having one part of the population download the app could lead to discrimination as no other age group is required to download the app or face repercussions. Furthermore, forcing downloads also could potentially violate ethical or legal principles which may ultimately, in the long run and for the wider non-student community, result in lower uptake.

5.4.2.4. Trust in Public/Private Institutions

For high uptake and proper usage of digital contact tracing apps, it is paramount for users to have a high level of trust in governing bodies, those involved with developing and promoting the app, as well as those who collect and store data. It was reported that Police Scotland may have access to Test and Protect data and mentions that the First Minister is being warned by scientists that the involvement of Police Scotland

⁵⁰ 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/>

⁵¹ Universities Scotland. (2020a). The voice of Scotland's universities. Retrieved from <https://www.universities-scotland.ac.uk>

⁵² Universities Scotland. (2020b). Preventing spread of coronavirus in universities. Retrieved from <https://www.universities-scotland.ac.uk/preventing-spread-of-coronavirus-in-universities/>

⁵³ Kersley, A. (2020). Scottish Labour: Covid inquiry in Scotland must investigate university chaos. Labour List. Retrieved from <https://labourlist.org/2020/10/scottish-labour-says-covid-inquiry-must-investigate-university-chaos/>

⁵⁴ Ibid.

in having this personal information may lead to less people getting tested for COVID-19 for fear of being fined by police if they violated safety measures.⁵⁵ According to the article, data can be shared “with police and other organizations that demonstrate an undefined ‘legitimate reason’ to access the data such as levying fines.”⁵⁶ The First Minister commented that “The NHS is not routinely sharing Test and Protect data with Police Scotland” but that the collected information by Test and Protect can be viewed by police on a “case by case basis.”⁵⁷ It is reasonable to suggest that the fear and potential decreased trust surrounding the police in relation to their involvement with Test and Protect data may expand to concerns about *Protect Scotland*. In other words, since *Protect Scotland* is a component of the larger Test and Protect initiative, if residents are concerned about the larger initiative due to lack of trust and fear, they may similarly have those concerns surrounding *Protect Scotland*, thereby creating a disincentive to downloading the app.

While the paragraph above describes the context in which users’ trust may be hindered, the government is trying to increase trust by being transparent and releasing an interim report relating to *Protect Scotland*. The report highlights the improvements and gaps the government would like to address as well as a phased plan on how to improve the app’s uptake.⁵⁸ Trust in the Scottish government and health authorities is generally very high as satisfaction with how NHS Scotland is operated is about 65% of the Scottish population.⁵⁹ Yet by increasing transparency of areas for improvement, and what steps are being taken to increase uptake, the general public may have increased trust towards the government. This may positively impact uptake, or at the very least neutralize the negative impacts arising from the fear and distrust surrounding police authorities in relation to the app.

5.4.2.5. Digital Capability

The digital capability of the *Protect Scotland* app aims to ensure the app is technologically accessible to as many people as possible both in Scotland and those that visit the country. There has been mention in the literature of the desire to create an exposure notification app that would work across borders in the UK.⁶⁰ Progress seems to be in the works as *Protect Scotland* is now compatible with other tracing apps in the Island of Jersey, Northern Ireland, England, and Wales. This means that as long as the *Protect Scotland* app is kept active, users will not have to download any other app or change any settings if they travel to one of these states; their device will connect to the apps associated with *Jersey COVID Alert*, *StopCOVID NI*, and *NHS COVID-19* app which are the respective apps of Jersey, Northern Ireland, and England and

⁵⁵ McLaughlin, M. (2020). Coronavirus: Police must be kept out of trace system, Sturgeon is warned. *The Sunday Times*. Retrieved from <https://www.thetimes.co.uk/edition/scotland/coronavirus-police-must-be-kept-out-of-trace-system-sturgeon-is-warned-09wzw5wdh>

⁵⁶ Ibid.

⁵⁷ McCall, C. (2020). Police Scotland ‘can access Test and Protect details’ but can’t use it to enforce self-isolation. *Daily Record*. Retrieved from <https://www.dailyrecord.co.uk/news/politics/police-scotland-can-access-test-22871031>

⁵⁸ Digital Health & Care Scotland. (2020). Interim National Equality Impact Assessment Protect Scotland App. Retrieved from <https://www.protect.scot/resources/docs/EQIA-17-september-2020.pdf>

⁵⁹ Scottish Government. (2020d). Survey shows high levels of trust in Scottish Government. Retrieved from <https://www.gov.scot/news/survey-shows-high-levels-of-trust-in-scottish-government/>

⁶⁰ Hamilton, M. (2020). Covid-19: Test and trace app incapacity angers cross-border residents. *BBC News*. Retrieved from <https://www.bbc.com/news/uk-england-54384743>

Wales.⁶¹ This compatibility is beneficial to travelers as well as essential workers who cross borders for work purposes. Another feature is that the app can work underground and on planes. This would mean the app is still active in subway stations and on moving subway trains, benefiting commuters and expanding the amount of locations where users can continue contact tracing.⁶² By increasing the compatibility of the *Protect Scotland* app, the number of users are now extended to travelers and workers in Jersey, Northern Ireland, England and Wales, which may increase both uptake and may improve the people's willingness to download the app as they would only have to download one app instead of multiple when crossing borders.

5.5. Conclusion

The *Protect Scotland* app is a privacy-centric, decentralized exposure notification app that has been released in an effort to slow the spread of community transmission of COVID-19 in Scotland. The app has currently been downloaded by 1.5 million users since its release on 10 September 2020. The factors that have been identified above highlight both positive and negative influences that will affect the app's uptake. Perceptions of data collection & management, impacted by experiences (such as women receiving unwanted texts) and beliefs (regarding Amazon Web Services' involvement in data collection, for instance) create both barriers and incentives for app-uptake. Elements of communication & misinformation include cash scams and mixed messaging which could hinder or help uptake. Considerations of accessibility & inclusion are especially relevant in the context of university aged students who are allegedly required to download the app. Although uptake may increase with mandatory downloads, trust in authorities may decrease due to associated ethical and legal violations, thereby negatively impacting uptake. Other factors that affect trust include the release of the Interim report which strived to transparently highlight the government's findings about the *Protect Scotland* app, incentivizes users to download the app as it increases government transparency. Finally, from people from other countries being able to use their own country's app due to expanding interoperability to Scotland's commuters being able to use the app on planes and trains, the app's digital capabilities have potentially influenced app-uptake amongst various populations.

⁶¹ Scottish Government. (2020e). Protect Scotland app compatible with tracing apps in Northern Ireland and Jersey. Retrieved from <https://www.gov.scot/news/protect-scotland-app-compatible-with-tracing-apps-in-northern-ireland-and-jersey/>

⁶² Fraser, G. (2020). In context: Protect Scotland app. *Holyrood*. Retrieved from <https://www.holyrood.com/inside-politics/view.in-context-protect-scotland>