CONTACT TRACING

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I. INTRODUCTION

In 2020, the Severe Acute Respiratory Syndrome Coronavirus 2 (COVID-19) outbreak was declared a global pandemic, requiring unprecedented government intervention to contain the spread of this highly-contagious and sometimes deadly virus.[1] One of the primary methods for containment of COVID-19 was contact tracing, whose success depends upon aggressive deployment.[2] This technology explainer will analyze the traditional contact tracing method and the supplementary technologies to contact tracing, especially as deployed for the COVID-19 pandemic.

II. BACKGROUND OF CONTACT TRACING

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[1] *See* Isobel Braithwaite et al., *Automated and Partly Automated Contact Tracing: A Systematic Review to Inform the Control of COVID-19*, 2 LANCET DIG. HEALTH e607 (Aug. 19, 2020), https://www.thelancet.com/action/showPdf?pii=S2589-7500%2820%2930184-9 [https://perma.cc/NTT7-WX8L]. *See generally* Vinceti et al., *infra* note 46.

[2] *See id.* at e607; *see also* Graham Mooney, *"A Menace to the Public Health"—Contact Tracing and the Limits of Persuasion*, 383 NEW ENG. J. MED. 1806, 1806-08 (Sept. 2, 2020), https://www.nejm.org/doi/full/10.1056/NEJMp2021887 [https://perma.cc/V2NA-CPQD].

Contact tracing is a process to control the spread of an infectious disease and identify people exposed to the disease.[3] In the 19th century, sanitary inspectors in the United Kingdom employed a method of "test, track, and trace" to locate and contain infectious outbreaks.[4] Today, this practice is known as contact tracing.[5] The first step of contact tracing is using diagnostic *testing* to confirm an individual is infected.[6] Following a confirmed diagnosis, the next step is to *track* the infected individual and the people with whom they have been in contact.[7] Tracking depends on numerous factors, including how the disease is transmitted, the transmission period's duration, and public health officials' capabilities.[8] Finally, *trace* occurs with locating the infected individual's contacts to find other potentially infected individuals.[9] Like tracking, tracing depends upon several factors such as the rate of disease transmission and the ability to locate contacts.[10] In turn, every infected person goes through the "test, track, and trace" process.[11]

For diseases such as COVID-19, contact tracing "breaks the chains of transmission" by identifying potential exposure, quarantine of disease-spreaders, notification allowing for preventative self-isolation, and testing and treatment for symptomatic individuals.[12] In doing so, the goal is to keep "the number of new cases generated by each confirmed case . . . below one."[13] Achieving this goal requires contact tracing to involve "community engagement and public support; careful planning and consideration of local contexts, communities, and cultures; a workforce of trained contact tracers and supervisors; logistics support to contact tracing teams; and well-designed information systems to collect, manage, and analyze data in real-time."[14]

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[3] Yi-Da Chen et al., *Incorporating Geographical Contacts into Social Network Analysis for Contact Tracing in Epidemiology: A Study on Taiwan SARS Data*, *in* 4506 LECTURE NOTES IN COMPUTER SCIENCE, INTELLIGENCE & SECURITY INFORMATICS: BIOSURVEILLANCE 23, 23-24 (Springer, 2007), [https://perma.cc/M7Z4-4YRB].
[4] *See* Mooney, *supra* note 2, at 1806-07.
[5] *See id.* at 1806-08.
[6] *See generally* Braithwaite et al., *supra* note 1.
[7] *See generally Contact Tracing in the Context of COVID-19: Interim Guidance*, WORLD HEALTH ORGANIZATION [WHO] (May 10, 2020), https://apps.who.int/iris/rest/bitstreams/1277571/retrieve [https://perma.cc/H4NE-5FRF] [hereinafter WHO Interim Guidance].
[8] *Id.*
[9] *Id.*
[10] *Id.*
[11] *Id.*
[12] *Id.* at 1.
[13] *See* WHO Interim Guidance, *supra* note 7, at 1.
[14] *See id.*

Contact tracing is a studied and proven public health measure that reduces disease transmission.[15] The emergence of COVID-19 has introduced new and developing technologies to facilitate contact tracing practices.[16] This technology explainer examines contact tracing (1) as traditionally deployed and (2) as supplemented by digital contact tracing tool(s) (DCTT(s)).

III. MANUAL CONTACT TRACING

Implementing any form of contact tracing necessitates public health officials' access to individuals and whole community's health information.[17] This information is typically under public health officials' direct discretion, with disease-related data collected from individuals, healthcare providers, and technology.[18] To effectively conduct contact tracing, public health officials depend upon community compliance with public health measures, as well as communal resources, like funding and proper training of public health employees.[19]

Public health officials that perform the process of manual contact tracing, "contact tracers," collect, transmit, and manage data on disease transmission.[20] The central feature of manual contact tracing is an interview of the infected individual, where both "accurate and reliable" disclosure is necessary to trace potential infections.[21] A contact tracer primarily relies upon "a person recalling their close contacts and activities."[22] But, manual contact tracing faces a recall problem when an infected individual does not know or remember each person they interacted with during the period of possible transmission.[23]

Once testing confirms infection, a case investigation opens, and a contact tracer's work begins.[24] The contact tracer conducts a phone interview

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[15] *See* Shubina et al., *infra* note 53, at 18; *see also* Watson et al., *infra* note 19, at 5, 6.
[16] *See generally* Braithwaite et al., *supra* note 1.
[17] *See generally* WHO Interim Guidance, *supra* note 7.
[18] *See id.*
[19] *See generally* Crystal Watson et al., *A National Plan to Enable Comprehensive COVID-19 Case Finding and Contact Tracing in the US*, JOHN HOPKINS UNIV. (Apr. 10, 2020), https://www.centerforhealthsecurity.org/our-work/pubs_archive/pubs-pdfs/2020/200410-national-plan-to-contact-tracing.pdf [https://perma.cc/S632-LGRE].
[20] *Id.*
[21] *See* Braithwaite et al., *supra* note 1, at e617; *see also* WHO Interim Guidance, *supra* note 7, at 2.
[22] Braithwaite et al., *supra* note 1, at e607.
[23] *See id.*
[24] *See* DIGITAL CONTACT TRACING FOR PANDEMIC RESPONSE: ETHICS AND GOVERNANCE GUIDANCE at 29 (Jeffrey Kahn & John Hopkins Project on Ethics and Governance of Digital Contact Tracing Technologies eds., 2020) [https://perma.cc/J4HY-J3UP] [hereinafter DIGITAL CONTACT TRACING].

with the infected individual to determine the person's "close contact[s]" from the start of potential infectious spread until their self-isolation began.[25] A contact tracer also seeks information relating to demographics and the kinds of contact that occurred.[26] Further, "daily monitoring" is performed to track "signs and symptoms" as well as an individual's failure to "follow-up."[27] Finally, the contact tracer recommends the individual self-isolate for a period of time dependent upon disease transmission factors.[28]

Next, the contact tracer notifies close contacts of their potential exposure, advising self-isolation for contacts meeting the definition.[29] This notification does not disclose the infected individual's identity to maintain privacy.[30] If a close contact is confirmed as infectious through diagnostic testing or symptoms of the disease, the process begins anew to test, track, and trace their contacts.[31] At this stage, a contact may be tested if asymptomatic but will forego it for diseases like COVID-19, where shortages in testing availability exist.[32] Instead, the contact tracer informs asymptomatic individuals to self-quarantine during the period of possible disease transmission and follows-up with the contact daily.[33] The purpose of these daily follow-ups is to identify symptoms arising during the transmission period.[34] If the notified individual is asymptomatic throughout that period—fourteen days for COVID-19—they can end self-isolation.[35]

Contact tracers refer infected individuals to support services in the community, which offer things like food delivery, healthcare providers, and support groups.[36] Given prolonged durations of quarantine or self-isolation, the human-aspect of manual contact tracing provides sympathy and outreach

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[25] *See Coronavirus Disease Appendix A – Glossary of Key Terms*, CENTER FOR DISEASE CONTROL AND PREVENTION, https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/appendix.html#contact [https://perma.cc/8DK4-5L5W] (defining close contact as "someone who was within 6 feet of an infected person for a cumulative total of 15 minutes or more over a 24-hour period starting from 2 days before illness onset (or, for asymptomatic patients, 2 days prior to test specimen collection) until the time the patient is isolated.").

[26] *See* WHO Interim Guidance, *supra* note 7, at 4.

[27] *See id.*

[28] *See id.* at 3.

[29] *See id.*

[30] *See* WHO Digital Tools, *infra* note 46, at 4.

[31] *See* WHO Interim Guidance, *supra* note 7, at 1, 5.

[32] *See id.*

[33] *See id.* at 4.

[34] *See id.*

[35] *See id.* at 5.

[36] *See Principles of Contact Tracing*, CENTER FOR DISEASE CONTROL AND PREVENTION (Updated Oct. 21, 2020), https://www.cdc.gov/coronavirus/2019-ncov/php/principles-contact-tracing.html [https://perma.cc/93NP-CYQ8] [hereinafter CDC Principles].

to individuals.[37] Manual contact tracing in health crises supports individuals and prevents future disease outbreaks.[38] Most importantly, manual contact tracing is advantageous because it is a studied measure proven effective at disease control.[39]

Despite the numerous advantages of manual contact tracing, some challenges are difficult to overcome, particularly for infectious diseases, such as COVID-19, which spreads rapidly from symptomatic and asymptomatic individuals.[40] Among these challenges is locating all potential infection cases because the infected individual may not recall all of their contacts.[41] Further, when disease spread goes beyond strictly close contacts, like with the occasional airborne transmission for COVID-19,[42] it is difficult to locate all contacts of an individual in more extensive social settings (*e.g.*, the gym, the grocery store, and religious gatherings).[43] Manual contact tracing, by itself, struggles to reach the sheer volume of human contact occurring in daily activities, where respiratory infections spread more readily than other diseases.[44] However, supplementary measures such as government-mandated lock-downs help manual contact tracing in overcoming this challenge by reducing the number of close contacts that occur, facilitating tracing potential disease cases.[45]

IV. DIGITAL CONTACT TRACING TOOLS

[37] *See generally* Braithwaite et al., *supra* note 1.
[38] *See generally* CDC Principles, *supra* note 36.
[39] *See* Shubina et al., *infra* note 53, at 18; *see also* Watson et al., *supra* note 19, at 5, 6.
[40] *See* Watson et al., *supra* note 19, at 6, 7.
[41] *See* Braithwaite et al., *supra* note 1, at e607.
[42] CENTER FOR DISEASE CONTROL *Scientific Brief: SARS-CoV-2 and Potential Airborne Transmission*, https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html [https://perma.cc/7X9X-PQFQ].
[43] *See* WHO Interim Guidance, *supra* note 7, at 2.
[44] *See* Watson et al., *supra* note 19, at 6, 7 (discussing the fewer implementation requirements for contact tracing with diseases transmitted through purely personal contact such as syphilis, a sexually transmitted infection, as compared to Covid-19).
[45] *See generally* Marco Vinceti et al., *Lockdown Timing and Efficacy in Controlling COVID-19 Using Mobile Phone Tracking*, 25 LANCET 100457 (Aug. 1, 2020), https://www.thelancet.com/action/showPdf?pii=S2589-5370(20)30201-7 [https://perma.cc/W6A8-R9NY] (discussing mobile phone tracking data from Italy showed a positive correlation between lockdowns restricting individuals' mobility to decreases in daily new COVID-19 cases).

DCTTs are technologies that *assist* manual contact tracing and case identification efforts.[46] DCTTs help governmental public health officials and individual users through internet and mobile phone applications (apps) by:

> identifying contacts, including those not easily found otherwise; finding and notifying contacts rapidly, before they develop symptoms if infected; analyzing the nature of contact to determine whether contact is high, medium, or low risk, and to support decisions about whether a contact should quarantine; and following up with cases and contacts so that public health can provide resources to support isolation and quarantine.[47]

The creation of DCTTs began in the early 2000s, but the demands placed on public health officials by COVID-19 led to the development of most apps and online registries used.[48] For apps alone, as of this technology explainer, more than 50 have been developed.[49]

Internationally, individuals and public health officials use apps and online registries with DCTTs.[50] While some countries access and use the same DCTTs—like the DCTT created by Apple and Google[51]—variations exist in DCTT implementation as between nations.[52] For some places, like Singapore, apps are developed and deployed primarily through governmental entities.[53]

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[46] *See Annex: Digital Tools for COVID-19 Contact Tracing*, WORLD HEALTH ORGANIZATION [WHO] (June 2, 2020), https://apps.who.int/iris/rest/bitstreams/1279465/retrieve [https://perma.cc/C78X-642X] [hereinafter WHO Digital Tools].

[47] *See* DIGITAL CONTACT TRACING, *supra* note 24, at 34.

[48] *See* Andrew Berry, *Online Symptom Checker Applications: Syndromic Surveillance for International Health*, 18 OCHSNER J. 298 (Dec. 2018), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6292459/ [https://perma.cc/7TTD-UUDE].

[49] *Survey of Decentralized Solutions with Mobile Devices for User Location Tracking, Proximity Detection, and Contact Tracing*, TAMPERE UNIVERSITY, (Nov. 8, 2020, 11:06 PM), https://sites.tuni.fi/survey-of-digital-solutions/apps/ [https://perma.cc/ENK2-865C] [hereinafter *Survey*] (providing an updated list of apps).

[50] *See id.*

[51] *Privacy-Preserving Contact Tracing*, GOOGLE & APPLE (2020), https://covid19.apple.com/contacttracing [https://perma.cc/PUA9-GWJL].

[52] *See generally Survey*, *supra* note 49.

[53] *See* Viktoriia Shubina et al., *Survey of Decentralized Solutions with Mobile Devices for User Location Tracking, Proximity Detection, and Contact Tracing in the COVID-19 Era*, J. DATA 22 (Sept. 23, 2020), https://www.mdpi.com/2306-5729/5/4/87/htm [https://perma.cc/4UX7-VENF] (discussing Singapore's BlueTrace and TraceTogether apps created by the government); *see also* Crystal Watson et al., *A National Plan to Enable Comprehensive COVID-19 Case Finding and Contact Tracing in the US*, JOHN HOPKINS UNIV. 5 (April 10, 2020), https://www.centerforhealthsecurity.org/our-work/pubs_archive/pubs-pdfs/2020/200410-national-plan-to-contact-tracing.pdf

For other countries, such as the United States, private entities are mainly responsible for creating and implementing apps but give public health officials access to the information an app collects.[54]

Further, a few countries implement additional case finding measures to reduce disease transmission, using "patient interviews as well as . . . medical records, cell phone GPS records, credit card transaction records, and closed-circuit television."[55] Others implement "Social Network Analysis" to map out an infected individual's contact network, connecting disease transmission locations to households.[56] *Each app is supplementary to contact tracing,* which is the necessary key to reducing disease transmission.[57]

DCTTs supplement contact tracing to "make it more efficient and facilitate implementation on a large scale."[58] However, DCTTs extend beyond contact tracing to perform tasks like modeling, predicting, and preparing response plans to future disease outbreaks.[59] Three primary forms of DCTTs are used with COVID-19 contact tracing: "outbreak response, proximity tracing, and symptom tracking tools . . . ."[60]

A. Outbreak Response Tools

Outbreak response tools facilitate contact tracing through electronic data entry of "case investigation, listing and monitoring of contacts, and automating analysis and performance monitoring."[61] Outbreak response tools are unique from the other DCTTs discussed in being (1) designed primarily for use by public health officials and (2) deployed through internet databases.[62]

First, outbreak response tools are used solely by public health officials "in contact tracing activities and outbreak investigation."[63] Online data management in outbreak response tools is particularly beneficial with highly

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[https://perma.cc/S632-LGRE] (discussing these techniques as used in South Korea in 2015, for Middle Eastern Respiratory Syndrome outbreaks).

54 *See generally Survey*, *supra* note 49. *See also* WHO Digital Tools, *supra* note 46, at 4.

55 Crystal Watson et al., *A National Plan to Enable Comprehensive COVID-19 Case Finding and Contact Tracing in the US*, JOHN HOPKINS UNIV. 5 (April 10, 2020), https://www.centerforhealthsecurity.org/our-work/pubs_archive/pubs-pdfs/2020/200410-national-plan-to-contact-tracing.pdf [https://perma.cc/S632-LGRE] (discussing these techniques as used by South Korea in 2015, for Middle Eastern Respiratory Syndrome outbreaks).

56 *See generally* Chen et al., *supra* note 3.

57 *See* WHO Digital Tools, *supra* note 46, at 4.

58 *See* WHO Interim Guidance, *supra* note 7, at 7.

59 *See* Shubina et al., *supra* note 53, at 30.

60 *See* WHO Digital Tools, *supra* note 46, at 1.

61 *See id.*

62 *See id.*

63 *See id.* at 2.

infectious diseases like COVID-19, where it helps contact tracers connect an entire network of individuals.[64] Outbreak response tools help public health officials "manage the dynamic relationships between cases and contacts."[65]

Second, the use of outbreak response tools is online. Public health officials manage information on internet databases, allowing faster implementations of contact tracing to control disease outbreaks.[66] Collecting health information online also permits the efficient allocation of healthcare resources to communities with high disease rates.[67] Further, online management provides public health officials the chance to coordinate response plans and communicate with other officials nationally and abroad.[68] Sharing information is vital to overcome the challenges with contact tracing and to combat disease outbreaks.[69]

B. Proximity Tracing Tools

Proximity tracing tools use "location-based (GPS) or Bluetooth technology to find and trace the movements of individuals to identify people . . . exposed to an infected person."[70] The collection of location-data allows users to be alerted about potential disease exposure after unwittingly coming into contact with an infected individual.[71] The primary users of proximity tracing tools are individuals, whereas public health officials are secondary users.[72] Implementation of proximity tracing tools is mainly through apps, but utilization is also possible through technologies like RFIDs, wearable technology, and Wi-Fi networks.[73] In apps, proximity tracing tools are available by download to smartphone users and facilitate contact tracing by storing and sharing user information with contact tracers.[74] Using information the app collects, it identifies users exposed to disease "depend[ing] on the probability of coming into close or frequent contact with . . . infected [individuals]."[75]

The first of two significant variations in proximity tracing tools is whether the tools implement GPS, Bluetooth, or both to capture nearby

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[64] *See id.* at 1.
[65] *See id.*
[66] *See* WHO Digital Tools, *supra* note 46, at 1.
[67] *See id.*
[68] *See id.*
[69] *See id.*
[70] *See id. See also* Shubina et al., *supra* note 53, at 13.
[71] WHO Digital Tools, *supra* note 46, at 2, 3.
[72] *See id.*
[73] *See* Shubina et al., *supra* note 53, at 15.
[74] *See* WHO Digital Tools, *supra* note 46, at 3.
[75] *See* Braithwaite et al., *supra* note 1, at e607; *see also* Shubina et al., *supra* note 53, at 13.

contacts.[76] GPS and Bluetooth help overcome the problem of recall and enlarge the information available to contact tracers in limiting disease outbreaks.[77] GPS directly tracks an individual's geographic locations, allowing public health officials to map out disease spread and connect transmission sites to households.[78]

Bluetooth technology (Bluetooth) works passively to detect nearby individuals that have downloaded the same app as a user.[79] Bluetooth detects nearby individuals who came into the range of transmission and stores this data.[80] Once the app receives a report that an individual is symptomatic or has tested positive for the disease, other users exposed to them during the transmission period, as found by Bluetooth, are alerted.[81] To facilitate the development of these tools, in April 2020, Apple and Google announced together that they would implement exposure notification systems across their respective devices that allow developers to create contact tracing apps as well as notify iOS and Android users if they had potentially been exposed to COVID-19.[82] The Bluetooth method creates a beacon with a random identifier, which changes periodically to protect anonymity of the user, that other phones nearby are able to listen for.[83] When a person positively tests for COVID-19 and reports it, they are added to a list which is sent out to all phones alerting anyone who has picked up their beacon.[84] This system allows those who are potentially infected to take precautionary measures while not giving up the anonymity of the exposing party.[85]

The second significant variation in proximity tracing tools is the storage structure keeping an individual's information.[86] Two storage structures for information exist: (1) centralized and (2) decentralized.[87] The first structure uses a single server to store individuals' information, usually maintained by a governmental entity.[88] The centralized structure grants public health officials direct access to users' data, creating privacy concerns about the misuse of

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[76] *See id.* at 2.
[77] *See id.* at 4.
[78] *See id.* at 2.
[79] *See id.* at 3.
[80] *See* Shubina et al., *supra* note 53, at 15.
[81] WHO Digital Tools, *supra* note 46, at 2, 3.
[82] *Exposure Notifications: Frequently Asked Questions*, APPLE (September, 2020), https://covid19-static.cdn-apple.com/applications/covid19/current/static/contact-tracing/pdf/ExposureNotification-FAQv1.2.pdf [https://perma.cc/ZW89-5HLX].
[83] *Id.*
[84] *Id.*
[85] *Id.*
[86] *See* Shubina et al., *supra* note 53, at 13.
[87] *See generally id.*
[88] *See* WHO Digital Tools, *supra* note 46, at 1; *see also* Shubina et al., *supra* note 53, at 14.

sensitive personal information.[89] The centralized structure's notion is that the immediate disease control response it enables outweighs accompanying privacy concerns.[90]

Comparatively, the decentralized structure uses several servers to store different parts of an individual's information.[91] Several private entities, rather than a singular governmental health agency, store information across the servers, but public health officials may access data to conduct manual contact tracing.[92] The decentralized structure enhances privacy by storing information separately and does not appear to forego speed, making it the more "promising" form of information storage for proximity tracing tools.[93]

C. Symptom Tracking Tools

Symptom tracking tools are deployed online and through apps to "routinely collect self-reported signs and symptoms to assess disease severity or the probability of infection. . . ."[94] The primary users of symptom tracking tools are individuals who self-report symptoms to the tool, which then diagnoses them and offers necessary medical services.[95] Public health officials are secondary users of the self-reported symptoms and diagnoses, which provides "real-time . . . collection, analysis, interpretation, and dissemination of health-related data. . . ."[96] This real-time collection is remarkable because it helps contact tracers establish baseline disease outbreak rates within a community.[97]

A single app can implement both symptom tracking tools and proximity tracing tools, which together are highly beneficial to contact tracing.[98] If a user self-reports signs consistent with an infection diagnosis, their past locations help find others exposed to the potentially infected user.[99] Contact tracers then use this data to broaden the scope of infected individuals traced and limit disease exposure.[100] Contact tracers are also benefitted by

[89] *See* Shubina et al., *supra* note 53, at 13, 21.
[90] *See id.* at 19, 21.
[91] *See id.* at 4.
[92] *See id.*
[93] *See id.*
[94] *See* WHO Digital Tools, *supra* note 46, at 1, 2.
[95] *See* Berry, *supra* note 48, at 298.
[96] *See id.*
[97] *See id.*
[98] *See id.*
[99] *See id.*
[100] *See* Berry, *supra* note 48, at 298.

having to do less work finding contacts when an individual is warned early on during transmission periods about their disease risk and self-isolates sooner.[101]

However, symptom tracking tools have downfalls, such as being less accurate than healthcare providers diagnosing individuals.[102] Further, disease transmission goes unchecked with improper diagnoses to asymptomatic individuals.[103] Even with these pitfalls, symptom tracking tools, especially when combined with proximity tracing and outbreak response tools, benefit contact tracers greatly in reducing disease transmission.[104]

V. CONCLUSION

Manual contact tracing is a measure proven effective in disease control.[105] Emerging DCTTs can help with disease control but come with numerous obstacles and lack rigorous research on their efficacy relative to their newness.[106] Thus, manual contact tracing remains the best bet for controlling the spread of diseases, including COVID-19.[107]

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[101] *See id.*

[102] *See id.*

[103] To note, contact tracing has dealt with privacy concerns since its conception in the 19th century (requiring bribes to induce infected individuals to disclose their contacts) to the present day, particularly with supplementary use of digital tools. Further, the concerns implicated with digital tools go beyond the scope of purely privacy concerns to issues such as lack of study on their efficacy, and non-uniform smartphone use, particularly in the most at-risk populations susceptible to serious illness. A few solutions have been proposed to provide greater privacy to individuals, but presently this concern lacks a conclusory resolution. *See* WHO Digital Tools, *supra* note 46, at 4; *see also* Shubina et al., *supra* note 53, at 14.

[104] WHO Digital Tools, *supra* note 46, at 4.

[105] *See* Shubina et al., *supra* note 53, at 18; *see also* Watson et al., *supra* note 19, at 5, 6.

[106] *See* Shubina et al., *supra* note 53, at 7.

[107] *See id.* at 18 (discussing study of contact tracing as used in the United States to reduce COVID-19 related hospitalizations and deaths); *see also* Watson et al., *supra* note 19, at 5, 6.