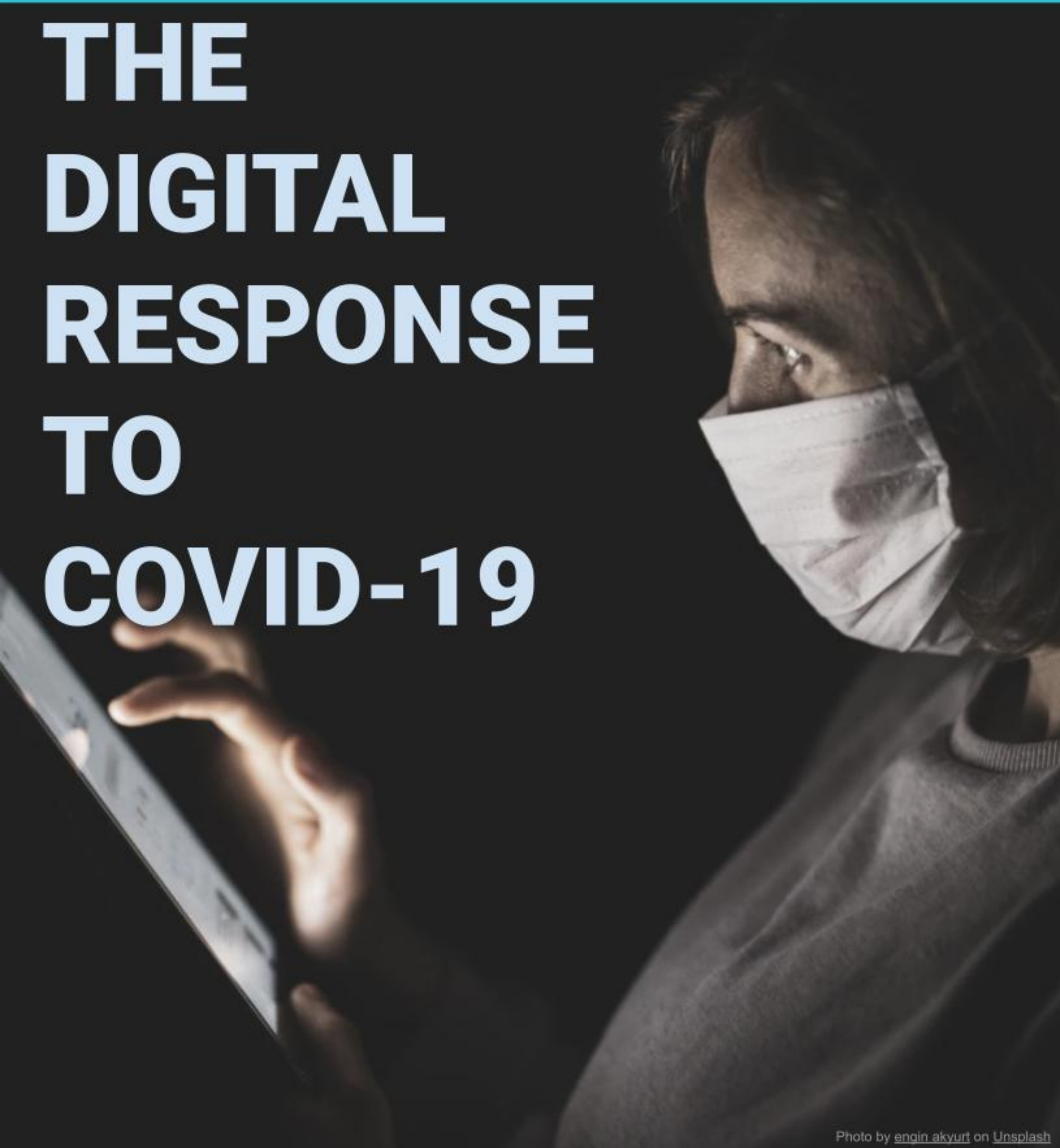
DGHH
Digital Global Health & Humanitarianism Lab

THE DIGITAL RESPONSE TO COVID-19



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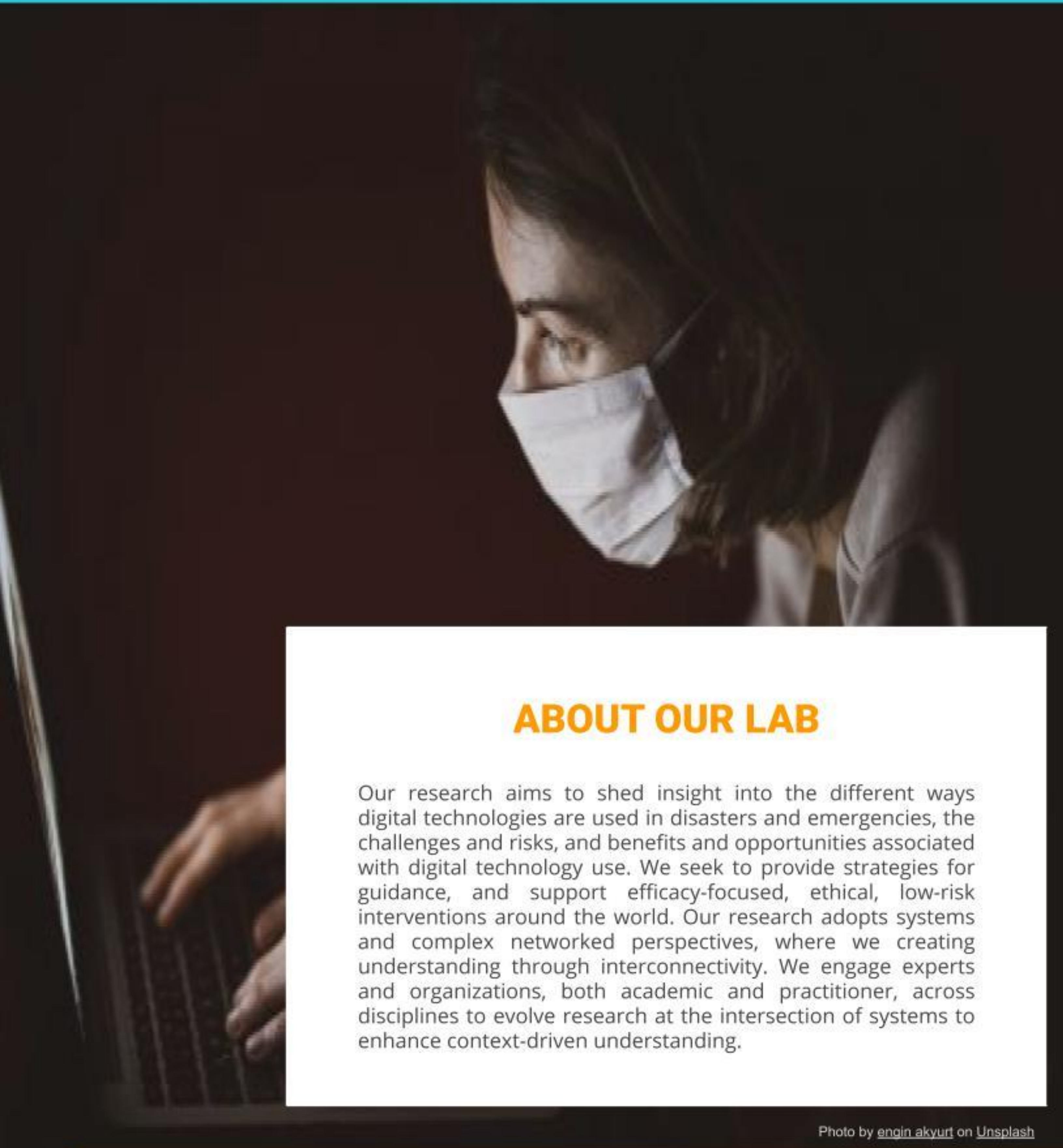

ABOUT OUR LAB

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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DIGITAL RESPONSE OVERVIEW

MODULE 3.
Public Communications, and Remote Diagnostics & Treatment

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1. The Digital Response to COVID-19 Study: An Introduction

The ongoing COVID-19 pandemic requires global clinical public health mitigation interventions. These are designed to identify, contain, control, and prevent outbreaks of COVID-19 infection. These mitigation interventions include isolation of active COVID-19 cases; social distancing practices ranging from 'lock-down' to limited social interaction in 'bubbles' of varying size; rapid individual or population testing for the presence of COVID-19; and contact tracing to identify and limit the further transmission of the virus.[1] The rapid spread of COVID-19 coupled with inadequate or insufficient public health resources and tools to identify, contain, mitigate and control the pandemic, has sparked the need to find innovative ways of using digital technologies to assist with the response. In turn, a digital response to the COVID-19 pandemic has emerged, where we are both observers of, and participants in (willingly or unwillingly), a global surge of digital innovations being used to identify, track, and mitigate the spread of COVID-19. While the digital response has been highly distributed with many novel solutions, these are typically ad-hoc, vary widely in their utility and in their proactive adherence to security, privacy and human rights protections. Early research of the media coverage offers a piece-meal attempt to generate an understanding of this digital response. Furthermore, little research exists that attempts to capture the digital response's nature, scale, scope, and wider implications.

This research study aims to fill this gap with three modules that describe the landscape of the Digital Response to COVID-19. These modules provide a *descriptive overview* of digital technologies used in COVID-19 in terms of 1) Digital Contact Tracing, or tracking viral spread; 2) Social Behavior Monitoring Communications, which is designed to influence or control social behavior, and 3) Public Communications alongside Remote Diagnostics & Treatment. Technologies assessed include mobile devices (SMS, apps, data), web platforms, drones, telemedicine, and Artificial Intelligence (AI). This study was conducted through meta-analysis of peer-reviewed and grey literature including media reports, blog posts, and social media data along the three research themes identified above.

The three modules (plus an Executive Summary) of the *Digital Response to COVID-19 Study* are:

Executive Summary
Module 1. Digital Response Overview: Digital Contact Tracing
Module 2. Digital Response Overview: Social Behaviour Monitoring
Module 3. Digital Response Overview: Public Communications, and Remote Diagnostics & Treatment

Note: *As this field is rapidly emerging, and the scale of innovation around the world is vast, this study is by no means comprehensive. It is meant to provide a rapid overview of the different initiatives in use around the world from the start of the pandemic to the end of June 2020. A brief examination was*

[1] S Hsiang, et al., The effect of large-scale anti-contagion policies on the COVID-19 pandemic, Nature, 584, 262–267 (2020).)

conducted in August 2020 to update any clearly outdated information, yet it is out of the scope to evaluate the impact, viability, and sustainability of all the tools identified.

2. Introduction to Module 3

This module of the *Digital Response to COVID-19 Study* focuses specifically on digital measures used to enable **public communications as well as remote diagnostics and treatment** during the COVID-19 pandemic**.** Public communications are introduced through a comparison of traditional and emergent forms of communications. Applications of digital technology use for public communications are explained through two main approaches: one-way and two-way communications. Remote diagnostics and treatment tools are introduced by explaining both concepts and distinguishing how diagnosis and treatment are typically performed from how they have been performed during the pandemic. Applications of remote diagnostics and treatment tools are described through three main approaches: screening and assessment, healthcare delivery, and decision-making and research support.

3. Public Communications (One-Way and Two-Way)

3.1. Introduction

3.1.1. What is public communications? How is public communications usually performed? How is this situation different? What is the need for a new approach?

Public communications encapsulates the act and process of sharing of information with the general population - a broad audience without specific subject matter expertise. Traditional mediums for public communications include radio, newspaper, and television. While these mediums are still in use, more modern public communications strategies leverage tools such as social media, text messaging, artificial intelligence (AI)-driven solutions (i.e. chatbots), and web and mobile platforms.

Public communications can be conducted via one-way and two-way communication methods. One-way implies information dissemination to an audience where there is no mechanism for a response. Historically speaking, King George VI announced war on Germany on September 3 1939 via radio broadcast for example.[2] A current application of one-way technology is the use of an emergency system text notification (i.e. an Amber Alert in Canada that notifies residents of child abductions or the *KATWARN* tool in Germany that notifies residents of disasters and dangerous situations) that goes out to all cell phones. In both situations, there is no ability to directly respond to the sender of the message.

[2] BBC Archive. (1939, September 3). King George VI addresses the nation. BBC Archive. Retrieved from https://www.bbc.co.uk/archive/king-george-vi-addresses-the-nation/zky9f4j

Alternatively, two-way communication implies the exchange of information between two parties and typically involves a smaller audience (i.e. a specific group of people or an individual). This form of communication can be facilitated in two ways: manually and automated. In this context, as defined by the DGHH lab, manual communication is human-to-human interaction. While this form of interaction typically occurs face-to-face (i.e. a patient's visit to their doctor), it can be facilitated through digital means. For instance, the use of Morse code is a historical example of a pseudo-digital technology that facilitates the sharing of information between two parties. A more relevant example is the use of telemedicine where various technologies (SMS, video conferencing, web chat, etc.) can be leveraged to facilitate a medical assessment between a patient and a medical professional. While this is a form of two-way communication, in our study we consider this tool to be more accurately described as a form of remote diagnosis and treatment; thus, these types of medical communication solutions will be described in more detail in Section 4.4. Automated two-way communication, as defined by the DGHH lab, refers to human-to-robot interactions and is typically facilitated through the use of AI and machine learning. Such communications have been integrated into various facets of daily life; for example, the interaction between a person and an assistance chatbot on a shopping website. The user is not speaking to a real person, but is interacting with a program that is designed to answer common questions and share information. These automated two-way communications have also been applied for use in crises, where applications can range from automated self-diagnostics to myth-busting. While automated two-way communication is relatively new in comparison to the aforementioned traditional and one-way communication methods, it has been used widely in the COVID-19 response. These uses will be explored in greater depth in the coming sections.

Each type of communication has its benefits. One-way communication is particularly useful for the mass broadcasting of information to a large audience, and two-way communication allows for tailored messaging to be delivered based on individual or group needs. The automation of public communications specifically enables a greater number of queries to be addressed and a greater number of people to receive information. Each of these attributes are valuable to different aspects of responding to a crisis situation, particularly when working with limited resources to communicate vital information to large groups, and responding directly to the concerns of individuals and smaller communities. In order to respond to these needs, innovators have been developing or repurposing interventions that leverage digital technologies to facilitate multi-faceted and cohesive public communication initiatives that respond to COVID-19. The following section will outline how digital technologies are being used to conduct one-way and two-way automated communication during the pandemic.

3.2. One-Way Communication

During the COVID-19 pandemic, many governments and organizations have been using automated one-way methods of public communications to connect with their respective populations. Emergency alert systems have been used in nations such as Canada, New Zealand, United Kingdom, Denmark, The Netherlands, France, and Romania to keep their citizens informed during the pandemic.[3] Oftentimes, these alerts are used to update populations on changing social distancing, quarantine, or lock-down measures.[4] For instance, Ontario, **Canada's** mass notification system that is typically used for natural disasters and amber alerts is being used for COVID-19.[5] In one instance, a mass notification was sent to all Ontario citizens to inform and reinforce the 14-day quarantine that travelers are supposed to immediately observe upon returning to the province. Similarly, **Germany** is using its public warning apps, such as *KATWARN* and *NINA*, to provide citizens with information relating to COVID-19 as well as any new instructions to follow (i.e. changes to social distancing measures).[6]

Meanwhile, Vodafone is aiding all governments to facilitate the dissemination of critical information via text alerts.[7] The company also has stated its interest in assisting with targeted text messaging, such as focused campaigns for residents in a particularly affected area.[8] This is a clear example of whole population and targeted-population communications. Another example of leveraging text messaging capabilities can be seen in *Safiri Smart*, an automated text service used in **Kenya** that alerts Safaricom subscribers of COVID-19 updates via USSD.[9] [10] Also in use in **Kenya** are various interventions put in place by BRCK, a company that focuses on making the internet accessible to everyone in Africa. BRCK designed a COVID-19 specific channel through their web app to connect Kenyans to COVID-19 information.[11] BRCK also built a platform through Public Service Announcements (PSAs) that sends COVID-19 related messages directly to smartphones.[12] These messages can be sent in different languages and formats to make sure that Kenyans receive helpful suggestions and reminders, such as proper social distancing protocols and effective hygiene practices, during the pandemic. Similarly, Viamo – a **Canadian** company focused on leveraging mobile technology to share vital information to isolated populations in **Africa** - has a 3-2-1 hotline and targeted mass messaging services that provide critical COVID-19 information through audio messages, SMS, social media, chatbots, and telephone calls.[13] These messages can be recorded in

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[3] Radio World. (2020, March 25). COVID-19 and Emergency Alerting Best Practices. *Radio World.* Retrieved from https://www.radioworld.com/news-and-business/news-makers/covid19-eas-best-practices
[4] Ibid.
[5] Rocca, R. (2020, April 04). Coronavirus: Ontario issues 2nd COVID-19 emergency alert. *Global News.* Retrieved from https://globalnews.ca/news/6779038/ontario-coronavirus-emergency-alert/
[6] EENA. (2020, April 20). *Data and strategies on emergency calls & public warning during COVID-19 outbreak.* EENA. Retrieved from https://eena.org/data-strategies-emergency-calls-public-warning-covid19/
[7] Vodafone Group. (2020, March 18). *Vodafone launches five-point plan to help counter the impacts of the COVID-19 outbreak.* Vodafone. Retrieved from https://www.vodafone.com/news-and-media/vodafone-group-releases/news/vodafone-launches-five-point-plan-to-help-counter-the-impacts-of-the-covid-19-outbreak
[8] Ibid.
[9] USSD stands for Unstructured Supplementary Service Data, it is a series of quick/feature codes used for a communication protocol by Global System for Mobile cellular telephones to communicate with their mobile network operator's computers
[10] Vota, W. (2020, March 25). Three Early Digital Health COVID-19 Response Success Stories. ICTworks. Retrieved from https://www.ictworks.org/digital-health-covid-response-success-stories/#.XsU6-xNKg3j
[11] Moja Discover. (2020). Coronavirus disease (COVID-19) Pandemic. *BRCK.* Retrieved from https://covid19.brck.com/
[12] Boma COVID-19 Summit. (2020). A global conversation on how we act. *Boma.* Retrieved from https://s3.amazonaws.com/media.boma.global/uploads/documents/f3df2c6b8bcb69f451ac7abc02b0d755819eff1d.pdf
[13] Viamo. (2020). *A global social enterprise improving lives via mobile.* Viamo. Retrieved from https://viamo.io/

local languages and are in use in countries such as **Haiti, Nepal, Mozambique, Democratic Republic of Congo**, and **Indonesia**.[14] Meanwhile, the Ministry of Health and Population in **Nepal** launched a mobile app alongside a web portal to keep the public updated on COVID-19 news and alerts.[15]

In other countries, drones also are being used to deliver public messages. In New Jersey, **USA**, drones are reminding people to practice correct social distancing procedures through automated voice messages.[16] Similarly, drones in **China** are approaching citizens to warn them about following social distancing protocols and using PPE (personal protective equipment) in order to prevent the spread of the virus.[17] In **India**, drones are warning individuals in high disease prevalence areas to practice proper hygiene and social distancing communication.[18] Ultimately, through the use of these drones, these governments are educating the public about the proper measures that need to be taken to combat the virus. Drones also are being used as a resource to capture information around the world; reporters are working around social distancing measures by flying drones from their homes to capture footage around the city.[19] While these drones are not being used directly for one-way public communications, this footage has the potential to be used as public communications content through a different method (television, social media, etc.) by other non-governmental organizations and businesses.

3.3. Two-Way Communication (Human to Robot)

Many countries and health agencies have leveraged SMS, mobile apps, web app services, AI, and drones to facilitate two-way, human-to-robot communication methods to share information.

WhatsApp, the widely used messaging app, has been repurposed specifically for COVID-19 purposes. *HealthAlert*, for example, is an **international** WhatsApp based helpline released by the WHO that uses AI technology to respond to users.[20] Through machine learning algorithms, it can accept incoming questions from users and respond using automated answers. This tool provides

[14] Ibid.

[15] Nepali Telecom. (2020, April 03). CoronaVirus mobile apps and website launched in Nepal. *Nepali Telecom.* Retrieved from https://www.nepalitelecom.com/2020/03/mobile-apps-covid-19-portal-nepal.html

[16] Krauth, D. (2020, April 15). Coronavirus News: Pandemic drones to monitor fever, crowds from above. *ABC News.* Retrieved from https://abc7ny.com/coronavirus-drones-covid-19-pandemic-nj/6102905/?fbclid=IwAR3VIVm1oWAY1U6buZLaFIOeZXfc7sNgxVNmEv06tBQtkIjl6Cgtl4_yVYk

[17] D'Amore, R. (2020, February 11). 'Yes, this drone is speaking to you': How China is reportedly enforcing coronavirus rules. *Global News.* Retrieved from https://globalnews.ca/news/6535353/china-coronavirus-drones-quarantine/

[18] The Economic Times. (2020, April 12). Drones for sanitising, robots in isolation wards, special stethoscope--innovations to fight corona. *The Economic Times.* Retrieved 2020, from https://economictimes.indiatimes.com/news/science/drones-for-sanitising-robots-in-isolation-wards-special-stethoscope-innovations-to-fight-corona/articleshow/75105576.cms?utm_source=contentofinterest

[19] Celine, T. (2020, April 15). Drone Technology: A New Friend Could Fight Against COVID-19. *Tech times* Retrieved from https://www.techtimes.com/articles/248861/20200415/video-coronavirus-are-drones-on-their-way-to-fight-covid-19.htm?fbclid=IwAR0ZcshFf2ERXn2JTiSgXdWIoefpbUdLZgJj6gV8YDvNMSZry6zMsP2AV78

[20] WHO. (2020, May 05). *WHO Health Alert brings COVID-19 facts to billions via WhatsApp.* World Health Organization. Retrieved from https://www.who.int/news-room/feature-stories/detail/who-health-alert-brings-covid-19-facts-to-billions-via-whatsapp

information on topics including symptoms, updated news on the pandemic, myths versus facts, and protection measures. Currently, this service is offered in Arabic, English, French, Hindi, Italian, Spanish, and Portuguese (in the regions where the app is available). The government in **New Zealand** was leveraging WhatsApp in similar ways. They launched a WhatsApp channel that automatically messages people every morning to ask how they are feeling.[21] This algorithm gathered whether a user displays any of the listed symptoms for the virus and sends this information to the Ministry of Health to respond accordingly. It also was a source for people to obtain trustworthy information but it was decommissioned on June 7, 2020 when New Zealand was reporting multiple days of zero COVID-19 cases and the need for immediate information dramatically reduced.[22]

Beyond Whats-App, other countries have developed other types of AI-driven chatbots for information sharing purposes. The **Lithuanian** government started using the AI-powered digital robot called *ViLTė* for two-way automated communication.[23] The AI's primary function is to answer questions from the Lithuanian public about the coronavirus, restrictions for travel, and the support provided by the government for entrepreneurs, unemployment, and education. This automated system can also answer questions about access to basic needs, services, the status of various religious and cultural places, civil services, waste management, police, and more, thereby ensuring that the Lithuanian public has access to any information they may need during the pandemic. Similarly, *askNivi* is a free interactive messaging service driven by AI that is offered through the Facebook messaging feature in **Kenya** and **India**.[24] It shares news and statistics about COVID-19 as well as information about best practices during the pandemic, such as how to practice good hygiene. MILA, based in Quebec, **Canada** is partnering with Dialogue and Nuance Communications to develop an AI-driven question system that will help take the burden off of the Quebec government's helplines.[25] Stallion.AI, also based in **Canada,** has built a multilingual virtual healthcare agent through AI capabilities.[26] While one of the main components of this agent is to facilitate a remote self-screening process (an approach to remote diagnosis that will be discussed further in Section 4.4.2), it is also able to answer questions about COVID-19, recommend protection measures, and provide clear guidelines.

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[21] Daalder, M. (2020, May 06). Govt app quietly rolls out daily health check-ins. *Newsroom.* Retrieved from https://www.newsroom.co.nz/technology/2020/05/01/1151690/govt-app-quietly-rolls-out-daily-health-check-ins

[22] Digital.Govt.nz. (2020, April 3). *COVID-19 response strengthened with Govt.nz WhatsApp service.* Digital.Govt.nz. Retrieved from https://www.digital.govt.nz/news/covid-19-response-strengthened-with-govt-nz-whatsapp-service/; Forrester, G. (2020, Aug 31). Coronavirus: Was the Government's WhatsApp channel worth the $672,000 price tag? *Stuff.* Retrieved from https://www.stuff.co.nz/national/health/coronavirus/122565173/coronavirus-was-the-governments-whatsapp-channel-worth-the-672000-price-tag

[23] Korona Stop. (2020). *Lietuvos Respublikos Vyriausybė*. Korona Stop. Retrieved from https://koronastop.lrv.lt/; ViLTė. (2020). *Official state virtual agent working 24/7.* ViLTė. Retrieved from https://viltebot.com/

[24] Goyal, S., Bellows, B., & Green, E. (2020). Hi, I'm Nivi. How can I help you? *Nivi.io.* Retrieved from https://www.nivi.io/

[25] MILA. (2020, April 02). *Mila and its partners rally the scientific community to develop novel data-driven solutions to assist with COVID-19 outbreak.* MILA. Retrieved from https://mila.quebec/en/mila-and-its-partners-rally-the-scientific-community-to-develop-novel-data-driven-solutions-to-assist-with-covid-19-outbreak/

[26] Obeidat, S. (2020, March 30). How Artificial Intelligence Is Helping Fight The COVID-19 Pandemic. *Entrepreneur* Retrieved from https://www.entrepreneur.com/article/348368

One of the largest communication problems faced during this pandemic has been managing the spread of fake news and misinformation pertaining to the virus. In response to this challenge, innovators and emergency response organizations have been developing creative ways for AI to identify misinformation and stop its spread. This form of communication is considered two-way because it involves automated monitoring and flagging of misinformation shared and the automated control and response information, like pushing misinformation alerts with social media posts deemed questionable. *CoronaCheck* is one such example of a tool developed to control the spread of misinformation. It is an AI-driven fact checker that was created through an **international** partnership between Eurocom, **Canada** and Cornell University, **USA**.[27] This app uses John Hopkins University's (**USA**) daily collection of data on COVID-19 as its data source to verify whether a claim is true or false. Other companies like Facebook (**USA**) are implementing algorithm controls to locate and block these posts spreading misinformation.[28] The Facebook algorithm is able to locate fake information through: 1) the use of natural-language models which helps better analyze the meaning of a post, and 2) evaluating content that consists of images and text combined. Google (**USA**) is also using an algorithm that identifies searches relating to COVID-19 and ensures that top entries are from trusted local and national sources in order to promote accurate information; it even creates a COVID-19 alert sidebar that summarizes information and statistics regarding COVID-19 that is relevant to the user's area.[29]

4. Remote Diagnostics & Treatment

4.1. Introduction

4.1.1. What is diagnosis and treatment? How are diagnosis and treatment usually performed? How is this situation different? What is the need for a new approach?

Diagnosis and treatment – the identification of a condition that ails an individual and the subsequent therapeutic approach taken to manage the condition, respectively – are the foundation of healthcare. In a non-pandemic situation, diagnosis and treatment are accomplished by patients visiting healthcare institutions, such as medical clinics or hospitals, where relevant histories are taken and referrals for appropriate tests made. Once results are obtained, treatment is administered if needed and the relevant public health authorities are informed should the patient be diagnosed with a disease that is of public health concern. These steps are traditionally performed in-person where precautions are taken if needed, albeit not to the extent seen in this pandemic.

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[27] CoronaCheck. (2020). *Computational Fact Checking for Statistical Coronavirus Claims.* CoronaCheck. Retrieved from https://coronacheck.eurecom.fr/en

[28] Hao, K. (2020, May 12). Facebook's AI is still largely baffled by covid misinformation. *MIT Technology Review.* Retrieved from https://www.technologyreview.com/2020/05/12/1001633/ai-is-still-largely-baffled-by-covid-misinformation/

[29] Chadwick, J. (2020, March 27). Google launches 'SOS Alert' for coronavirus in search results. *The Daily Mail.* Retrieved from https://www.dailymail.co.uk/sciencetech/article-7951707/Google-launches-SOS-Alert-coronavirus-search-results.html

Given the highly infectious nature of COVID-19, the actions taken to diagnose and treat individuals must be balanced with protecting healthcare workers, other patients, and members of the community as well as preventing the overburden of the healthcare system. These considerations become further complicated by additional pressures, such as shortages in personnel and personal protective equipment.[30] Yet, accurate diagnosis and effective treatment remain essential for the proper control and management of COVID-19. Therefore, this situation warrants the use of Information Communications Technologies (ICTs) to facilitate *remote* diagnosis and treatment so that COVID-19 diagnosis and treatment processes can be done from a distance (i.e. the medical professional and the patient are not in physical contact with one another). This shift has resulted in a surge of digital solutions development, as well as steps taken to repurpose existing digital tools, to facilitate remote diagnosis and treatment. In the context of COVID-19, remote diagnosis and treatment is conducted via three approaches: screening and assessment, healthcare delivery, and decision-making and research support.

4.2. Screening & Assessment

The diagnosis process briefly described above includes screening and assessment components. In the COVID-19 pandemic context, the screening phase entails identifying the potential of an individual having the virus, while the assessment stage includes taking steps to confirm a COVID-19 diagnosis and determine a treatment pathway. To respond to this need for remote diagnosis during the pandemic, digital tools that facilitate screening and assessment have been developed and implemented. These tools fall under two categories: self-screening and physiological monitoring.

Self-screening

In the context of COVID-19, self-screening tools encompass digital solutions that enable individuals to: 1) facilitate a self-report/review for coronavirus-related symptoms; 2) share this information with a program or person for analysis; and 3) receive information about the likelihood of having COVID-19 and instructions regarding next steps (i.e. whether the person requires additional care in a healthcare facility or is able to manage these symptoms at home). These screenings and two-way sharing of information can be completed in isolation which prevents unnecessary exposure and transmission of the virus in public areas.

Numerous national, state, and local governments have implemented mobile and web apps to facilitate this remote self-screening process. For instance, the Community of Madrid, **Spain** released an app allowing users to enter their contact information, answer evaluation questions, and receive instructions and recommendations for further steps.[31] Similar apps and questionnaires have been developed by the Community of Catalonia in **Spain**; Andrija.ai in **Croatia**; the Ministry of Health and

[30] Pole, A. (2020, April 6). Anxieties over COVID-19 and possible PPE shortages prompting some health care workers to draft wills. *CBC.* Retrieved from https://www.cbc.ca/news/canada/covid-doctors-wills-equipment-shortages-1.5523357
[31] Comunidad de Madrid. (2020, March 23). *COVID-19 Self Assessment*. Comunidad Madrid. Retrieved from https://coronavirus.comunidad.madrid/

Population in **Nepal**; Apple, Microsoft, Ipsoft-Sharecare-NTT Data, and Partners Healthcare System in the **USA**; Diagnostic Robotics in **Israel**; and the global health technology company Ada and Stallion.ai in **Canada**. AI algorithms process the entered information to provide standard risk evaluations and recommendations based on national or WHO guidelines. These platforms often emphasize that their questionnaires are not to be seen as a conclusive diagnosis of COVID-19.[32] **Cambodia's** *115 Hotline* (established in 2015 for the community to report any disease outbreaks via public reporting) has been enhanced by the Cambodia Ministry of Health for the COVID-19 pandemic to help screen callers and provide them with appropriate referrals to response and contact tracing teams.[33] In this situation, a person, rather than a program, manually analyzes the answers provided by the caller to determine next steps.

Physiological Monitoring

Another means of facilitating the screening and assessment components of the COVID-19 diagnosis process is through *remote physiological monitoring*. Physiological monitoring is the monitoring of a wide range of a person's bodily functions. In the COVID-19 context, numerous devices have been developed to detect fevers, measure the frequency of symptoms, monitor vital signs, and record lung sounds in an effort to screen, assess, and diagnose an individual. There has been significant development of fever-detection digital solutions that seem to be designed to screen individuals for the purpose of detecting those that may need further assessment. For instance, companies such as Amorph Systems (**Germany**) and INESA (**China**) are using digital software developed by VANTIQ (**USA**) to explore the potential of detecting high temperatures in high-volume areas (i.e. airports and elevators) in **China**.[34] Similar AI-driven programs have been created by SenseTime and Sunell for the possible detection of individuals with fevers in crowded areas in **China**.[35] Drones with thermal cameras have also been identified as a potential digital intervention to detect high temperatures in crowded areas and were found to be used in the Suba district in **Colombia**.[36] It is not yet clear however, as to how the data being obtained by the drones is used, although one report by the CBC claims it was used to detect persons breaking quarantine rules.[37] Finally, as mentioned in Section

[32] Lyons, K. (2020, March 21). CDC uses Microsoft healthcare chatbot service to create coronavirus symptom checker. *The Verge.* Retrieved from https://www.theverge.com/2020/3/21/21189227/cdc-microsoft-chatbot-coronavirus-symptom-checker

[33] ICTWorks. (2020, May 6). Cambodia's 115 Hotline: Successful COVID-19 Digital Response. *ICTWorks.org.* Retrieved from https://www.ictworks.org/cambodia-115-hotline-digital-response/#.Xr25XxNKjfY

[34] VANTIQ. (2020). *INESA Case Study: Real-Time Smart Cities at Scale*. VANTIQ. Retrieved from https://vantiq.com/customer-stories/inesa/

[35] SenseTime. (2020, February 10). SenseTime Joins Fight Against Novel Coronavirus Outbreak. *Sensetime Newsroom*. Retrieved from https://www.sensetime.com/en/news/view/id/140.html; Heilweil, R. (2020, Feb 27). Coronavirus is the first big test for futuristic tech that can prevent pandemics. *Vox.* Retrieved from https://www.vox.com/recode/2020/2/27/21156358/surveillance-tech-coronavirus-china-facial-recognition

[36] CBC News. (2020, May 20). Police in Colombia using drones to detect people flouting coronavirus quarantine. *CBC News.* Retrieved from https://www.cbc.ca/news/world/drones-colombia-bogota-coronavirus-quarantine-1.5577395

[37] CBC. (2020, May). Police in Colombia using drones to detect people flouting quarantine rules. *CBC.* Retrieved from https://www.cbc.ca/player/play/1740532291973

4.2.3, the **UAE** is using its extensive surveillance network to monitor temperature of passersby and are even trying to equip police with helmets that monitor temperature as well.[38]

Other digital tools focus less on the screening component and more on the assessment component of diagnosis and even venture into the monitoring component of healthcare (healthcare delivery will be further discussed in Section 4.4.3). *BioSticker*, created by **US**-based BioIntelliSense and provided FDA clearance in January 2020, is a wearable sensor that has the potential to continuously monitor a patient's vitals for up to 30 days, send this data to a healthcare team for accurate and timely diagnosis of COVID-19, and appropriately monitor COVID-19 patients or frontline staff.[39] VitalConnect, **USA**, also was granted Emergency Use Authorization from the FDA to use *VitalPatch*, a wearable biosensor that can monitor physiological vitals for COVID-19 patients undergoing drug treatment for COVID-19.[40] Similar diagnosis and monitoring claims have been made for devices created by AMC Health, Current Health, Bifourmis, and PMD Healthcare – all of which are created by companies based in the **USA** or **Europe -** although Bifourmis' *Biovitals Sentinel* is being used in **Singapore**.[41] Other biosensors include the **Indian** Institute of Technology of Bombay's "digital stethoscope" for the purpose of identifying heart and lung abnormalities in the assessment stage.[42]

Another interesting realm of diagnostic inquiry and development has focused on vocal changes as potential diagnostic markers for COVID-19. Voca.ai (Israel) has partnered with researchers from Carnegie Mellon, **USA** and Vocalis Health (**USA**) has partnered with the **Israeli** government to identify whether an individual has COVID-19 based on voice recordings.[43] Another initiative based out of **Israel** is the adaptation of Cordio Medical's speech analysis AI system *HearO* (which normally detects congestive heart failure) to detect bilateral pneumonia with edema found in COVID-19

[38] Gambrell, J. (2020, July 9). Virus projects renew questions about UAE's mass surveillance. *CTV News.* Retrieved from https://www.ctvnews.ca/world/virus-projects-renew-questions-about-uae-s-mass-surveillance-1.5016922
[39] MDDI. (2020, April 11). Several Telemedicine and Remote-Patient Monitoring Solutions Cutting Through the COVID-19 Clutter. *Medical Device and Diagnostic Industry*. Retrieved from https://www.mddionline.com/several-telemedicine-solutions-cutting-through-covid-19-clutter; Lawrence, S. (2020, July 9). Philips, Biointellisense partner on at-home patient wearable to monitor COVID, chronic disease. *BioWorld.* Retrieved from https://www.bioworld.com/articles/436355-philips-biointellisense-partner-on-at-home-patient-wearable-to-monitor-covid-chronic-disease
[40] CISION. (2020, May 5). FDA Grants Emergency Use Authorization to VitalConnect for Cardiac Monitoring in COVID-19 Patients. *Cision.* Retrieved from https://www.prnewswire.com/news-releases/fda-grants-emergency-use-authorization-to-vitalconnect-for-cardiac-monitoring-in-covid-19-patients-301052783.html
[41] MDDI. (2020, April 11). Several Telemedicine and Remote-Patient Monitoring Solutions Cutting Through the COVID-19 Clutter. *Medical Device and Diagnostic Industry*. Retrieved from https://www.mddionline.com/several-telemedicine-solutions-cutting-through-covid-19-clutter; Lee, G. (2020, July 31). Biofourmis deploys Biovitals Sentinel platform in Singapore. *BioWorld.* Retrieved from https://www.bioworld.com/articles/496399-biofourmis-deploys-biovitals-sentinel-platform-in-singapore
[42] The Economic Times. (2020, April 12). Drones for sanitising, robots in isolation wards, special stethoscope—Innovations to fight corona. *The Economic Times*. Retrieved from https://economictimes.indiatimes.com/news/science/drones-for-sanitising-robots-in-isolation-wards-special-stethoscope-innovations-to-fight-corona/articleshow/75105576.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst\
[43] Wiggers, K. (2020, April 1). Cordio and Rambam Hospital will trial AI that detects coronavirus cases from speech samples. *VentureBeats*. Retrieved from https://venturebeat.com/2020/04/01/cordio-and-rambam-hospital-will-trial-ai-that-detects-coronavirus-cases-from-speech-samples/

patients.[44] Currently under clinical trials at Ramban Medical Center in Israel, the company claims to identify lung changes earlier than patients themselves and aims to identify deterioration within 10-48 hours.[45] One expert however, claims that this technology is likely not going to be useful for monitoring COVID-19 patients.[46] Similar to the efforts put forward by Cordio Medical, the *RESP system* created by Strados Labs in the **USA** records lung sounds to be played back by clinicians and nurses remotely.[47] Though currently only available for investigational use, the company hopes to be able to capture and quantify cough symptoms for the early detection and monitoring of COVID-19.[48] Finally, another **USA**-based initiative (developed through a partnership between MIT researchers, Stanford University researchers, and venture capital fund Atomic) is *Cough for the Cure* which aims to collect cough sounds from individuals with varying symptoms of COVID-19.[49] These sounds will be used to train AI algorithms to detect COVID-19 from audio recordings alone.[50] Ultimately, all of the above voice-based diagnostic tools, if validated, may allow for a completely remote, digital-only diagnostic tool for COVID-19.

4.3. Healthcare Delivery

While digital approaches can provide useful diagnostic information and assist with diagnosis, it is essential for healthcare workers to be able to connect with patients to provide guidance and care. This goal can be accomplished remotely through the use of telemedicine technologies providing *virtual consultations*. Numerous companies around the world have established platforms for healthcare workers to connect with patients virtually. **Pakistan**, **India**, **Nigeria**, and **Kenya** are using apps and websites – including *Sehat Kahani*, *Intelehealth*, *Afridokta*, *TeleDr4You*, *Baidu*, *DoctHERs*, and *BetterNow* – to remotely connect patients with physicians through video chat. TytoCare, a telehealth company that has partnered with over 100 major health systems in the **USA, Europe, Asia**, and **Israel,** recently was acknowledged for its innovative all-in-one telehealth platform that enables AI-powered, on-demand, remote medical exams that responded specifically to the pandemic.[51] In the **Chinese** provinces of Sichuan and Hubei, a 5G network infrastructure has been established to better facilitate and handle video consultations and has been reported as providing "indispensable"

[44] Wiggers, K. (2020, April 1). Cordio and Rambam Hospital will trial AI that detects coronavirus cases from speech samples. *VentureBeats*. Retrieved from https://venturebeat.com/2020/04/01/cordio-and-rambam-hospital-will-trial-ai-that-detects-coronavirus-cases-from-speech-samples/
[45] Ibid.
[46] Glatter, R. (2020, June 23). This New App Analyzes Your Voice Quality To Diagnose Congestive Heart Failure: Can It Help With Covid-19? *Forbes.* Retrieved from https://www.forbes.com/sites/robertglatter/2020/06/23/this-new-app-analyzes-your-voice-quality-to-diagnose-congestive-heart-failure-can-it-help-with-covid-19/#674308d3257a
[47] MDDI. (2020, April 11). Several Telemedicine and Remote-Patient Monitoring Solutions Cutting Through the COVID-19 Clutter. *Medical Device and Diagnostic Industry*. Retrieved from https://www.mddionline.com/several-telemedicine-solutions-cutting-through-covid-19-clutter
[48] Ibid.
[49] Cough for the Cure. (2020). *Cough for the Cure*. Cough for the Cure. Retrieved from https://coughforthecure.com/
[50] Ibid.
[51] Cision. (2020, July 16). Tyto Care Selected as the Winner of the 2020 Extreme Tech Challenge COVID-19 Innovation Award. *Cision.* Retrieved from https://www.prnewswire.com/il/news-releases/tyto-care-selected-as-the-winner-of-the-2020-extreme-tech-challenge-covid-19-innovation-award-301094930.html

communication support.[52] Yet, the 5G network in **China** also plays a role in supporting technology conducting various tasks discussed through the report: unmanned vehicles (i.e. drones) that are monitoring citizens or broadcasting messages; medical robots that help staff to "conduct consultations, disinfection, cleaning, and deliveries;" and temperature detection.[53] In the above situations, video consultations allow patients to remain physically distant and/or self-isolate while also having their progress monitored. *Virtual consultations* are also being leveraged for the triage process and obtaining information for emergency responders to aid in healthcare delivery. 911 dispatch centers in New Orleans, **USA** have started to use video chatting technologies with users to provide more information to emergency responders as well as improve the triage process for both COVID-19 cases and other medical issues.[54] A similar virtual triage assessment center has been developed in a region of Ontario, **Canada** to provide care to individuals.[55] This system links individuals with a physician or nurse practitioner where phone or video appointments are given, usually within a few hours.[56] Approximately 80% of the calls do not require an in-person visit, thereby preventing overcrowding at hospitals and limiting the possible transmission of the virus.[57]

Medication delivery technologies also have been developed to facilitate healthcare while also maintaining physical distancing recommendations and reducing the risk of viral transmission between healthcare workers, patients, and the general public. Drones, such as Google's Wing, **USA**, and Drone Delivery **Canada**, have been identified as excellent tools to deliver essentials, including medications.[58] Drone Delivery Canada is currently in talks with the Canadian federal government to work with health systems and implement this contactless delivery approach.[59] In fact, Drone Delivery Canada is confirmed to be transporting COVID supplies to a First Nation community in

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[52] Industrial Automation Asia. (2020, April 24). The Future of 5G In The COVID-19 Era. *Industrial Automation Asia*. Retrieved from https://www.iaasiaonline.com/the-future-of-5g-in-the-covid-19-era/

[53] Ruize, O. (2020, July 9). 5G's indispensable role in China's fight against COVID-19. *CGTN.* Retrieved from https://news.cgtn.com/news/2020-07-09/5G-s-indispensable-role-in-China-s-fight-against-COVID-19-RXRu9TlZ9S/index.html

[54] Descant, S. (2020, May 13). New Tech Aids 911 Centers During COVID-19 Crisis. *Government Technology*. Retrieved from https://www.govtech.com/public-safety/New-Tech-Aids-911-Centers-During-COVID-19-Crisis.html?utm_term=New%20Tech%20Aids%20911%20Centers%20During%20COVID-19%20Crisis&utm_campaign=Iowa%20Governor%20Delays%20Reopening%20as%20Cases%2C%20Deaths%20Rise%20in%20State&utm_content=email&utm_source=Act-On+Software&utm_medium=email

[55] Arsenault, A., & Barr, J. (2020, May 24). House calls, revisited: Mobile medical team provides in-home care to help take pressure off hospitals. *CBC News.* Retrieved from https://www.cbc.ca/news/health/virtual-triage-assessment-centre-renfrew-1.5579197

[56] Ibid.

[57] Ibid.

[58] De Zeen. (2020, April 15). Google's Wing drones deliver essentials during coronavirus pandemic. *De Zeen*. Retrieved from https://www.dezeen.com/2020/04/15/google-wing-drone-delivery-coronavirus-virginia/?fbclid=IwAR19YpaY3V_GV-iEL31Qr0uwOteScrRk2DRnxljLclb_aVIJs7-OsX1NINA; Drone Delivery Canada. (2020, March 25). Drone Delivery Canada reaches out to healthcare industry for COVID-19 related drone delivery use cases. *Newswire*. Retrieved from https://www.newswire.ca/news-releases/drone-delivery-canada-reaches-out-to-healthcare-industry-for-covid-19-related-drone-delivery-use-cases-839027203.html

[59] Drone Delivery Canada. (2020, March 25). Drone Delivery Canada reaches out to healthcare industry for COVID-19 related drone delivery use cases. *Newswire*. Retrieved from https://www.newswire.ca/news-releases/drone-delivery-canada-reaches-out-to-healthcare-industry-for-covid-19-related-drone-delivery-use-cases-839027203.html

Ontario.[60] Drone technology also is being considered for the transportation of laboratory materials for COVID-19 testing as well as the transportation of contagious wastes for safe disposal, both of which would help limit infected individuals' contact with public areas.[61] Instead of drones, VANTIQ (**USA**) technology is being utilized by The IVT Group, a regional technology services firm based in **Asia**, to create a *Medical Services Queue Management* app that mitigates the risks of COVID-19 by dispensing medicines without manual input.[62] As seen by the examples above, patients with COVID-19 can be managed and treated entirely through virtual means. Such is the case at Jefferson Health in Philadelphia, **USA**, where patients with COVID-19 have been evaluated and treated without referrals to in-person care.[63]

4.4. Decision-Making and Research Support

The final approach to facilitating remote diagnosis and treatment is through supporting decision-making at individual and systemic levels as well as supporting research initiatives. Various technologies also have been deployed to assist frontline healthcare workers with clinical decision-making to best serve patients. InStrat's Global Health Solutions (a company that facilitates improved healthcare delivery in **Africa**) released a COVID-19 app designed to provide front-line healthcare workers with accurate information and screening tools based on the WHO guidelines.[64] An app titled *COVID-19 Triage* also has been developed for healthcare workers in **South Korea** providing guidelines on how to assess a patient's symptoms and epidemiological factors .[65] Similarly, Skymind Holdings has implemented an AI system in a **Malaysian** hospital to support healthcare professionals with diagnoses and early interventions while increasing "medical efficiency."[66]

In addition to providing healthcare workers with support on an individual level, numerous technologies are in the process of development, or have been developed and implemented, to assist healthcare systems with planning and handling large influxes of patients. Computer scientists from the University of Copenhagen, **Denmark** collaborated with Rigshospitalet and Bispebjerg Hospital to create an AI system that calculates the risk of a COVID-19 patient requiring intensive care or a

[60] Reagan, J. (2020, August 4). Drone Delivery Canada transporting COVID Supplies to First Nation Community. *Dronelife.* Retrieved from https://dronelife.com/2020/08/04/drone-delivery-canada-transporting-covid-supplies-to-first-nation-community/

[61] Drone Delivery Canada. (2020, March 25). Drone Delivery Canada reaches out to healthcare industry for COVID-19 related drone delivery use cases. *Newswire*. Retrieved from https://www.newswire.ca/news-releases/drone-delivery-canada-reaches-out-to-healthcare-industry-for-covid-19-related-drone-delivery-use-cases-839027203.html

[62] VANTIQ. (2020). *Countering COVID-19*. VANTIQ. Retrieved from https://vantiq.com/vantiq-coronavirus-applications/

[63] Hollander, J. E., & Carr, B. G. (2020). Virtually Perfect? Telemedicine for COVID-19. *The New England Journal of Medicine*, *382*, 1679–1681. Retrieved from https://doi.org/10.1056/NEJMp2003539

[64] Instrat. (2020). *InStrat's Android COVID-19 Application*. Instrat Global Health Solutions. Retrieved from http://instratghs.com/instrats-android-covid-19-application/

[65] COVID-19 Triage. (2020). *Covid-19 Triage.* Covid-19 Triage. Retrieved from http://ncovcheck.com.s3-website.ap-northeast-2.amazonaws.com/index.html?lang=en#/

[66] BioSpectrum Asia Edition. (2020, April 20). Assistive diagnostic AI tool to tackle COVID-19 in Malaysia. *BioSpectrum Asia Edition*. Retrieved from https://www.biospectrumasia.com/news/91/15811/assistive-diagnostic-ai-tool-to-tackle-covid-19-in-malaysia.html

ventilator.[67] The Jewish General Hospital in Montreal, **Canada** is using an AI platform to obtain reliable daily projections on the expected number of COVID-19 patients.[68] These two digital solutions help the respective hospitals prevent resource shortages, improve resource allocation (such as PPE and beds required), and maximize efficiency.[69] Meanwhile, researchers from New York University (NYU) have partnered with Wenzhou Central Hospital and Cangnan People's Hospital in **China** to develop an AI tool to predict the severity of COVID-19 cases.[70] In addition to its use as a clinical decision-making aid, this tool may be able to determine which patients are in need of hospital resources and which patients can manage the illness from home.[71] VANTIQ (**USA**) has partnered with **Singapore**-based Personify to develop a risk and quarantine management app for hospitals.[72] The app aims to reduce wait times and exposure to the virus by managing the spread of COVID-19 through efficient patient triage, capacity management, and tracking and routing patients.[73] Similarly, EISOT is collaborating with state governments in **Latin America** to monitor the COVID-19 outbreak by leveraging the VANTIQ system.[74] The objective is to create a system that manages the dispatch of emergency services and optimize treatment regionally. Finally, Qventus is working with healthcare systems in the **USA** to "to improve operations and drive more efficient patient flow" by modelling the spread of COVID-19.[75]

Many research groups around the world are working to develop a treatment for COVID-19 and are leveraging ICTs to support these pursuits, particularly through the use of AI. BenevolentAI and the Imperial College of London, **United Kingdom** have developed an AI algorithm to integrate molecular structure data with biomedical information on receptors and diseases to identify drug targets.[76] Insilico Medicine, **Hong Kong** recently partnered with Arctoris, **United Kingdom** – a company that developed the "world's first fully automated drug discovery platform" – to more effectively identify and evaluate novel small molecules which will assist in discovering, synthesizing, and profiling "a set of inhibitors for COVID-19 treatment."[77] Google's DeepMind, **United Kingdom** has developed

[67] University of Copenhagen. (2020, April 2). Artificial Intelligence to predict corona-patients' risk of needing ventilators. *EurekAlert!* Retrieved from https://www.eurekalert.org/pub_releases/2020-04/uoc-ait040220.php
[68] Derfel, A. (2020, April 3). Jewish General Hospital using AI program to project COVID-19 cases. *Montreal Gazette*. Retrieved from https://montrealgazette.com/news/local-news/jewish-general-hospital-using-ai-program-to-project-covid-19-cases/
[69] Derfel, A. (2020, April 3). Jewish General Hospital using AI program to project COVID-19 cases. *Montreal Gazette*. Retrieved from https://montrealgazette.com/news/local-news/jewish-general-hospital-using-ai-program-to-project-covid-19-cases/
[70] NYU School of Medicine. (2020, March 30). Experimental AI tool predicts which COVID-19 patients develop respiratory disease. *Science Daily*. Retrieved from https://www.sciencedaily.com/releases/2020/03/200330152135.htm
[71] Ibid.
[72] VANTIQ. (2020). *Countering COVID-19*. VANTIQ. Retrieved from https://vantiq.com/vantiq-coronavirus-applications/
[73] Ibid.
[74] Ibid.
[75] Qventus. (2020, March 13). Predicting the Effects of the COVID Pandemic On US Health System Capacity. *Qventus*. Retrieved from https://qventus.com/blog/predicting-the-effects-of-the-covid-pandemic-on-us-health-system-capacity/
[76] Richardson, P., Griffin, I., Tucker, C., Smith, D., Oechsle, O., Phelan, A., & Stebbing, J. (2020). Baricitnib as a potential treatment for 2019-nCoV acute respiratory disease. *The Lancet*, *395*(10223), E30–E31.
[77] Henderson, E. (2020, July 9). Insilico Medicine, Arctoris announce technology partnership to discover new COVID-19 drugs. *News Medical Life Sciences.* Retrieved from https://www.news-medical.net/news/20200709/Insilico-Medicine-Arctoris-announce-technology-partnership-to-discover-new-COVID-19-drugs.aspx

algorithms to predict protein folding which is an essential step for identifying drug targets.[78] Through their *Alphafold* system, they have worked with researchers around the world to release structure predictions of varied under-studied proteins associated with COVID-19.[79] Alchemy, **USA** has suggested the use of progeny drugs, as determined by AI algorithms, to fight COVID-19 should initial drugs fail.[80] The **Korean** AI company Deargen used their *Molecule Transformer-Drug Target Interaction* model to identify "commercially available drugs" that could be effective against COVID-19.[81] In Montreal, **Canada,** My Intelligent Machines (MIMs) developed an AI platform called *PandemIA* to personalize COVID-19 treatment and vaccination.[82] By identifying population subgroups most at risk and most associated with specific efficacy and toxicity issues, the platform aims to optimize vaccinations and treatment for each patient.[83] Iktos, **France** and SRI International, **USA** collaborated to develop antiviral therapies for COVID-19 using "deep generative models'' of AI.[84] Similar drug discovery and development technologies are also being explored by Gero, **Singapore**, Exscienta, **United Kingdom**, and SenseTime, **Hong Kong**. These technologies can assist researchers with exploring promising leads as well as save considerable amounts of time and resources.

5. Conclusions

This module describes **public communications, and remote diagnostics and treatment** to help build understanding of how digital technologies have been used to track and control social behaviour during COVID-19. Discussion begins by introducing the concept of public communications, how it is traditionally performed and how they have been applied during COVID-19. Applications are described through one-way and two-way communications approaches. Remote diagnostics and treatment are also described through traditional versus present approaches, and applications are categorized by focus on screening and assessment, healthcare delivery, and decision-making and research support.

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[78] Service, R. F. (2018, December 6). Google's DeepMind aces protein folding. *Science Mag*. Retrieved from https://www.sciencemag.org/news/2018/12/google-s-deepmind-aces-protein-folding;
[79] DeepMind. (2020). *Computational predictions of protein structures associated with COVID-19.* DeepMind.com. Retrieved from https://deepmind.com/research/open-source/computational-predictions-of-protein-structures-associated-with-COVID-19
[80] Moskal, M., Beker, W., Roszak, R., Gajewska, E. P., Wolos, A., Molga, K., Szymkuć, S., Grynkiewicz, G., & Grzybowski, B. (2020). Suggestions for second-pass anti-COVID-19 drugs based on the Artificial Intelligence measures of molecular similarity, shape, and pharmacophore distribution. *ChemRxiv*. Retrieved from https://chemrxiv.org/articles/Suggestions_for_second-pass_anti-COVID-19_drugs_based_on_the_Artificial_Intelligence_measures_of_molecular_similarity_shape_and_pharmacophore_distribution_/12084690/2?file=22286139
[81] Deargen. (2020). Deargen Predicted Potential Antivirals for The Novel Coronavirus Infection using AI. *Deargen*. Retrieved from https://deargen.blog/2020/02/07/deargen-predicting-coronavirus-treatment-using-ai/
[82] MIMs. (2020, April 9). MIMs and its partners are building PandemIA: An explainable Artificial Intelligence platform to personalize COVID-19 vaccination and treatment. *MIMs*. Retrieved from https://www.mims.ai/blog/pandemia-artificial-intelligence-covid-19-vaccination-treatment
[83] Ibid.
[84] SRI International. (2020, March 3). Iktos and SRI International Announce Collaboration to Combine Artificial Intelligence and Novel Automated Discovery Platform for Accelerated Development of New Antiviral Therapies. *SRI International*. Retrieved from https://www.sri.com/iktos-and-sri-international-announce-collaboration-to-combine-artificial-intelligence-and-novel-automated-discovery-platform-for-accelerated-development-of-new-anti-viral-therapies/press-release/

To continue learning more about the digital response to COVID-19:

Executive Summary.
Module 1: Digital Response Overview: Digital Contact Tracing, describes the concept of digital contact tracing and how it works, and explains different types of applications around the world from centralized (involuntary and voluntary) to decentralized interventions.
Module 2: Digital Response Overview: Social Behaviour Monitoring, describes how other types of digital technologies have been used to monitor and control social behaviours, such as the use of eBracelets to ensure that people self-isolate.