Digital Health Surveillance and COVID-19

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***Abstract*—This paper summarises four presentations in a special track of the 15th International Conference on Digital Society entitled "Digital Health Surveillance and COVID-19". Faced with a virus of unknown pathogenicity, transmission, and treatment, governments and public health agencies sought to control the spread of COVID-19 using a variety of mechanisms including stay-at-home orders, social distancing, and self-isolation. Health surveillance and digital technologies, in general, enable governments and public health agencies to reduce the transmission and mitigate the morbidity and mortality associated with COVID-19, locally, regionally, and internationally. In addition to existing national health surveillance systems, the COVID-19 pandemic has seen the widespread introduction of additional new digital technologies and capacities for rapid pandemic response and tracking, infection screening, contact tracing, quarantine and self-isolation, health delivery, clinical management, as well as countering misinformation. The research work in this track addresses the adoption and use of three discrete digital technologies impact impacting public health response to COVID-19 - digital contact tracing, telemedecine, and social bots. These papers contribute to our understanding of how health communications and surveillance is enacted through digital technologies in a global pandemic, and provide timely theoretical and practical insights to academia, policymakers, and practitioners.**

Keywords*—*Health Surveillance; COVID-19; Contact Tracing; Telemedicine; Social Media; Anti-vaccination; Antivaxx; Social Bots; Technology Adoption and Use; Technology Acceptance

I. Introduction

For most of 2020, governments and public health agencies worldwide were faced with a highly transmissable virus of unknown pathnogenicity and treatment but with relatively high fatality rates. Stay-at-home orders, closure of non-essential businesses and public amenities, travel restrictions, social distancing and self-isolation were just some of the common non-pharmaceutical interventions implemented globally. While these interventions helped to control the spread of COVID-19, they highlighted the challenges of continuing delivery of traditional health services, health surveillance, and contact tracing that relied on physical human interactions.

The relatively recent convergence and ubiquity of cloud computing, mobile telecommunications, Big Data analytics, social media, and the Internet of Things enabled society as a whole to continue to function during the COVID-19 pandemic, and lifted a significant part of the burden in health surveillance and clinical management. In particular, health surveillance and contact tracing has been transformed. New digital technologies and capabilities have been implemented for pandemic response and tracking, infection screening, contact tracing, quarantine and self-isolation, health delivery, and clinical management [1]. These innovations come with a cost, not least freedom of movement and privacy.

The effectiveness of many of these technologies, and specifically social distancing and contact tracing, depends on high uptake of the technologies by the overwhelming majority of the population. Yet, these innovations combine technologies such as location based services, mobile health, and artificial intelligence, with which many citizens have significant concerns. Adoption hesitancy for both digital and non-digital innovations, for example vaccines, is further fueled by misinformation and disinformation on social media and sometimes from those in authority. Consequently, it is critical that we have a greater understanding of the drivers of not only adoption and use of health innovations, but also non-use including user hesitancy and rejection.

This special track included four papers that contribute to our understanding and application of how ehealth and health surveillance is enacted through digital technologies in a range of international contexts.

II. Submissions

The first two papers deal with the adoption and use of digital contact tracing although through different theoretical lens and empirical contexts. Firstly, Fox et al. [2] present "A Longitudinal Analysis of the Determinants of Citizen Acceptance of Contact Tracing Mobile Apps" in which they combine the Privacy Calculus Theory (PCT) with (i) Social Exchange Theory (SET) and (ii) separately with Procedural Fairness Theory (PFT) to explore the influence of privacy perceptions, positive beliefs and trust on citizen acceptance of mobile contact tracing apps in Ireland. The study is notable as they collect data one month prior to the introduction of the Irish COVID-19 contact tracing app (T1) and then one month after (T2). They test their proposed model via

Structured Equation Modelling. Preliminary evidence suggests that perceived benefits, social influence and trust are positively related to adoption and disclosure intentions, while, somewhat unsurprisingly, privacy concerns have a negative effect.

The second paper entitled "A Preliminary Analysis of the Determinants of Acceptance of Contact Tracing Apps in Brazil" is on a similar topic to Fox et al. [2] however explores adoption and use of contact tracing apps through the lens of PCT and Social Contact Theory (SCT) [3]. In addition to the difference in theoretical lens, Endo et al. [**?**] explore non-users and users in in Brazil, one of the largest countries in the world by population and size but also one of the countries worst hit by COVID-19 in terms of infections and deaths. The theoretical and empirical juxtaposition is interesting given the cultural differences between Ireland and Brazil. Cultural differences can have a significant impact on privacy concerns and therefore it is surprising that the findings are so similar. Here, Endo et al. [3] find that perceived privacy, reciprocal benefits, and social influence have a positive effect on individuals' intentions to download or continue use of contact tracing apps. Furthermore, intention to adopt, perceived privacy, and reciprocal benefits have a positive effect on intention to disclose information. Furthermore, they report differences in findings from users and non-users. Perceived health benefits had a positive effect on intention to continue to use contact tracing apps by users while it has a negative effect on non-users' intention to adopt [3]. The difference in user and non-user findings is noteworthy. All too often the focus of innovation diffusion research is on adoption and use and not user resistance or technology rejection. Indeed, these categories may not be entirely useful as they assume all non-users are alike, with homogeneous attitudes and behaviour. In reality, it is much more nuanced and research suggests a wide variety of reasons for non-use including technology anxiety, privacy concerns, lack of awareness, confusion, digital access, digital competence, exclusion, and indeed rejection of the technology and the technology provider [4]. Indeed, hesitancy to adopt a contact tracing app in the context of COVID-19 may indeed be a denial of the disease itself.

Egli et al. [5] pursue a related topic to vaccine hesitancy and denial in the third paper in the track entitled "Bad Robot: A Preliminary Exploration of the Prevalence of Automated Software Programmes and Social Bots in the COVID-19 #antivaxx Discourse on Twitter". This paper examines the role of social media, in this case Twitter, as a health information source. This paper situates itself in December 2020 as the first COVID-19 vaccines are approved and rolled out in the US. Using a data set of 8,949 English-language tweets featuring the #antivaxx hashtag, they explore (a) the prevalence of automated software and social bots in the #antivaxx discourse on Twitter during the focal period, (b) the prevalence of social bot use by active and visible users, and (c) the effectiveness of social network platforms to moderate misinformation. The findings are surprising in that it would seem that the overwhelming majority of participants engaged in this particular discourse, or at least using the #antivaxx hashtag, are pro-vaccination supporters and while there is evidence of social bot use, for the large part, it is in support of vaccinations. Egli et al. [5] also note that Twitter seems to be effective in policing misuse with respect to the anti-vaccination movement including warnings when one searches for related tweets. The authors note that this research is *preliminary* and it may well be that the anti-vaccination movement is active in the wider COVID-19 discourse on social media and just does not participate in the #antivaxx discourse as it is too easy for their opponents to target them. Additionally, it may be that there is a "shy anti-vaxxer" phenomenon and that vaccine deniers or those who are hesitant do not participate visibly on social media for fear of reprisals.

The final paper is a Polish paper by Grata-Borkowska et al. [6] entitled "Use of Medical Teleconsultations During the COVID-19 Pandemic in Poland - Preliminary Results" which examines the use of telemedicine in the Lower Silesia District of Poland during COVID-19. This paper is timely given that prior to COVID-19, Poland ranked 17th in the EU in e-health adoption and use, with just 14% of Poles having used health and care services provided online [7]. Similarly, e-Prescriptions were used by only 7% of general practitioners (GPs) and only 16% of GPs exchanged medical data compared to EU averages of 50% and 43% respectively [7]. The COVID-19 effect on digital acceleration has been much discussed by the media and commentators. Here, Grata-Borkowska et al. [6] provide real evidence of not only significant rates of adoption for telemedicine but satisfaction with teleconferencing as a means of clinical consultation. This is not to say there are no drawbacks. Over 80% of respondents surveyed cite the inability to physically examine the patient and reliably verify the patient's condition as a significant disadvantage [6]. Notwithstanding this, 97% of respondents claimed that they would continue to use teleconferencing for consultations post-pandemic.

III. Conclusion

The papers in this track suggest that research into both ehealth and health surveillance adoption and use, as well as non-use and user hesitancy to adopt, remains a fruitful of area for research. In particular, one might argue that the COVID-19 pandemic, the common international responses, and the shared global experience it represents presents a wealth of opportunity for researchers. In particular, there is a need to review the existing research base and examine whether there is a need for renovation. The papers in this track present a number of tensions in a variety of empirical contexts including tensions between health and privacy concerns, health decision-makers and citizens, users (adopters) and non-users (non-adopters), vaccination supporters and vaccination deniers, and arguably health professionals and patients. It is important to recognise that each of these stakeholder groups are not necessarily binary and homogeneous but rather represent people of different cultural, socio-technological, political and personal contexts and lie along various points along a continuum. Understanding the antecedents for rejection, hesitancy, adoption and use will

help health decision-makers and technologists design better and targeted e-health and health surveillance programmes and technologies while providing citizens with the necessary control, assurance, and accountability.

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