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Co-learning in crisis: A comparative analysis of digital preparedness during COVID-19 in Taiwan and the United Kingdom

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ABSTRACT

This article provides a comparative analysis of digital interventions implemented in Taiwan and the UK during the COVID-19 pandemic to examine how national contexts shaped the rollout and reception of these technologies. Our analysis challenges the simplistic East/West divide often invoked in pandemic response analyses, which arose during and in the wake of the pandemic, arguing that successes or failures of digital health interventions must exceed assumed cultural traits in East or West, and consider sociohistorical factors, legal frameworks, and specific political contexts. By advancing interdisciplinary co-learning between research communities in Taiwan and the UK, this article offers actionable insights for enhancing digital preparedness for future global public health emergencies, underscoring the importance of cultures of preparedness, transparency, and public trust and responsible data governance for digital health technologies.

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Introduction

In the wake of COVID-19, there has been a marked increase in comparative scholarship and research seeking to understand important differences, similarities, and lessons learned in countries' digital responses to disease outbreaks like COVID-19 across the globe. Diverse and varied in scope, this research has focused on crisis, knowledge and politics (Jasanoff et al., 2021), digital adoption in global health systems leading up to COVID-19 (Heinrichs et al., 2022), assessments of regional government responses to COVID-19, particularly in East and Southeast Asia (Chen et al., 2021), comparative analyses of digital health systems during COVID-19 in Asian countries, including Taiwan (Kulnarni & Tamgadge, 2021), and how lessons learned from past outbreaks, including the Middle East respiratory syndrome (MERS) in East Asian states can better inform responses to public health emergencies (Feitelson et al., 2022).

However, despite ongoing research, very little comparative scholarship has been undertaken during and after the COVID-19 that specifically investigates how digital technologies, which collect and/or process data (including quarantine-monitoring and digital contact-tracing apps), were implemented across different countries to respond to the pandemic and how national contexts shaped these responses, especially across countries in the East and West. This is a disservice, as the COVID-19 pandemic continues to underscore the need for timely, cohesive, and effective collection, exchange, and analysis of health data via digital technologies to better understand, research and respond to new and ongoing outbreaks (Austin et al., 2021; Budd et al., 2020; Dron et al., 2022; Pratt & Bull, 2021). Understanding the range of experiences, opportunities, and challenges brought forward by digital interventions in different countries during health emergencies is crucial to informing ongoing and future preparedness activities for emergent and re-emergent disease outbreaks. As Shadbolt et al. (2022, p. 1) have emphasised, '[i]n the context of infectious disease control, every facet of the understanding we seek to achieve is underpinned by data'. If we are to

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use these data, we need to understand how interventions to collect digital health data during COVID-19 unfolded across diverse global contexts.

At the same time, in the aftermath of the COVID-19 pandemic, and with growing concerns and calls for vigilance regarding the onset of future public health emergencies (Dye & Barclay, 2024), much is still unclear and unknown regarding the rollout of digital technologies during COVID-19, particularly during the pandemic's emergency phase (2020–2023). Considering this knowledge gap, this study comparatively analyses digital responses during the COVID-19 emergency phase in Taiwan and the United Kingdom (UK), two liberal democratic countries with different geographical, historical, and political contexts. The article is structured as follows. First, we present and describe the value of using a collaborative co-learning method of analysis to examine the contexts of our two case studies and the importance of examining pandemic histories and modes of preparedness in East/West democracies. Second, we focus on the Taiwanese story, journeying through the implementation of the Taiwan's widely cited electric fence programme, Taiwan's social distancing app (TSDA), and the 1922 SMS Contact Tracing System. We then introduce the UK's primary digital response: the development, trial, and implementation of the National Health Service (NHS) COVID-19 contact-tracing app. We finally bring the two cases together to explore critical lessons for ongoing digital preparedness for future public health emergencies in both countries.

The need for collaborative co-learning in East/West contexts

To address important research gaps in digital preparedness in Taiwan and the UK, we introduced and utilised a *co-learning* method between the Taiwan and UK teams involved with this research project. Adapted from its disciplinary origins in education and pedagogical sciences, we draw upon and integrate Laal and Ghodsi (2012, pp. 486–487) define collaborative learning as an 'approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task or create a product'. As these authors have underscored, the need for this type of human collaboration and engagement across groups has become a twenty-first-century trend, with a growing need for diverse groups to think and work together as the range of critical issues around the globe has increased (2012, pp. 486–487). Elsewhere, in the contexts of global health research, 'a focus on equitable co-learning allows for individuals, teams and institutions to learn from each other' and 'equitable and effective collaboration with an emphasis on co-learning, creates an environment that enables the translation of scientific knowledge to public health action' (Stewart-Ibarra et al., 2022, pp. 2–5).

Building from this, we adapted a collaborative co-learning approach to assessing and understanding key differences and similarities in digital preparedness in Taiwan and the UK during COVID-19 to better inform responses to future outbreaks and public health emergencies. This included reciprocal and reflective exchanges of information, experiences, and expertise between interdisciplinary Taiwanese and UK researchers and scientific networks in the context of a joint one-year research project. This project involved a week-long immersive country visit for both country teams, along with regular online meetings, to explore the nuanced understandings of important factors associated with the sociopolitical contexts of digital preparedness in each country.

In particular, the week-long immersive country visit created an opportunity for both teams to engage with key institutions in Taiwan and the United Kingdom that are central to digital data governance and epidemic prevention, including public health agencies, data research and policy institutes, and science media centres. Through these encounters, we not only listened to the experiences and perspectives of professionals but also engaged in sustained discussions around the critical issues that surfaced in the context of COVID-19. Within this iterative process of dialogue and reflection, many of the central themes of this paper gradually took shape. In this way, our collaborative co-learning approach was further strengthened by the co-analysis of UK and Taiwan academic, policy, government, and archival documents related to digital interventions in both countries.

On similarities and differences: COVID-19, Taiwan and the UK

In post-pandemic assessments, Taiwan and the UK appear to offer sharp national similarities and important contrasts in each country's navigation of COVID-19. For example, both countries are maritime states that

have received much attention in terms of how national borders can be regulated to control the spread of COVID-19; both countries have established centralised national health systems that provide universal health coverage and, during the emergency phases of COVID-19, featured heavily as key response institutions – Taiwan's National Health Insurance (NHI) system and the UK's NHS – both countries have political systems and histories traditionally dominated by two-party political systems. While the UK has traditionally exemplified one of the liberal democratic models in the West and Taiwan showcases the achievement of a young democracy in East Asia (Sacks, 2024), both are regarded as vibrant democracies in an era marked by increased political polarisation and authoritarianism (Our World in Data, 2023).

Despite these similarities, larger national contexts and early response models to COVID-19 differed between the countries. Taiwan became cited for the 'Taiwan Model', a term proposed by President Tsai Ing-Wen in May 2020, which received global attention for the country's digital capacities and infrastructures to be integrated into large public health and pandemic response initiatives to combat the spread of COVID-19 without disrupting social orders or sacrificing human rights (Office of the President Republic of China (Taiwan), 2021; Wu, 2022).

Strategically, the 'Taiwan Model' was noted for proactive and timely responses to COVID-19, including mandatory incoming passenger quarantine to the country and border screening, extending back as far as late 2019 and long before the declaration of COVID-19 by the World Health Organization (WHO) as a *public health emergency of international concern* (PHEIC) on 30 January 2020. Taiwan's early pandemic response model mobilised actors across Taiwan, including the government, civil society, tech start-up communities, and invested in 'digital resilience' capacities (Lee et al., 2023), such as the government's utilisation of existing digital health insurance data for enhanced border control and surveillance. During the early months of COVID-19, as the coronavirus overwhelmed healthcare systems and national lockdowns were rapidly enacted across the globe, Taiwan avoided these drastic impacts of the pandemic and was celebrated in global media outlets for its digitised, data-driven response to the pandemic, which had 'beaten' COVID-19 (Farr & Gao, 2020; Nabben, 2020).

In contrast, in the UK, responses to counter the spread of COVID-19 at key intervals of the critical early phase played out within highly fragmented and contested contexts. In juxtaposition to the Taiwan model, consistent and clear public health messaging around COVID-19, as well as foundational outbreak responses, including community contact tracing, were lacking (Iacobucci, 2020) and were identified as early key drivers of climbing infections, which led to the imposition of the first UK national lockdown in March 2020. At the onset of the pandemic, while the UK government emphasised how the 'power of data in a pandemic [could] provide a single source of truth about the rapidly evolving situation' (Gould et al., 2020), strong public concerns for privacy mounted on how digital data could be collected, used and exchanged between government, healthcare and Big Tech actors in the UK's COVID-19 'data goldrush' (Cox, 2020).

Despite the different pandemic histories of COVID-19 in Taiwan and the UK, in the aftermath of COVID-19, there remains a lack of overall research and focus on how the rollout of digital technologies for data collection occurred in both countries and how national contexts shaped and impacted the piloting of these interventions.

Taiwan

Legacies of outbreak preparedness and advanced deployment

Throughout COVID-19 and particularly during critical early phases, Taiwan's pandemic response was often constructed and presented by global media outlets, policy circles, and scientific communities as a success story and a case study for effective pandemic response (Institute for Government, 2020; Aspinwall, 2020; Graham-Harrison & Davidson, 2021; Steinbrook, 2021). Below, we examine this narrative, which rapidly circulated the globe as infections from COVID-19 spiked across countries.

In both public and official discourses, Taiwan's proactive and timely responses to the COVID-19 pandemic were connected to experiences and lessons acquired during the severe acute respiratory syndrome (SARS-CoV–1) outbreak in 2003. Following the early detection of coronavirus in 2019, the Taiwanese government emphasised that, based on the accumulated experience during the first SARS

epidemic, it had increased its capacity to respond to the coronavirus outbreak with immediate and impactful effects. This was underscored by the Taiwanese Centres for Disease Control (CDC), which emphasised that 'when the SARS epidemic occurred in 2003, there was no effective cooperation among government departments in place. After the epidemic, the central government strengthened cooperation and learned to maximise the effectiveness of epidemic prevention' (Ministry of Health and Welfare, 2020).

Within this context of epidemic vigilance, the Taiwan CDC became cautious about the deaths and illnesses due to unidentifiable, novel pneumonia being reported in China in late 2019, and preventive measures were promptly implemented in early 2020, even before its border closures in March 2020. Digital infrastructures were central to the early success of Taiwan's pandemic response. The Central Epidemic Command Center (CECC) began health screenings and collected passenger data for arrivals in December 2019 and January 2020. This rapid mobilisation, built on existing digital systems, was framed as both legally and politically justified, and it reassured the public through narratives of a 'safe island', popularised by the Taiwan Public Television Service programme, Our Island (Huang, 2021), and of Taiwan's 'advanced deployment' (超前部署) in contrast to a 'dangerous elsewhere' amid rising global transmissions (Li & Lee, 2023). Crucially, this language did more than describe policy; it also helped mobilise national sentiment.

During the pandemic, the discourse of 'advanced deployment' and similar rhetoric were associated with the Taiwanese government approach that leveraged digital capacity and anticipatory governance as markers of competence and tools to galvanise public support. An example is when an initial shortage of face masks caused public fear, the government moved swiftly to persuade specific manufacturers to form a 'national team' (國家隊) to support the pandemic response by prioritising the production of such supplies. In another example, this discourse was extended internationally, as a diplomatic gesture, to Taiwan's sending of protective masks to other countries with the slogan 'Taiwan Can Help', positioning Taiwan as a committed partner to support the health and wellbeing of the international community in the wake of the pandemic. These discursive practices sat alongside military metaphors associated with a collective desire for security against the new disease from China, which was roundly criticised for its slow and unclear reporting of the initial coronavirus outbreak and was further accused of producing and circulating global digital disinformation regarding the pandemic (Kurlantzick, 2020; Li & Lee, 2023; Sparrow, 2021).

Taiwan's electric fence programme

Taiwan's electric fence programme combined digital mobile phone tracing and locator technologies, which triangulated with accessible NHI data, to enable the surveillance of individuals in quarantine and formed an unprecedented, digitised approach to contact tracing of infected individuals (Chen et al., 2020). It was built as an assemblage of digital infrastructures, including NHI patient data, immigration and customs databases, and roaming and GPS data collection processes (Lin, 2021). The programme began with the Diamond Princess cruise ship outbreak, leaving from Keelung, Taiwan, on 31 January 2020 and subsequently led to the quarantine of the vessel at Yokohama Port, Japan, following Taiwan's public warning regarding a mitigation plan to identify and trace identified potential cases. In building upon Taiwan's unique political and epidemic histories, as well as levels of mutual trust between the Taiwanese population and government (Huang, 2020), the electric fence programme was paired alongside Taiwanese nationalistic sentiments against the international marginalisation of Taiwan and the need for national self-reliance to respond to the pandemic (Lee & Yeh, 2022).

The 'advanced deployment' discourse was further legitimised by the *Communicable Disease Control Act*, along with a *Special Act for Prevention, Relief, and Revitalisation Measure for Severe Pneumonia with Pathogens* (adopted on 25 February 2020 and revoked on 1 July 2023). Controversially, however, this legal framework bypassed the *Personal Data Protection Act*, which established protocols for traditional methods of collecting data for contact tracing and set no endpoint for data collection regarding disease surveillance during the pandemic (Lin, 2021). As the pandemic progressed beyond its first year, the electric fence programme became emblematic of the early phases of COVID-19, associated with the need to contain and maintain low levels of infection, ensure effective quarantine of exposed individuals, and halt the import of coronavirus into the country. In the next year of the pandemic, however, digitisation would also feature in its second act, which corresponded to shifting pandemic contexts in Taiwan.

Taiwan's social distancing app and the 1922 SMS contact tracing system

For over one year from 2020 to 2021, the Taiwanese model of pandemic response resulted in low levels of infection and importation of COVID-19 into the country, which was attributed to the rapid implementation of comprehensive surveillance, decisive border control and digital information technology support (Cheng & Liu, 2022). As many countries entered 2021 in various stages of continued national lockdown, overall cases of infections, hospitalisations, and deaths in Taiwan remained low.

After nearly a year of comparative freedom, Taiwan faced its first major outbreak in 2021, which is linked to and exposes the harsh reality of inadequate pre-emptive measures and planning, exemplified by a significant COVID-19 vaccine shortage. Amid the introduction of a new phase of the pandemic in Taiwan and with the need to regulate rising cases, in May 2021, the *Taiwan Social Distancing App* (台灣社交距離, TSDA), which had been co-developed by the Executive Yuan's Department of Cyber Security in partnership with the domestic Taiwan AI Labs, was launched by the Taiwanese CDC. The TSDA also drew sharp contrasts with the earlier electric fence programme, which sought to use digital assemblages to draw a boundary of containment between Taiwan and the rest of the world, unlike the TSDA, which now sought to demarcate and forecast zones of safety and/or exposure within Taiwan where COVID-19 was now in wide circulation.

Like other contact tracing apps employed in many other countries earlier in 2020 (Bengy Puyvallée & Storeng, 2021), the TSDA informed people potentially exposed to infection via Bluetooth signal strength obtained from smartphones, with contact history being stored over 14 days. To address data privacy concerns, the collected data were inoperable and would not be accessible to other government departments or third-party actors. Additionally, like other contact tracing apps, the app requires a high level of downloads to reach a threshold of effectiveness. To encourage downloads, the Taiwanese media extensively covered and reported on the UK's NHS COVID-19 app, which had been previously launched in England and Wales in September 2020. To further streamline the uptake and emphasise the importance of the TSDA, the remarks of Matt Hancock, the former UK Secretary of State for Health and Social Care, were circulated on Taiwan's news: 'Downloading the app can help protect yourself, loved ones, and the community. The more people download, the more effective the app becomes' (Sparrow & Marsh, 2020). By the end of 2021, and likely related to these discourses of social responsibility and togetherness, the app had been downloaded more than 10 million times, constituting almost half of the population of Taiwan (Huang et al., 2024). However, the rollout of the app was not fully uncontested in Taiwan, and sudden and rapid app downloads led to public unease surrounding the growing unpreparedness of the situation in which Taiwan now found itself. This was coupled with concerns that Taiwan's digital technocracy could increasingly pose a risk to individual privacy, already marginalised groups, and human rights in Taiwan's ongoing efforts to control the pandemic (Lee, 2021).

Despite these concerns, the *1922 SMS Contact Tracing System* (實聯制) was introduced by the Ministry of Digital Affairs of Taiwan. According to Tang (2021), then the Minister of Digital Affairs, the SMS Contact Tracing System was a collaborative effort 'with the five major telecommunications carriers', also contributed by the eMask rationing teams established in 2020. Extending from TSDA as the pandemic continued in Taiwan, the SMS Contact Tracing System required all residents to scan a QR Code before entering public places. This enabled the Taiwanese CECC to inform individuals of high-risk locations where infections or potential exposures had been reported. The use of the SMS Contact Tracing System marked an important shift in digital intervention contexts in Taiwan: unlike the earlier electric fence programme, for which individuals in quarantine were not able to opt-out of digital interfaces, citizens were encouraged to 'actively opt-in'.

Nevertheless, despite safeguarding commitments put in place by the government, the launching of both the TSDA and the 1922 SMS Contact Tracing System were met with concerns regarding data privacy and security around the surveillance enabled by these digital tools (Hsieh et al., 2024). Given these concerns, outcry peaked when it was widely reported that the Taiwanese police force gained access to these data for the purpose of locating a criminal suspect (Chang & Liao, 2022). Not only did this data scandal damage and weaken public faith in the transparency of the government's ongoing pandemic response strategy, but it also brought increased scrutiny and public concern forward regarding the setting of 'dangerous precedents

of bypassing data protection and due process requirements' within these emergency pandemic contexts in Taiwan (Chang & Liao, 2022).

The United Kingdom (UK)

A decade of critical unpreparedness

In juxtaposition to Taiwan's advanced border deployment and collection of digital data via the electric fence programme, the regulation of the UK's border throughout the pandemic was marked by inconsistency and flux. During the early months of the pandemic, self-isolation for people returning from affected countries remained voluntary. On 13 March 2020, all self-isolation guidance for travellers arriving in the UK was removed, 'at a time when other comparable countries were strengthening their border measures, and when hundreds of new COVID cases were arriving every day' (UK Parliament Committees, 2020). While the first cases of COVID-19 were identified in late January 2020, it was not until 8 June 2020 that the first mandatory border regulations requiring incoming passengers to the UK to self-isolate for 14 days were introduced by the government, only to be eased three weeks later as the government moved to ease coronavirus measures in the summer of 2020 (UK Parliament Committees, 2020).

Even prior to COVID-19, there was a substantial weakening of the UK's capacity to respond effectively to a wide-scale public health emergency. Unlike Taiwan, the government was on the global periphery of the outbreak of SARS from 2002–2003, reporting only a few cases overall. Some years later, the UK again reported several hundred deaths during the 2009 H1N1 swine flu pandemic. During this period, pandemic influenza was recognised as the top non-malicious risk and an emerging infectious disease as one of the most significant risks outlined in the UK's *National Risk Register* (National Audit Office, 2021). Moreover, in the wake of the 2009 H1N1 swine flu pandemic, the UK updated and launched the *UK Influenza Preparedness Strategy*. Drawing on the recent experience of the swine flu pandemic, the updated strategy sought to '[d]evelop better plans for the initial response to a new influenza pandemic when the focus should be on rapid and accurate assessment of the nature of the influenza virus and its effects, both clinically and in relation to wider public health implications' (Department for Health, 2011:7).

However, despite this elevation and recognition of pandemic risk, particularly pandemic influenza, in the UK, sustainable preparedness systems fell out of sync even as a series of new global public health emergencies unfolded from the 2010s onward. This absence of integrated preparedness across the UK in the wake of mounting outbreaks was further illustrated by two critical warnings. First, the Centre for Health and the Public Interest (CHPI) 2014 Report warned that the NHS was not prepared for the onset of a future pandemic. Second, Exercise Cygnus (2016), a large-scale cross-government simulation exercise organised to assess the UK's capacity to respond to and manage a serious influenza pandemic, casts doubt on the UK's ability to manage such an acute public health emergency and provides further specific warning for the impacts that such an outbreak could have on UK health system stress and for care homes.

Unlike Taiwan, the UK entered the COVID-19 pandemic with markedly differing capacities and experiences of outbreak preparedness. Whereas early response to Taiwan utilised digitisation in rapid border control and screening and was built upon accumulated expertise from past outbreaks, the UK lacked critical experience in managing large-scale outbreaks and, rather, implemented shifting and inconsistent policies of border control and screening despite its perceived geographical advantage as an island nation. These lagging and fragmented early responses to the pandemic critically impact and shape key aspects of the UK's pandemic response strategy, including the contested and uneven implementation and uptake of digital technologies.

The NHS COVID-19 app

With the onset of the pandemic and periods of delayed response in the UK between January and March 2020, cases began to rapidly climb, resulting in panic across the country and calls for the government to enact a swift response. Here, digital contact tracing apps emerged as a potential approach to control rising infections, as the West looked to the East for potential effective solutions following the rollout of digital

technologies, paired with the then effective case-control in East Asian countries like Singapore, South Korea, and Taiwan (Huang et al., 2020).

As demonstrated, however, the UK was significantly delayed compared to Taiwan and other East Asian states in initial and proactive outbreak responses, and moves to develop a digital contact-tracing infrastructure were rushed in early spring 2020, led by NHSX, the NHS unit responsible for digital innovation at the time. Within these timeframes and amid an atmosphere of growing crisis, NHSX was under enormous pressure to develop an app at immense speed (Samuel & Lucivero, 2022) – work commenced in February 2020 and was ready for trial in May. During the initial stages of development, the UK made the decision to develop a contact tracing app that collected data and stored it in a centralized database (Jones, 2020). This meant that when a positive case was registered on the app, all devices that recently shared a code would receive an alert to self-isolate. Data from the positive case's app, as well as from the devices with which the user had been in contact, were then transmitted to a central anonymised database. The aim of the centralised data collection model was to enable public health authorities to understand the spread of reported symptoms and the virus across exposed contacts and to further enable the development of specific interventions to contain viral spread.

However, during the months within which the app was in development, significant public and policy debate and concern gained momentum in the UK about the privacy aspect of the app. Privacy advocates in the UK were worried about access to data in the centralised model, as well as the data being re-purposed for other uses (Ada Lovelace Institute, 2020). Many commentators compared the centralised approach to app development as 'privacy-diminishing' in comparison to what they perceived as a more 'privacy enhancing' decentralised model, which was being adopted in many European countries (Abeler et al., 2020) and was based on an application programming interface (API) provided by Google and Apple. In this latter model, when a user alerts an app that they have tested positive for COVID-19, the random codes shared by devices predominantly remain on people's phones. Other concerns also began to emerge, including the governance of app development, democratic processes and oversight and important discussions around solidarity and the uptake of the app when it was launched (Samuel et al., 2022). To respond to these public concerns, an Ethics Advisory Board (EAB) was established to provide timely advice, guidance and recommendations on ethical issues associated with the app's development (Gould & Lewis, 2020). However, criticisms also emerged from academic and research communities in the UK and around the globe, who collectively warned against the implementation of a centralised approach to digital contact-tracing citing impacts on personal privacy (Joint Statement on Contact-Tracing, 2020).

Amid continued public debate on the place of privacy within these contact-tracing operations, the UK NHSX app was trialled on the Isle of Wight in May and June 2020. The app was presented as vital in response to COVID-19 and was mobilised using collective discourses that were published and disseminated across local news outlets on the Isle of Wight that encouraged individuals to participate in the trial by appealing to Island interests, identity and social obligations (Jasanoff & Kim, 2009; Matheson et al., 2024). Through a mixture of both promissory discourses and altruistic discourses of solidarity regarding the trial of the app (Samuel & Sims, 2023), an imaginary was created in the context of the app trial that was imbued with implicit understandings of what is good or desirable conduct in the pandemic context. These emerging discourses, coupled with framings of how technological advancements constitute forces of good (Floridi, 2023), played an important role in shaping perceptions of whether to use the technology during its trial.

Indeed, the potential for health benefits and uptake of the app seemed closely connected with the threat posed by COVID-19; that is, the health benefit of using the app among residents of the Isle of Wight was synonymous with risk management during the pandemic. Reflected in Samuel and Sims (2023) qualitative study on the rollout of the app during its trial, interviewees discussed and expressed different perceptions of safety and risk understood through interacting with and uptake of the contact-tracing app: 'I downloaded it…because I wanted to keep safe' (interviewee 15); and as another respondent reflected: 'I have taken my [app] off, now I feel less safe…[.].more vulnerable…[.].I haven't got any of that safeguard at the minute' (interviewee 14). In this way, the threat of COVID-19 seemed to have significantly shaped willingness to engage with the trial of the app by the communities of the Isle of Wight and, therefore, the benefit or protection the app ostensibly promised, trumping any concerns which respondents initially held either regarding the app itself or the UK government during the period of the app's trial.

Despite this initial rollout and the willingness of trial participants to engage with the centralised digital contact-tracing app, the trial was halted in June 2020 because of reported technological issues. Further observations during this period also revealed how the cancelling of the digital contact-tracing app was linked to ongoing and pervasive privacy concerns across larger UK contexts, which led to the redesign of the app to utilise the Google/Apple API (White, 2021) and widely held perceptions that decentralised contact-tracing models were scientifically safer or more privacy-preserving than their centralised counterparts (White & van Basshuysen, 2021). Following this, a new decentralised app was launched in England and Wales in September 2020, eight months after the first reporting of cases in the UK, and it became the main contact-tracing app used for the duration of the pandemic in these countries.

Subsequent research, however, has indicated how the use of the original centralised app during the Isle of Wight trial was indeed associated with a marked reduction in the spread of COVID-19 during the time of its operation (Kendall et al., 2020). Within the public debates regarding the UK's contact-tracing app, concerns for privacy amid these digital innovations originated from an established network of lobbyists who possessed strong social legitimacy in the UK in the years leading up to COVID-19 (Samuel & Lucivero, 2022). Importantly, in UK contexts, the recent past provides many examples of how privacy advocates and groups have protested and shaped public perceptions towards a range of public policy agendas, ranging from national censuses in the European Union to national identity cards in the UK and worldwide (Bennett & Lyon, 2008; Hurwitz & Jaffer, 2020).

In addition to national privacy debates, over the past decade, UK public trust has eroded in the wake of a series of 'Big Data disasters' (McDonald, 2016), including the Snowden whistleblowing of UK government surveillance capacities, the Google DeepMind-Royal Free Hospital data-transfer breach, and the Cambridge-Analytica data-harvesting scandal, all of which further inflamed public concerns and pervasive debate around digital data collection and retention of data in areas of health and security in the UK. This weakened trust in the government was reflected further in survey data carried out early in the pandemic, which revealed that while three-quarters of those surveyed were confident that they could download and use a contact tracing app, only approximately 40% indicated that they were confident in the ability of the government to protect personal data (Duffy, 2020). Other surveys conducted simultaneously found similar support for contact tracing apps, yet a quarter of participants were anxious about government surveillance after the pandemic (Abeler et al., 2020).

Further qualitative research conducted during this time in the UK also presented mixed views on proposals to utilise digital contact tracing apps as a response to COVID-19 in the UK. These views ranged from those who were very supportive of using apps for contact tracing and spoke in terms of solidarity about using the data for research purposes for the benefit of all to those who were extremely cautious about digital contact tracing apps because of distrust in the UK government, in terms of privacy and surveillance issues, and in terms of matters related to the growing and expanding digital 'Big Data' landscape that the interviewees felt increasingly subsumed within and resigned to. These views and concerns were operationalised by identifying with recycled British nationalistic narratives associated with individual liberty and expressions and language borrowed from author George Orwell's novel *Nineteen Eighty-Four*, which have often featured prominently in British culture to underscore public unease with expanding governmental surveillance practices on society (Polzer & Goncharenko, 2021; Samuel et al., 2022).

With the eventual launch of the NHS COVID-19 app in England and Wales in September 2020, the app was downloaded more than 20 million times. Despite this and corresponding with a worsening pandemic situation in the UK, the app continued to be impacted by technological and functional problems throughout the duration of its operation, including the issuing of *ghost notifications* and the *pingdemic* in the summer of 2021, in which hundreds of thousands of app users received incorrect self-isolation exposure alerts and led to a drop in app downloads and an increase in the willingness to delete the app among users in the UK (Otte, 2021). Moreover, an investigative report by the UK Parliament Committees (2021) eventually revealed that the larger NHS Test and Trace System, which the NSH-COVID-19 app was a key digital component, in the context of the pandemic had failed in its overall objective to deliver its central promise to 'vert another lockdown' despite the 'unimaginable' cost of the program.

Discussion

Our case studies in East and West contexts collectively reveal important contextual differences with the launch of digital health interventions in both countries during the COVID-19 pandemic. In Taiwan, key legal frameworks were shaped after the 2003 SARS outbreak, leading to reforms in the *Communicable Disease Control Act* that expanded administrative powers, healthcare infrastructure, and epidemic control expertise (Yeh & Cheng, 2020). Lessons from earlier outbreaks, such as border surveillance and database integration, enabled effective digital interventions during the early and emergency phases of COVID-19. The electric fence programme and TSDA were framed and presented within nationalistic narratives which underscored Taiwanese solidarity and prioritised the collective safety of the country from the threat of China and COVID-19 (Lee & Kao, 2022). These digital interventions were swiftly enacted, resulting from various levels of preparedness, including administrative, legal, and technological preparedness.

Similar narratives of community protection were seen in the UK's Isle of Wight contact-tracing trial. However, in this case, these discourses occurred only after substantial earlier preparedness and response errors of the UK Government, both before and during the onset of the pandemic, and after significant debate and concern regarding the design, which was eventually abandoned for a decentralised app. Furthermore, while Taiwan had moved rapidly even before the onset of the pandemic to utilize its extensive digital infrastructure, the UK lost swathes of time at critical phases of the pandemic, first by ceasing manual contact-tracing and community testing and then by opting for the separate development of, first, a centralised, and then a decentralised contact-tracing app.

These findings further underscore the vital importance of a range of preparedness practices and activities. When paired with discourses of solidarity and togetherness, the swift implementation of policies and interventions is likely to improve public support for digital health. Collective experiences with and prior learning from public health emergencies also bolster response resilience, as seen in Taiwan's collective memory of the 2002–03 SARS outbreak, which laid the groundwork for subsequent narratives and practices of 'advanced deployment'. More recently, this repertoire has been reframed through the official discourse of an 'Island of Resilience' (National Development Council, 2024), reinforcing the linkage between preparedness, cohesion, and confidence in digital health governance.

Our findings also offer a further important critique of the apparent 'East/West divide' (Jamison & Wu, 2021), which maintained, among other factors, that many Asian countries, including Taiwan, had handled COVID-19 better owing to cultural factors (Navarro, 2021), which juxtaposed against a more individual-focused West. First, Taiwan was seen to internalise and integrate key messaging, which emphasised social responsibility and together to encourage the download and uptake of its TSDA, partly because of the relatively more amicable relationships between the government and civil society organisations during Tsai's administration and mainly because of close and social connections among citizens (Lo, 2024). However, inspiration was drawn from the perceived success of messaging by the UK Health Secretary and the high volume of downloads of the NHS COVID-19 app.

Second, as our analysis has shown, important episodes and discourses of individualism and collectivism played out and overlapped both in Taiwan and the UK amid the launch of these digital interventions. In both Taiwan and the UK, public mistrust and concerns over digital surveillance grew over time and were shaped and informed by data breaches before and during the pandemic, leading to significant public outcry. In any democratic society, regardless of East or West contexts, such data breaches should be met with marked public concern, investigation, scrutiny, and accountability. Finally, as we saw earlier, nationalistic discourses work equally in Taiwan and the UK, as shown by how collective discourses also surfaced during the trial of the NHS COVID-19 contact-tracing app by appealing to senses of collective security, community and island identity, and the notion of shared risk.

As these examples demonstrate, the legacy of these digital interventions during COVID-19 cannot be easily categorised into the Eastern/Western binary, challenging dominant and uncritical assumptions of digital success stories and digital disasters. Moreover, as both case studies have illustrated, collective discourses which emphasise togetherness and social responsibility were effective in bringing people together in support of digital interventions only if they were followed by commitments to good data governance, communication and engagement, and government investment in solidaristic practices, which

have been reflected in further evidence elsewhere (Johnson et al., 2023). In Taiwan and the UK, the task remains ongoing and vital in that governments continue to build trust and demonstrate competency and oversight in digital innovations for global and public health to foster trust and provide protection and due accountability from Big Data disasters and poor pandemic preparedness.

The accounts of pandemic response and preparedness from our collaboration show that co-learning is not about co-imagining a single blueprint for 'better' digital health. Rather, as our co-analysis, archival and policy research, and site visits unfolded, co-imagining stayed situated and case by case, grounded in what each setting made possible. We learned from one another's strengths and from the troubles our societies encountered, separately and together. A key preparedness capacity is to 'stay with the trouble' in moments of crisis, through bearing discomfort, working with frictions, and allowing them to reshape practice (Haraway, 2006).

Our approach goes further: we co-learn through the trouble—looking across jurisdictions and jointly assessing risk-communication options, while remaining anchored in the evolving legal and policy contexts of Taiwan and the UK. Rather than benchmarking fixed indicators on a linear timeframe, we trace discursive flows between the two settings to show preparedness as an ongoing negotiation and process between citizens and governments. Practically, this indicates the need for clearer legal bases with proportionate sunset clauses of digital interventions; independent oversight and public transparency (e.g. monitoring and evaluation [M&E] and accountability mechanisms); accessible redress based on human rights principles; and cross-jurisdictional co-learning channels to work collaboratively and exchange best practices and lessons learned between research and lay communities in important and democratic contexts, like Taiwan and the UK.

Conclusion

This article has undertaken a comparative analysis of digital interventions launched in Taiwan and the UK during COVID-19 to co-learn how national contexts and public discourses shaped the rollout and uptake of these technologies. In examining these digital pandemic case studies, our analysis has drawn an important focus to considering critical sociopolitical contexts in each country, including systems of preparedness and collective national experiences in response to pandemics, as well as the importance of solidarity and trust in both Taiwan and the UK in ensuring community buy-in and uptake of these digital interventions during public health emergencies.

In doing so, we have argued and demonstrated how these experiences observed in Taiwan and the UK challenge the idea that the success or failure of digital interventions in East and West contexts can be solely attributed to assumed cultural attributes such as communitarianism versus individualism. Our article and its key findings have further emphasised and presented the value and contributions of interdisciplinary co-learning approaches in global health for improving digital preparedness across contexts for future public health emergencies.

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