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Impact of COVID-19 on the digital divide: a rapid review

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ABSTRACT

Objective The increased reliance on digital technologies to deliver healthcare as a result of the COVID-19 pandemic has meant pre-existing disparities in digital access and utilisation of healthcare might be exacerbated in disadvantaged patient populations. The aim of this rapid review was to identify how this 'digital divide' was manifest during the first wave of the pandemic and highlight any areas which might be usefully addressed for the remainder of the pandemic and beyond.

Design Rapid review and narrative synthesis.

Data sources The major medical databases including PubMed and Embase and Google Scholar were searched alongside a hand search of bibliographies.

Eligibility criteria Original research papers available in English which described studies conducted during wave 1 of the COVID pandemic and reported between 1 March 2020 and 31 July 2021.

Results The search was described using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses and identified nine studies. The results are presented within a refined framework describing the three key domains of the digital divide: (1) digital access, within which one study described continuing issues with internet connectivity among vulnerable patients in the UK; (2) digital literacy, where seven studies described how ethnic minorities and the elderly were less likely to use digital technologies in accessing care; (3) digital assimilation, where one study described how video technologies can reduce feelings of isolation and another how elderly black males were the most likely group to share information about COVID-19 on social media platforms.

Conclusions During the early phase of the pandemic in the developed world, familiar difficulties in utilisation of digital healthcare among the elderly and ethnic minorities continued to be observed. This is a further reminder that the digital divide is a persistent challenge that needs to be urgently addressed when considering the likelihood that in many instances these digital technologies are likely to remain at the centre of healthcare delivery.

Strengths and limitations of this study

- ► This rapid review provides timely information on the impact of COVID-19 on the digital divide during the first wave of the pandemic.
- ► The findings were presented within a framework developed to provide a more comprehensive context for this and future explorations of the digital divide.
- ► The search covered three key databases and was augmented by manual searches though the quality of the papers identified was not formally assessed.

INTRODUCTION

A growing range of digital tools have been developed to help patients track their condition, connect with peer and clinical support, enable self-management and aid more appropriate utilisation of health services.[1 2] When coordinated with the appropriate digital infrastructure they appear well placed to meet the need for more effective personalised healthcare,[3] which is capable of bridging the gap between increasing demand and restricted resource.[4] The WHO's recently launched global strategy for digital health confirmed the expected role of digital technologies in creating a more equitable future for healthcare by offering 'effective clinical and public health solutions to accelerate the achievement of the health and well-being… leaving none behind, [whether] children or adults, rural or urban'.[5]

Implicit within the digital transformation of healthcare and its role in reducing inequalities is that the relevant technologies are available across all levels of society.[6 7] However, persistent discrepancies exist across geographies and between communities in how they access and use digital technologies, differences compounded by the growing sophistication in the functionality of devices and connectivity.[8–10] The result is that comparative advantages continue to be afforded to those groups that can maximise the capabilities of digital technologies.[11 12] These societal differences in access and adoption are commonly referred to as the 'digital divide',[12] a catch-all phrase which implies a simple dichotomy but in reality describes a complex range of users whose level of adoption changes over time influenced by infrastructure, socioeconomic environment and individual characteristics such as educational background and physical disability.[13–17]

Despite the acknowledged inequities in digital access and utilisation, measures

introduced to reduce infection rates following the onset of the COVID-19 pandemic in spring 2020 led to an acceleration of the reliance on digital health technologies both in Europe and the USA.[6 18–20] Because the spread of COVID-19 was so rapid many of these digital interventions were introduced without the recommended periods of consultation and evaluation.[21 22] This rapid introduction led to concerns that the new digitally reliant models of healthcare delivery will disproportionately affect the health of disadvantaged communities[23–26] such as ethnic minorities,[27] rural populations,[28] the elderly[29] and residents of care homes.[30] These concerns were heightened when it became apparent that the same groups on the 'wrong' side of the digital divide were the most likely to experience severe symptoms and higher levels of mortality as a result of contracting the virus.[23–26]

Many of these novel digitally reliant processes that in March 2020 were considered a short-term fix are now becoming embedded in existing systems of care in the UK and elsewhere.[19 31] Therefore, it is important to understand the implications of these new systems for patients and the quality and safety of the care they receive. This rapid review aims to explore how the digital divide manifested during the first wave of COVID-19-generating knowledge that can improve digital inclusion for the remainder of the pandemic and beyond.

METHODS

Study design

Rapid reviews have previously been recommended by the WHO among others for their ability to provide timely and credible evidence for policymakers and practitioners in what is a dynamic and evolving public health crisis.[32 33] We have used many of the principles of a systematic review process; our search terms were clearly defined using Boolean principles and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) described the search.[34] The inclusion and exclusion criteria were also clearly defined and two reviewers agreed on the selection of the various papers. (The search terms can be found in online supplemental file 1.) However, the systematic review process was expedited by amending several steps, that is, drawing only on the major medical databases and forgoing a structured appraisal of the quality of selected studies in place of a transparent description of the characteristics of each within the results.

The results are presented within the three key domains of a framework (informed by Ai-Chi Loh and Chib's[35] work) to enable a more systematic description of the various aspects of the digital divide explored by each study (see table 1).

Table 1 Framework for interpreting the digital divide in healthcare (after Ai-chi Loh and Chib[35])

Domain	Definition	Construct	Definition	Example
Digital access	The ability to access the necessary hardware, software and internet services associated with utilisation of digital technologies.[114]	The types of device available.	The nature and functionality of the digital device.[12]	The model of smartphone or desktop computer and any peripheral or supporting technology such as hard drives or printers.
		The ease with which devices can be accessed.	How readily individuals can access digital devices.[8 12]	Relying on the local library for access to a computer.
		The autonomy and reliability of internet connectivity.	The degree of independence with which the internet can be reliably accessed.[115 116]	Consistent access to the internet via a user's home internet network.
Digital literacy	The degree of sophistication with which individuals are able to use digital technologies.[117]	Digital skill set.	The confidence and ability of an individual to use a variety of digital technologies.[118]	The ability to use and manage email.
		Types of digital usage.	The ways in which digital technologies are used.[119]	Using search engines to access information on current affairs.
Digital assimilation	The degree to which digital technologies are incorporated and used in everyday life.[114 120]	Engagement with digital technologies.	The degree to which individuals use digital technologies to enhance social connections and values.[121]	Establishing a community group on a social media platform to support elderly neighbours.
		Social support.	Social connections that facilitate an individual's engagement with digital technologies.[118]	The availability of technical support in the use of digital technologies from a son or daughter.
		Harnessing digital outcomes.	The ability to contextualise the use of digital technologies to achieve quantifiable outputs.[122 123]	Using software apps to reach and maintain fitness goals.

Search strategy

We searched PubMed, Embase and Google Scholar, alongside hand searches of bibliographies, to identify relevant manuscripts. In doing so, we used a combination of the search terms 'COVID 19' or 'pandemic' or 'COVID' and 'digital health' or 'telemedicine' or 'remote access' or 'digital divide' to identify studies which had explored the access or utilisation of information or communication technologies in relation to health and care since the onset of the COVID-19 pandemic. Bibliographies within the publications we identified were searched alongside a manual search.

Inclusion criteria

To be included in our review, the manuscript must consist of original research specific to individuals using digital technologies in relation to their health or well-being since the beginning of the pandemic recognised by the WHO as March 2020 with any publication published from 1 March until 31 July 2021.[36] This includes the diagnosis, monitoring or treatment of COVID-19 and any other condition or disease. The focus of our work was the provision of care within the developed world (ie, one which is predominantly industrialised and more economically developed with a higher individual income[37]) during the early phase of the pandemic to ensure relevance for policymakers, commissioners and providers in these areas and so we limited the papers included to those that were available in English.

Study selection

The process followed the four stages of PRISMA[34]: identification, screening, eligibility and final inclusion and the search data presented in the PRISMA diagram (see figure 1). This involved two reviewers (IL and SG) screening the titles, abstracts and, where appropriate, full texts against the inclusion criteria and the final selection of papers agreed by both.

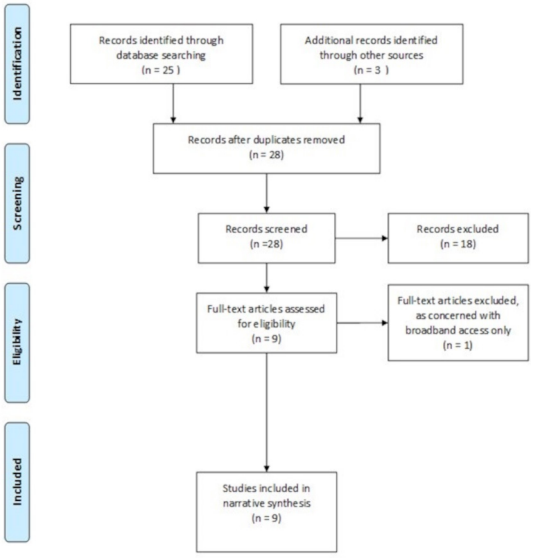

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram.

Analysis procedures

We developed a framework that built on the work of Ai-Chi Loh and Chib[35] to reflect a more nuanced representation of the digital divide describing it within three key domains: digital access relating to the ability to access devices and internet; digital literacy describing the skill set of individuals; and digital assimilation addressing the degree to which digital technologies are incorporated into everyday life. Each domain consists of a series of related constructs and these are further defined and presented with examples of each in table 1. A descriptive summary of the characteristics of each included study was produced (see table 2) and the findings from the identified papers are analysed within each of the three domains of our refined framework.

Patient and public involvement

No patients or members of the public were involved in the conceptualisation, design or undertaking of this rapid review.

RESULTS

A total of 28 candidate articles were identified from a search of the named databases and hand searches from the bibliographies of these references. Ultimately, nine papers were selected for the analysis, the remaining papers were excluded as they were either opinion pieces that did not contain original research or despite being published after March 2020 referenced research conducted prior to the onset of the epidemic. One study looked at digital access; set in UK primary care it explored internet connectivity among vulnerable patients (including those who have received an organ transplant, are undertaking immunotherapy or an intense course of radiotherapy for lung cancer).[38 39] It was also one of the seven studies that looked at digital literacy[39] alongside five studies set in the USA that explored the use of digital technologies in accessing care among different ethnic groups[40–44] and one study conducted in Italy that looked at the age and gender of patients using telemedicine.[45] Two studies were concerned with digital assimilation, one set in Italy described the social support gained from using video messaging platforms[46] and a second again set in the USA explored the characteristics of individuals posting COVID-related content on social media.[47] The key characteristics of these papers are summarised in table 2.

Digital access

We identified one study concerned with the access of digital technologies, specifically the reliability of internet connectivity. It was conducted in UK primary care as part of a study whose overall aim was to explore whether vulnerable patients might be usefully supported by telecoaching in the use of digital health technologies, in this

Table 2 Summary of study characteristics

Authors	Study design	Country	Study population	Research question	Analytical framework	Findings
Campos-Castillo and Anthony[44]	Cohort study	USA	10 624 US-wide survey respondents	What are the characteristics of patients who used ICTs to connect with care providers in relation to COVID-19?	Logistic regression	Total of 17% of respondents self-reported using telehealth because of the pandemic. Black respondents were more likely than Whites to report using telehealth because of the pandemic (OR 1.42; 95% CI 1.07 to 1.88).
Campos-Castillo and Laestadius[47]	Cohort study	USA	10541 US-wide survey respondents	What are the characteristics of patients posting COVID-19-related messages on social media?	Logistic regression	Respondents who identified as black (OR 1.29; 95% CI 1.02 to 1.64; p=0.03) or Latino (OR 1.66; 95% CI 1.36 to 2.04; p=0.03) had higher odds than respondents who identified as white of reporting that they posted COVID-19 content on social media.
Chunara *et al*[40]	Cohort study	USA	140184 patients	What are the characteristics of patients who use telemedicine?	Descriptive statistics and logistic regression	Black patients nearly half as likely as white patients to access care through telemedicine (OR 0.6 times; 95% CI 0.58 to 0.63).
Eberly *et al*[43]	Cohort study	USA	2940 cardiovascular outpatients	What are the characteristics of patients who complete a telemedicine consultation?	Logistic regression	Being female and being non-English speaking were independently associated with less telemedicine use.
Gabbiadini *et al*[46]	Cross-sectional	Italy	465 respondents	Whether the use of ICT promoted perceptions of social support (mitigating the psychological effects of lockdown).	Separate multiple and simple regression models	The amount of technology use was a significant predictor of perceived social support (OR 2.40, p<0.02, 99% CI –0.01 to 0.31).
Hughes *et al*[39]	Mixed methods	UK	156 high-risk individuals and a further 1217 vulnerable patients over the age of 70	Can medical students (general practitioner trainees) use teleconsultations to assess the needs of patients and support digital access to healthcare?	Descriptive statistical analysis. Thematic analysis of conversation issues arising, no theoretical framework named.	A total of 22% high-risk patients and 44% of vulnerable patients reported connectivity issues. Participants reported who were confident in ordering medication online.
Runfola *et al*[45]	Cohort study	Italy	33 bariatric outpatients	What are the characteristics of patients who completed a telemedicine consultation?	Categorical data were compared using the X^2 test. Continuous variables compared using the Student's t-test.	57.6%completed the consultation. No significant differences were found between participants and non-participants in terms of age and gender.
Weber *et al*[41]	Cohort study	USA	52585 patients diagnosed with COVID-19	What are the characteristics of patients who access care by telemedicine, ER or office visit?	Descriptive statistics and multinomial regression analysis	White patients had the highest predicted probabilities of using telehealth (46.7%). Black and Hispanic patients over 65 have the lowest predicted probability (11.3%).
Whaley *et al*[42]	Cross-sectional	USA	Data from 5.6 to 6.8 million US individuals with employer health insurance between 2018 and 2020	What are the characteristics of patients who use telemedicine?	Logistic regression	Patients living in postcodes with lower income or majority racial/ethnic minority populations had lower rates of adoption of telemedicine; ≥80% racial/ethnic minority postcode: –71.6 per 10 000 (95% CI –87.6 to –55.5); 79%–21% racial/ethnic minority postcode: –15.1 per 10 000 (95% CI –19.8 to –10.4).

ER, emergency room; ICT, information and communication technology.

instance by general practitioner trainees.[39] As part of these conversations a direct question was asked around internet connectivity and the authors reported that 22% of high-risk patients and 44% of vulnerable patients reported issues.[39]

Digital literacy

A total of seven studies addressed the domain of digital literacy and in particular an individual's digital skill set, specifically in relation to the ways in which they accessed care. All provided comparisons of use between groups using descriptions of demographic characteristics that included age, gender and ethnicity.[48] Two studies used routinely collected electronic health data, though were conducted independently of each other at two different sites in New York (USA).[40 41] The first study used data gathered from patients at New York University Hospital collected over a 6-week period to determine whether they had received their COVID-19 diagnosis at an office visit or via video consultation. The authors described that the digital infrastructure of the service was well resourced and established and therefore attributed the reduced utilisation of telemedicine by black patients to factors unrelated to the digital capacity of the facility.[40] The second study set in New York was also situated within a large healthcare centre and again compared the means of accessing healthcare between ethnic groups within the early months of the pandemic.[41] They found that black and Hispanic patients were more likely to visit the emergency room (ER) or arrange an office visit than use telehealth than their white or Asian counterparts.[41] In this instance, the authors recognised that the more extensive use of ER may be due to the disproportionate number of ethnic minorities that experienced severe COVID-related symptoms.[41] Another study set in the USA compared the use of telemedicine among commercially insured patients from 2018 through to 2020.[42] In doing so, they explored differences in both the nature of the care they received and the means of access in the first 2 months of the pandemic and described that though there was an increase in telemedicine it did not make up the shortfall in the number of visits in comparison to the usual levels of assessing preventative or elective care among ethnic minorities.[42] Campos-Castillo and Anthony conducted a secondary analysis of of cross-sectional survey data from the Pew Research Center's American Trends Panel. This is a national, probability-based online panel of adults (18 or older) living in US households that they used to explore self-reported use of telemedicine. Following adjustment for socioeconomic status (SES), age and perceived level of threat to their health from the pandemic (no threat, minor or major), [44] they found black patients were actually more likely to contact care providers using information and communication technologies if they perceived their health was threatened by the virus.[44]

Two studies specifically explored whether there were differences in the characteristics of patients fulfilling prearranged or routine video consultations during the pandemic. One of these studies was also set in the USA and compared the characteristics of cardiovascular patients who 'attended' teleconsultations and found no differences in cancellation rates based on race, ethnicity or household income. However, differences between genders were observed with those completing telemedicine tending to be male and older.[43] In Italy, Runfola *et al* explored the utilisation and subsequent satisfaction with video consultations among a group of bariatric patients. They found no significant differences in terms of age or gender between those who succeeded or failed to complete a video call.[45] However, in terms of overall numbers just under 58% of patients fulfilled the video consultation and the authors felt that this was due to the absence of basic computer skills and a lack of self-efficacy in using video call systems.[45] In relation to self-efficacy, the Hughes *et al*'s study set in the UK also assessed vulnerable patients' confidence and ability to order medications online and reported they were comfortable and confident with the process.[39]

Digital assimilation

Two studies explored the use of digital technologies in relation to maintaining or interacting with a social network. One study set in Italy described how feelings of loneliness, boredom and irritability were all reduced as a result of regular utilisation of video calls, and the positive effects on maintaining meaningful relationships and mental health.[46] Meanwhile, in the USA, another secondary analysis of the same cross-sectional survey data from the Pew Research Center's American Trends Panel was conducted to understand if there were differences in the characteristics of individuals who posted COVID-19-related content to social media platforms.[47] The authors discovered that proportionally members of racial and ethnic minority groups and among these older black males were the most likely to contribute COVID-19-related content.[47]

DISCUSSION

General findings

Our rapid review identified how pre-existing societal disparities in access to and utilisation of health-related digital technologies were accentuated by COVID-19. We identified nine studies that explored various constructs within the three domains of our digital divide framework. In relation to digital access, poor internet access among the elderly was reported[39]; as regards digital literacy lower levels of take-up of telemedicine among certain communities in the USA were described particularly among black and Hispanic patients.[41–44] Within the domain of digital assimilation one study described how face-time technology can sustain relationships among dislocated peer groups,[45] and another how black and elderly males, previously considered a group unprepared to share health information on social media platforms, were the demographic most likely to post content on the pandemic, an

important consideration in understanding the emerging scepticism of the COVID-19 vaccine in ethnic groups.[46]

Strengths and weaknesses

Our search strategy was designed to capture the experiences and broader lessons that might be learnt by exploring the initial stages of the pandemic, including those of countries that had health services of sufficient maturity to initiate agile and integrated responses. We focused on the early phase of the pandemic in order to understand the impact of the rapid changes to service delivery on those most vulnerable to the digital divide with the intention of producing timely findings that might inform service delivery in subsequent phases. That our search uncovered so few studies can be attributed to two factors relating to the pandemic; first that the research capacity of healthcare organisations would have been compromised by dealing with the exceptional demand on their services[49 50]; second that the issue of the 'digital divide' which had previously failed to be considered a priority was unlikely to be addressed during the most serious public health crisis in a generation.[51]

Although our search initially uncovered numerous titles many were opinion or editorial pieces, demonstrating how widely recognised the phenomenon of the digital divide is but also its lack of priority as a subject for original research.[24 28 52–54] The studies identified were conducted within only three countries at the time of the first wave they constituted three of the top four worst death rates from COVID-19 *per capita*.[55 56]

Our rapid review discovered only a small number of heterogeneous papers of limited geographic scope which precluded data synthesis and may have introduced a degree of bias. The lack of a theoretical underpinning in many of the papers limited generalisability[56] and that two of the studies relied on self-reported data[39 44] raised familiar issues regards their reliability.[57] However, previous comparisons between systematic and rapid reviews have failed to find significant differences in the outcomes they report[58 59] and all of our included studies offered valuable insight into how the digital divide was magnified by the changes to health delivery in the early stages of the pandemic.

Specific findings

Digital access

The Hughes *et al*'s paper provides the latest example of how discrepancies in reliable internet connectivity continue in England[39 60] findings which were corroborated by the most recent surveys of digital access conducted in the UK which found that nearly 7% of homes in England and Wales did not have a reliable internet connection,[61 62] a lack of connectivity that disproportionately affected the elderly, those of lower SES and the disabled.[61–64]

Despite the calls to harness digital technologies on a global scale,[5 65–67] these also need to address the stubborn differences in digital access that remain within the developed world where significant divisions in digital connectivity and utility remain and continue to affect the most vulnerable members of society.[8 65 68–75] The pandemic prompted broader acknowledgement of these differences in several health economies where a number of initiatives were introduced.[54 76] For example, in the UK broadband providers lowered the prices and reduced data caps for the vulnerable,[77] and in the USA roving buses were used to provide Wi-Fi access for unconnected communities.[78]

Digital literacy

The patterns in digital literacy relating to SES, age or race described in four of the studies we identified[40 41 43 44] have been observed for nearly three decades.[8 18–20 63 64 79–81] However, prior to the pandemic, using traditional methods of in-person access did not hold the same degree of risk as during a pandemic where airborne transmission led to widespread recommendations to minimise social contact.[36] This may be due in part to variations in individual perception of risk influenced by personal experience, social values and the attitudes of friends and family.[82] It also reflects the resistance of the digital divide to intervention. A number of previous attempts have been made to connect less technologically enabled patients to the appropriate care.[53 83 84] However, the non-adoption and abandonment of telehealth technologies by the intended users is common,[85–88] complicated by the influences of the provider organisation and the design and compatibility of the intervention.[89] Self-efficacy, patient activation and motivation are also critical yet underexplored components of the uptake of digital technology[90] as are the impact of patients' knowledge of their condition; the expectations of the care they should receive, their social situation and the resources at their disposal.[91]

In attempting to unpick this complexity a number of theoretical frameworks have been developed, intended to support adoption and produce transferable learning for a range of digital innovations.[92] There have also been calls for greater patient and public involvement in designing and developing digital healthcare to ensure the needs and preferences of the full range of patients are incorporated.[93 94]

Digital assimilation

For over a decade the internet has been recognised as a key source of health information for the public and patients, yet the precise role of social media in the communication of health-related information is less clear.[95] Although limited, evidence tended to suggest that sharing health information online was favoured by the young[96] and was less so among the elderly or those of lower SES.[97] However, one study we found described how older black males were more likely to share information about COVID-19 through social media channels than other demographic groups.[47] This may in part be due to the growing reluctance among black and ethnic minority groups to trust information provided by healthcare professionals or the mainstream media.[98–100] That

highlights how the growing consumption of health information through a largely unregulated network of social media platforms can have serious repercussions for public health.[100–104] This is of particular concern when placed in the context of the growing scepticism about the COVID-19 vaccine in minority communities.[105 106]

Despite the potential for spreading misinformation, the work by Runfola *et al* observed benefits for mental health from the use of face-to-face digital contact during the pandemic[45] and related work found benefits from the introduction of an online blog tailored for psychiatric patients.[107] The last 5 years have seen a growing realisation that the responsible use of social media can be an effective means of alleviating depression and social isolation and improve mental well-being.[108–110] In particular, the utilisation of face-time technologies has been shown to increase and enhance social interactions[111] and engagement.[112] During the pandemic, these benefits were recognised by the UK government in their scheme that provided free tablets to care homes to help connect isolating residents with their families and loved ones.[113]

CONCLUSIONS

The rapid incorporation of digital technologies into mainstream healthcare delivery due to the COVID-19 pandemic was widely understood and accepted by patients in the developed world unwilling to breach social distancing advice. However, not all patient groups were either willing or able to use the digital services made available nor maximise the reported benefits of face-time technology to alleviate the effects of isolation. Our findings provide further evidence that patient engagement with any model of digital healthcare is vulnerable to complex sociopolitical factors. If more are to reap the potential benefits of digital healthcare then improvements in infrastructure are needed as are more concerted efforts to train, equip and motivate all patients in its use.

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