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eHealth literacy during the COVID-19 pandemic: seeking, sharing, suspicion amongst older and younger UK populations

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Summary

The containment of infectious diseases is most successful when at-risk populations have a high level of relevant health literacy (HL). To achieve this both literacy needs and patterns of knowledge sharing must be understood within the context of the disease being studied. It is also important to understand these processes from both offline (HL) and online (eHL) perspectives and amongst demographics with access to different types of information and social capital, and who have different levels of vulnerability. This paper discusses the insights gained over a series of 30 interviews with the UK residents aged either $19-30$ years of age or older than 70 years—focussing on how they seek, understand, evaluate and convey information about COVID-19 during the current pandemic. Using thematic analysis, we identified themes around motivations to seek information, the information journey, digital choice and engagement, dilemmas and challenges of managing and appraising information, and sharing information. There was little difference in the eHL between the two age groups who both had high levels of education and were sophisticated digital citizens. The COVID-19 pandemic highlights three dominant processes in managing complex and uncertain information: some individuals may suffer from information fatigue but there was no evidence of any impact on their behaviours; others seek and share information across many networks; and there were strikingly high levels of distrust leading to complex processes of meaning-making demanding critical health literacy skills.

Key words: health literacy, eHealth literacy, digital health literacy, pandemics, health information

The rapid development of the COVID-19 disease has necessitated a vast amount of information to be communicated quickly and for populations to access, understand and apply such information to their own behaviours. Yet, as Abel and McQueen (Abel and McQueen, 2020) point out, this abundance of health information from multiple sources must be translated into behavioural

actions; a particular challenge when so much scientific knowledge is uncertain. The current study aimed to explore how people made sense of and acted upon online information during the 2020 COVID-19 pandemic in order to improve our understanding of eHealth literacy (eHL) in the context of emerging infectious diseases and make recommendations for best practice. eHL is often

used interchangeably with the related concept of digital health literacy. While definitions vary and overlap exists between the two, digital health literacy refers typically to the use of health information available on the internet while eHL is a broader concept (Van der Vaart and Drossaert, 2017) which includes (within some conceptualizations), not only health information but also media, health, computer and scientific literacies (Norman and Skinner, 2006). A multidimensional e-Health literacy framework (Sykes *et al.*, 2020) developed by the authors illustrates the complex interactions and movements people engage in between: information based digital platforms, conversational digital platforms and offline personal sources of information as they seek to access, understand, appraise and apply health related information from online sources.

INFORMATION AND HEALTH LITERACY DURING HEALTH CRISES

WHO guidance on public communication and information (WHO, 2020) outlines the importance of proactive communication about what is known, what is unknown, and what is being done to gain more information so that trust can be built and the probability that advice will be followed increases. It also cautions against 'infodemics' (an excessive amount of information about a problem that makes it difficult to identify solutions), hence it swiftly set up the WHO Information Network for Epidemics (EPI-WIN) (Zarocostas, 2020).

The need for information messaging that is clear, rigorous and actionable in times of crisis led Rudd and Baur (Rudd and Baur, 2020) to call for health literacy (HL) insight to be applied to communication strategies. HL refers to the ability of people to access and use information to make decisions related to their health (Sørensen *et al.*, 2012). Studies have shown that a large proportion of citizens do not have adequate HL to understand information and take action when faced with infectious diseases (Castro-Sánchez *et al.*, 2016) yet the ability of citizens to understand the information provided, follow health guidance, and make effective decisions related to their health has rarely been of more significance than during the COVID-19 pandemic.

eHL AND COVID-19

COVID-19 poses new challenges for understanding eHL needs in relation to public information, the movement of citizens between information environments and patterns of knowledge sharing in an era of 'false narratives'. Contemporary conceptualizations of eHL (Griebel *et al.*,

2018; Sykes *et al.*, 2020) have highlighted the importance of distributed HL, pointing to the two-way dialogical opportunities offered by social media platforms. These allow for misinformation and myths to spread but also for individuals or infection control teams to act as amplifiers of scientific advice and preventative actions, as during the Ebola outbreak in 2015/16 (Marais *et al.*, 2016). Sykes *et al.* (Sykes *et al.*, 2020) describe how citizens may be not only consumers of information online, seeking information to find out about services, symptoms, help with decision making and emotional support but may also converse about, support and facilitate their own or others' behavioural actions. This distributed HL (Edwards *et al.*, 2015) can be found online or in other contexts such as families or social networks and can act as a buffer for low levels of functional HL but it can also offer the potential for the spread of misinformation (Ishikawa and Kiuchi, 2010). Myths and rumours about COVID-19 abound including that the virus was made in a laboratory, is spread via 5G mobile masts, can be killed by drinking warm water, or that antibiotics or malarial drugs can offer protection. These false beliefs can lead to what Van den Broucke (Van den Broucke, 2020) has called the 'illusion of truth' when frequently shared on social media.

FACTORS POTENTIALLY AFFECTING EHL IN THE CONTEXT OF EMERGING INFECTIOUS DISEASES

The information that citizens actively seek about COVID-19 will likely be influenced by context, emotions and various perception-related biases or heuristics on how they internalize the magnitude of risk from COVID-19 and the willingness to comply with government-advised preventive measures (Bavel, 2020; Dolinski *et al.*, 2020; Druică, 2020). Some may have a tendency to seek information that confirms beliefs already held, some may veer to catastrophic or pessimistic thinking from a tendency to attach more importance to negative rather than positive information, and some may have an optimistic bias and possibly a false sense of security from the tendency to consider oneself at less risk for negative consequences [e.g. (Klein and Helweg-Larsen, 2002)]. Studies during previous pandemics, such as SARS and H1N1 found that higher age, high anxiety, high self-efficacy and paying much attention to media information was associated with compliance with preventive measures (Leppin and Aro, 2009; Bults *et al.*, 2011).

Pandemics demand active communication from governments to respond to threats, provide calmness and build trust (Hyland-Wood et al., 2021). A United Nations study (United Nations Department of Economic and Social Affairs, 2020) found that 86% of member states had placed COVID-19 information on national websites by April 2020. As the OECD [(OECD, 2020), p. 46] observed 'the realisation of the potential benefits of digitalisation in this matter depends crucially on the relevance, quality and user-friendliness of the information being generated by the digital systems and made available to the public'. There is criticism of many countries' responses—e.g. Kim and Kreps (Kim and Kreps, 2020) claim the US government had inconsistent and misleading messages which led to confusion, In the UK, analyses of the government's handling of the pandemic criticize the early communication as complacent (Sanders, 2020; Gaskell et al., 2020). Engagement with public health information will also be influenced by cultural and social identity, age, access to resources and variations in literacy and numeracy. For instance, the most vulnerable groups for COVID-19 are older populations. They are also more likely to have barriers to eHL (Choi and Dinitto, 2013) arising from financial restrictions, technology limitations and digital complexity (Kim and Xie, 2017). Younger people are more likely to be sophisticated digital citizens with more opportunities for sharing and purveying information online.

THE CURRENT STUDY

Understanding eHL in the context of a pandemic, such as COVID-19, is vital in planning and implementing future effective containment strategies and communications, as well as in the creation of trust in public institutions and professional and scientific advice at a time of crisis. The current study was conducted during the period of lockdown in England when individuals were most likely to be trying to assess their personal risk, understand public health information and make decisions about their precautionary actions. It investigated the experiences and perceptions of older and younger population groups in accessing, making sense of and using information online during the COVID-19 pandemic.

METHODOLOGY

Purposive sampling was undertaken with two distinct groups of people (those aged $19 - 30$ years old and those aged over 70). Recruitment of the sample was facilitated by (i) social and professional contacts of the research team, (ii) word-of-mouth from participants, (iii) social media announcements and (iv) promotion on a psychology blog. Interviews were conducted between 17 April 2020 and 6 May 2020 during the COVID-19 lockdown in the UK, in which people were asked to leave their houses as little as possible, schools and retail businesses closed and non-essential workers either worked from home or were 'furloughed' (placed on paid leave). Participants were informed that the study was looking at the way that people seek, understand and share online information related to the COVID-19 pandemic. In total, 32 eligible individuals contacted the research team and 31 interviews were undertaken. The remaining participant was unavailable during the data collection period. Of these, 14 were in the $19-30$ age sample ($n = 6$ females, $n = 8$ males) and 17 were in the 70+ age sample ($n = 6$ females, $n = 11$ males). Four of the participants from the total sample were educated to secondary school level, 12 to undergraduate and 14 to postgraduate level. No other demographic data were collected. Data from one interview in the 70+ age group were lost due to equipment failure (this interview was not repeated).

A semi-structured interview schedule was created using the key dimensions of the eHL model developed in Sykes et al. (Sykes et al., 2020). Interviews were scheduled at a time convenient to the participant and were conducted remotely via telephone or a messaging service. Consent was recorded using a signed electronic document or email and interviews were audio recorded with the participant's permission. Each participant undertook a single interview only that took $20 - 40\,\text{min}$ which was transcribed professionally. Transcripts were not returned to participants for comment. Data collection continued until a date agreed by the team (on the basis that theoretical saturation was expected to have been reached at that point). The team agreed that saturation had been achieved at that point. In the interests of transparency, the above methods are reported following the COREQ guidelines and checklist (Tong et al., 2007).

Data analysis

Informed by Braun and Clarke (Braun and Clarke, 2006) and using a hybrid approach of inductive and deductive coding and theme development (Fereday and Muir-Cochrane, 2006), data were coded semantically. All members of the research team coded portions of the data. Data were assigned so coders coded interviews from each sample group, did not code interviews from people they knew personally and coded interviews they had not conducted.

To ensure familiarization with the data, one researcher read the data vertically and organized the two data samples within Nvivo 12 software. For theoretical and conceptual consistency, a coding framework (available at: https://osf.io/d6sxr/) was developed based on the domains of the eHL model described in Sykes *et al.* (Sykes *et al.*, 2020). The relevance of these codes was refined through the initial coding of two transcripts and were then discussed and agreed by the whole team resulting in a framework of 69 codes. Additional inductive free coding allowed for codes not represented in the existing eHL model to be captured, and where such 'free codes' showed similarity they were then collapsed. Data were then read horizontally across each code to ensure consistent coding had taken place across the research team. To identify patterns that took place within and across the sample groups, two researchers organized the codes into themes that represented a central organizing concept. A process of corroborating and legitimating the themes in discussion across the research team and through an iterative scrutiny of the transcripts ensured each theme reflected and was supported by the original data. The relationship between themes were developed through a thematic mapping process.

Findings

Findings are presented across the whole dataset but where differences were found between age groups, these are reported. Five themes were developed from the analysis that represent the experiences and perceptions of both sample groups in relation to motivations to seek information, the information journey, digital choices and engagement, dilemmas and challenges of managing and appraising information, and sharing information.

MOTIVATIONS TO SEEK INFORMATION

Participants across both sample groups showed a strong motivation to seek out information and to avoid the discomfort and possible anxiety from uncertainty. They exhibited an intrinsic motivation and energetic drive to be informed about COVID-19 as an infectious disease so that they could understand its symptoms and treatment:

> I just like to be aware, like if I don't know something I like to check it to make sure that I'm right with my facts and stuff, because it is something that everyone's talking about constantly and I don't want to be misinformed about anything. (Participant 26, age 19 − 30)

> People wanted to find out, and as people have found out more, as the medical, particularly the scientific community, is coming out with useful information then it's opened the floodgates really, it's trying to make sense of it all in your own little world. (Participant 9 age 70+)

Having knowledge about personal risk and precautionary actions were seen as the primary attribute that individuals could have to control their own lives during the pandemic:

> ..like measures to try to prevent if ever I were to have coronavirus in an asymptomatic way, to try to prevent transmitting it to other people or to try to prevent me catching it from other people. (Participant 6, 19 − 30)

Assessment of individual susceptibility and severity of COVID-19 was informed more by this cognitive assessment than any emotional response. Although individuals expressed emotions of anxiety and of being overwhelmed, there was no catastrophic thinking and no one said they had been motivated to seek emotional support online outside their own family/friends' communication groups:

> To be honest I haven't felt like I've needed it [emotional support] too much. Again, through work and healthcare professionals, I've kind of been told that there's a lot of access to things if I feel like I need it, and maybe after the initial shock I feel a lot more secure and stable. I'm quite lucky, I can phone some friends and family if I needed it, so I don't feel that I need emotional support. (Participant 13, age 19 − 30)

Important to both groups was being informed about policy decisions. Individuals referred to a desire to know practically how to apply guidelines and regulations, e.g. about shopping and travel, rather than any desire to follow the law; although there was an expressed commitment to be compliant with regulations:

> Then as time went on it was more about looking up when would lockdown happen, how would that impact me in terms of my work specifically and my day to day life, that kind of more practical information in terms of how it would affect life rather than the actual illness itself, more the side effects on society. (Participant 19, age 19 − 30)

Very common across both groups was the desire to be informed about the wider context of the pandemic including information about spread and country comparisons and there was considerable seeking out of alternative information sources:

> The only thing I would like to know, and I don't know why nobody tells it, is the per capita death rate, like whatever our death rate is lower or less than Spain given

that Spain is smaller than we are, but we don't have it. (Participant 30, age 70+)

…data from across the world on numbers in different countries and death rates and testing amounts done in various places… I check it most days, to be honest, just the number of cases and the number of deaths. (Participant 3, age 19 − 30)

Although there was widespread awareness of the impact of the pandemic on the economy, climate change and in exacerbating social inequalities, only a minority described the pandemic as demanding a social responsibility from individuals:

This is quite an interesting opportunity off the back of it to build a more resilient society, one that is climate ready, one that we can try and rebuild economies but with a different system and with climate change in mind. Obviously, the concern is that people can get more populist, more insular, more protectionist, and everyone tries to get things back to normal as quickly as possible with no regard for the resilience from either future viruses or indeed climate change or anything like that. (Participant 14, age 19 − 30)

Information journey

The nature of individuals' interaction with online information varied across the timeframe since COVID19 was first reported in terms of frequency and degree of proactivity. Most were aware of the virus at the start of 2020 but reported only actively seeking information in March when the virus progressed through Europe. The younger sample group showed themselves to be more proactive but the initial high level of activity was not sustained, with both groups reporting that they became less proactive in seeking information over time:

There was obviously the need to stay abreast of what was happening and particularly COVID updates with work, and then yes, lockdown and I understood that this was going to be for the foreseeable. I think it then tailed away to now, probably these last few days or week or so I haven't checked any death tolls or anything like that. (Participant 14, age 19 − 30)

This reduction in seeking information was due to feelings of being overwhelmed by the volume of information available and its unsolicited nature. Some of the older group claimed that they did not need to look for information as it was continually being directed at them without any action required on their part, demonstrating a push rather than a pull of information:

Well, no, I didn't because there was no need because information was beginning to come hard and fast at me, even if I didn't want it. There's been so much information that … sometimes, a bit too much, quite overpowering. So, no, I haven't had to look specifically for information, no. (Participant 2, age 70+)

Participants felt that content was becoming increasingly uniform with repeated messaging that that already been absorbed. Several participants from both groups implemented strategies to actively manage their information seeking, such as only watching one daily news broadcast or the daily government briefing but no individual claimed to actively avoid public information. For some, there was an awareness of the negative impact that information could have on them by fuelling anxiety and a small minority described themselves as compulsively seeking information which they knew to be unhelpful:

I am a bit of a news junky and I've been feeling a bit overloaded recently so I'm actually not looking at detailed items in the last couple of weeks, to be frank. (Participant 25, age 70+)

Digital choice and engagement

Friends and family were identified as the most important sources of information but all participants engaged with some form of online information. While both groups demonstrated a reliance on broadcast or online news outlets as a source of information, the older group were more likely to identify the radio or newspapers as an important source of information. No technical barriers were identified by either group in accessing digital information.

Several aesthetic drivers were identified as influencing choice of sources including: ease of use, digestible information and sources that were direct, factual and broken into consumable sections:

I think that the interface of the BBC has actually been very easy to manage if you want clear information, it is primarily preoccupied with coronavirus right now. I think it feels familiar when I have managed the page, whereas it's kind of taken me time to explore other sources, it seems a little pointless right now, so I've just been using the one really. (Participant 13, age 70+)

Both groups had accessed websites and information-based apps. There was similarity across both groups as to which sources were preferred. The most commonly identified digital sources were the British Broadcasting Corporation (BBC), National Health Service (NHS) sources, or Government sites. Additional websites were also identified, e.g. Worldometer, WHO, MIND and the Guardian newspaper, but these varied both across and

between the sample groups. Many participants across both groups followed a habitual online journey following a pattern of sources described by one individual as a clicking pattern that their finger routinely followed across digital apps:

> My finger tends to find its way on the phone, as things do, it tends to be a pattern that you use (Participant 14, age 19 – 30)

While the younger group used social media, they did not see it as a reliable source of information in the same way that they might rely on websites. Most of the younger group described themselves as consumers on social media rather than actively engaged in generating or sharing information or discussion and were very considered about which social media platforms they used, what they used each for, and who they chose to follow. They described the use of social media as providing them with a quick insight:

> So, I find social media is good for getting a quick insight into what's going on and potentially what certain people think about it. (Participant 29, age 19 – 30)

The younger sample group were far more active on social media than the older group although they expressed a sophisticated cynicism about the ways in which social media promoted particular sources of information with algorithms and 'Clickbait' (links presented for the purposes of generating clicks, regardless of the veracity or quality of content):

> I, obviously, use it a lot. But, I, at the same time, know that things are blown out of proportion and things aren't always true and it's so easy to spread rumours on social media. (Participant 12, age 19 – 30)

Older people were far less likely to engage with social media and were very dismissive of its value in providing information:

> Well, certainly not social media. I mean … Good grief! No. If I wanted proper information, then I would go to the websites. (Participant 4, age 70+)

Both groups used closed social media and messaging apps to converse with a specific and an identified friendship group, primarily to enquire about well-being.

DILEMMAS AND CHALLENGES OF MANAGING AND APPRAISING INFORMATION

Both groups felt that information did not always provide clear answers to their questions but there was a recognition that as a new, and poorly understood, virus this was understandable. These gaps in knowledge as well as different claims being made by different sources, created problems in making sense of information:

> I think the clear messages that are coming out that I need to take away for safety reasons I kind of got, but I guess there is an element of, if I don't understand something at the moment, that it's not crucial that I do understand it. So I think there's a bit of disengaging in some way, but probably, if I wanted to understand something, I'd try and read a bit more around it from other, more simplistic sources. (Participant 14, 19 – 30)

Because of the volume and complexity of the information about COVID-19 as an infectious disease, and the conflicting information about its spread, participants called into question the trustworthiness of both provided and circulating information:

> I think it's critical that people get the correct information because, if there's any sort of misunderstanding or miscommunication about what to do in this situation, it could prove fatal for someone. So, it's very important that information is trustworthy. (Participant 18, age 19 – 30)

Both groups recognized that there were political drivers for the information provided about, e.g. the number of deaths in residential care or the amount of Personal Protective Equipment (PPE) available for health care workers. They expressed a clear and confident scepticism, claiming a political literacy in which they could recognize bias and would actively choose a source believed to be independent and non-partisan. This was widely thought to be the BBC which is a public service:

> To be blunt I don't necessarily trust what this government says and does, and while I have absolutely no doubt and no reason not to trust the scientists who may be advising them, I really struggle to think that some of the decisions that have been made haven't necessarily been fully explained to us, I think some of them are questionable. (Participant 29, age 19 – 30)

Yet alongside this information scepticism, was a selection and confirmation bias in which one of the dominant drivers of choice for the use of online information was if it matched an individual's own political allegiances. This was particularly important for the older group:

> The source of the information clearly, if I read something in The Daily Mail, I might be less inclined to trust it, if Donald Trump said something because I've listened to his briefings as well! So, it's the source of the information, where it's coming from (Participant 1, age 70+)

Well, yes. If it's on the Fox News, I wouldn't trust them as far as I could throw them. But, yes, the BBC, Channel 4, Sky – I guess – yes, I sort of trust. The internet? I don't know. It's difficult, isn't it? I mean, there's so many people with weird opinions. I don't trust everything you read on the internet, no. (Participant 8, age 70+)

In responding to these dilemmas both groups followed a similar sophisticated pattern of triangulating information. One element of this was the checking of information with another trusted digital source. Whilst political independence was one indicator of trust, credibility and a scientific basis was also important for both groups. Credibility derived from being an established and reputable organization. For the younger group credibility also came from an individual that they trusted and followed:

I find medics quite useful to follow because it's quite practical, and I guess, yeah, not really with a stance or agenda at all. (Participant 13, age 19 – 30)

..proper organisations like the World Health Organisation and stuff like that, yes, I listen to them and believe what they say, yes. (Participant 8, age 70+)

The second part of the triangulation of information was the checking and discussing of information with friends and family. Young people were more proactive in this while the older group did this 'in conversation':

In my house there's myself and two other housemates, we are all quite into reading the news and seeing what's going on at the moment and there is a paramedic, so he always has a medical input of being on the frontline, so generally if there's a news article that doesn't quite makes sense or maybe contradicts what the paramedic housemate says I will drop it in a group chat between us three and we will have a discussion over dinner or in a group chat (Participant 27, age 19 – 30)

The third part in the triangulation of information was 'sense making' in which individuals checked information against an autonomous cognitive process described as 'common sense' or 'my own judgement'. Particularly amongst the older group, this helped them to make sense of a wide range and flow of information about infection and risk factors that might otherwise be inexplicable:

I think it was based on what I regarded as information that I could believe or I could accept and understand. (Participant 22, age 70+)

SHARING INFORMATION

Information was discussed as part of managing and appraising information and was also shared in order to inform others. This was seen to have taken place more frequently at the beginning of the pandemic and was primarily described by the younger group. They identified their main motivation for sharing information as the protection of older family members:

Whereas with my mom it's just to make sure that she's informed and doing what she should. I mean, she's actually going way too cautious but that's fine, I'll take it. Yes, so making sure that she's getting good information as she can but not too much. (Participant 28, age 19 – 30)

Several participants referred to information that they had seen circulated but which they had dismissed and not shared and referred to this as 'rumours' such as that drinking warm water can kill the virus. The attribution of the coronavirus to the pervasiveness of 5G mobile masts was also dismissed as an unlikely conspiracy theory. Both groups said they would or had challenged misinformation that they saw circulated:

For example, I might have a family member who shared something from the Daily Mail and they believe everything and they are very scared or they're saying lockdown is going to be lifted in three weeks, but then I will read it and then maybe privately message them and say please don't trust anything from the Daily Mail, it's not a reliable news source from wide experience (Participant 27, age 19 – 30)

And then because I work with a few health professionals whenever there's been those stupid pieces of health advice going around WhatsApp groups, I've often participated in telling people to stop sharing nonsense. (Participant 20, age 19 – 30)

Information was seen as worthy of being shared if it was interesting, useful and true such as how to breathe or wash hands properly or if a person had acquired information that had unique insight:

And two friends have text, not just me, but a circle of people they know, in detail. One who's had what she called a 'moderate' bout of the Coronavirus, which was, in fact, devastating. And, even now, eight weeks after she emerged from it, she's not herself. Yes. I don't know if this is what you're interested in but I've had personal accounts of people's direct experience of having the virus. (Participant 25, age 70+)

DISCUSSION

The global threat of COVID-19 has increased the calls for HL to be prioritized as a strategy to ensure that complex and urgent public information is conveyed in a

manner that can be understood and appraised by individuals and communities (Abel and McQueen, 2020; Paakkari and Okan, 2020). Understanding the role of eHL within this context is particularly important in a world dominated by digital information (Chong *et al.*, 2020). During the pandemic we see whole populations seeking information on the same health issue within the same limited time frame while facing a requirement to make sense of this information and apply it within the context of their own lives. This magnifying glass on eHL offers us important insights that can be useful in understanding how HL is applied in both pandemic and non-pandemic contexts.

The HL lens has typically focussed on the characteristics of health communications that facilitate or impede access to information, comprehension, and action and especially a recognition that some population groups experience far lower levels of HL than others, including across the lifecourse (Okan *et al.*, 2019). This study does not include those most likely to experience communication gaps or low which may impede access to information, communication and action. The digital divide that exists in relation to eHL is well documented with age, education, income, perceived health and isolation acting as predictors of internet use for health information (Mackert, 2016; Estacio *et al.*, 2019). However, this divide in technical skills and motivation to engage with digital information was not evident amongst the two sample groups in this study. The older group did not identify technical difficulties in accessing information and all were engaged with a range of technical platforms. The key difference in digital access pivoted around the use of social media. The lower levels of social media use for information seeking amongst the older group was not driven by technical challenges or lack of awareness of social media platforms, but by a critical scepticism of their value and reliability. What this study shows is that an educated sample with higher functional literacy also has similarities of eHL application across younger and older adult age groups.

Discussions about the application of HL have focussed on rather 2D interpretations with a linear movement assumed from access to understanding and appraisal and finally to application of information and this focus has continued as HL is applied to the COVID-19 pandemic (Okan *et al.*, 2020; Paakkari and Okan, 2020). What is increasingly evident however, is that there is a 'black box' of HL. In this, complex processes are applied between the point of access and use of information that moves beyond functional HL skills and draws on facets of both critical health literacy and distributed HL. In this vein, the study confirms the multi-dimensional eHL model proposed by Sykes *et al.* (Sykes *et al.*, 2020) in which complex movement and triangulation of sources is used as a strategy for managing complex and changing information. That HL is context specific has been previously highlighted (McKenna *et al.*, 2017; Okan *et al.*, 2020) in which individual skills interplay with specific health and social systems or particular areas of health such as infectious diseases. The contextual difference of a pandemic, however, is that the importance of interactions with health professionals, a reputable source of information, is replaced by discussions with family and friends. These communication intermediaries reduce the opportunity for misinformation to be checked and corrected as part of the process.

Disease outbreaks such as MERS-COV, Avian influenza, Ebola and Zika have prompted a focus about risk communication as a key element in the response to epidemic and pandemics. It is generally agreed that communication must successfully instruct, inform, and motivate appropriate self-protective behaviour; update risk information; build trust in officials; and dispel rumours (Vaughan and Tinker, 2009), all in the context of an interactive and dynamic platform of the internet. The sheer volume of information about COVID-19 alongside conflicting information about its origin, its prevention and its treatment created uncertainty. The highly sophisticated digital citizens in this study claimed to understand the simple risk messages in public information but actively pursued further information about potential mortality, morbidity and life disruption in the early stages of the pandemic response. Although none of the participants expressed catastrophic thinking, the multiple sources of information and the ambiguous nature of information created some anxiety. All of the participants had developed ways of managing information following a decline in trust in information sources as the pandemic progressed from avoidance out of information fatigue to advanced meaning-making.

Participants in this study were aware that they were making judgments about the knowledge and expertise of those communicating to them and their honesty and openness. The two sample groups differed in age but shared high levels of education and showed evidence of critical thinking and a high level of concern regarding the trustworthiness of sources. We are in what van der Linden and Lofstedt (van der Linden and Löfstedt, 2019) have called a 'post-truth' society and our participants, in common with a US study in March 2020 (McFadden *et al.*, 2020), exhibited high levels of scepticism about the presented information from government and most other sources, other than scientists. They drew on pre-existing beliefs and information sources to make

sense of the information about the pandemic in an active cognitive process. This demonstrates the importance of critical health literacy skills and echoes calls by Abel and McQueen (Abel and McQueen, 2020) and Chong *et al.* (Chong *et al.*, 2020) for critical health literacy skills to be seen as central in applying information and challenging misinformation during a pandemic.

Whilst participants' information seeking was personally motivated during the pandemic crisis and very much focussed on what an individual could do to protect themselves and their family, there was some expression of solidarity with those most vulnerable (usually identified as the poorest in society) and of a social and political mobilization about climate change and the foundational economy of essential services and associated workforces. Indeed, many of the participants had taken some form of social action from making scrubs and masks to distributing food to vulnerable neighbours. Such mobilization was enabled by social media networks through local appeals and through known individuals. Values of 'solidarity' and 'all in this together' were frequently voiced suggesting that speaking to values in public communication may increase the likelihood of individuals taking preventative actions.

CONCLUSION

One of the societal challenges during the COVID-19 crisis has been to help the public to find accurate and reliable health information and in so doing adapt communication for low levels of HL in populations. This study highlights a second challenge for the HL demands of communication strategies which is about the abilities of individuals to critically assess information and how to live with uncertain information. A third challenge is how communication can encourage individuals to respond to information for the collective good. The narratives in this study, e.g. were as much about 'what I should do' as about 'what is the true story and who is to blame?'.

ETHICAL APPROVAL

Ethical oversight for this study was provided by London South Bank University's School of Applied Sciences research ethics committee, ethics application number ETH1920-0151.

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