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# Health literacy action framework for health emergencies and infodemics

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**Abstract.** This paper addresses the critical role of health literacy during the COVID-19 infodemic and provides recommendations for decision-makers regarding how health literacy can be advanced as an empowering resource to mitigate the harmful effects of future infodemics. Based on a comprehensive literature review, key areas concerning health literacy are identified that help provide a strategic response during an infodemic. A framework for systemic health literacy capacity and policy advice is presented to inform and guide decision-makers on managing an infodemic with health literacy strategies. The way forward includes emphasizing the rights to access information and a broader view of how health literacy can help build back better in the aftermath of the COVID-19 pandemic. Finally, the paper includes a call to action for decision-makers to integrate systemic health literacy responsiveness into public health emergency strategies to counter a future infodemic's diffusion.

Keywords: Health literacy, digital health literacy, Covid-19, infodemic, public understanding and misunderstanding

## 1. Background

According to the World Health Organization, the Coronavirus disease (COVID-19) is the first pandemic in history in which digital technology (including mass media, digital media, and social media) were used comprehensively to keep people safe, informed, productive, and connected [1,2]. However, in a modern

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information environment (coupled with health and health information inequities), a technology that connects and informs also facilitates the propagation of questions, concerns, as well as the development of information voids. A public diffusion of misinformation and disinformation occurred during the COVID-19 pandemic and other, recent outbreaks such as Ebola, cholera, and Mpox [1,3,4]. Consequent infodemics undermined global and local responses and limited the effectiveness of adherence to health guidance and public health and social measures [1,5].

The term “infodemic” was coined during the SARS outbreak in 2003 [6]. Its understanding and definition developed with the rapid evolution of the digital information environment, along with changing business models, and information-seeking and consumption patterns. Since the beginning of COVID-19, the term gained traction due to its role in countering public adherence to health guidance, public health and social measures, and their related, harmful impacts on public health and health systems [7].

An infodemic is characterized by an overabundance of information, accurate or not, in the digital and physical space, accompanying an acute health event such as an outbreak or epidemic [8]. It includes questions, concerns, information voids (people seeking health information but not finding credible, accurate sources), and other circulating narratives, misinformation, and disinformation. An infodemic includes deliberate attempts to disseminate inaccurate (and non-evidence based) health information to undermine public health responses and advance the alternative agendas of groups or individuals.

An infodemic can harm people’s physical and mental health; foster a loss of trust in the health system, health workers or emergency response; increase stigmatization and hate speech against groups of people or health workers; threaten significant health gains; and advance a poor observance of public health and social measures. The latter endangers a nation’s ability to respond to an epidemic or pandemic [1,3,9].

Moreover, misguided actions, such as seeking unproven treatments or prophylactics based on misinformation, can cost lives [2]. Without appropriate trust and credible, accurate information, diagnostic tests go unused, immunization campaigns will not meet their targets, and a virus will continue to thrive [10–12].

Finally, the diffusion of health misinformation and disinformation during COVID-19: polarized public dialogue; amplified hate speech; heightened the risk of conflict, violence and human rights violations; and threatened long-term prospects to advance democracy, human rights, and social cohesion [1,3,9,13]. The global scale of the COVID-19 infodemic was unprecedented and fostered a PHEIC (public health emergency of international concern). While people’s questions and concerns recently may have shifted to other health emergencies, some narratives and underlying drivers of COVID-19 misinformation could reappear in future public health and medical emergencies [14]. While the widespread impact of infodemics is fostered by a surrounding information environment and people’s information exposure/diet, some research suggests health literacy represents a significant mediator [12,15,16].

In this paper, the authors seek to explain the critical role of health literacy in the context of the COVID-19 and future infodemics. The authors provide recommendations for decision-makers on how health literacy can be improved as a resource of citizens and systems to mitigate the harmful effects of future infodemics and health emergencies. Some recommendations for health literacy and infodemic management are provided, and reflections are shared regarding the way forward.

## **2. Health literacy**

During the COVID-19 pandemic, health literacy and digital health literacy played a crucial role in how the public understood and responded to the PHEIC [12]. Generally, health literacy refers to the ability of individuals to obtain, understand, and use information to make informed decisions about their health [17].

Digital health literacy refers to the ability to access, understand, and use digital health information and services to make informed health decisions [18]. Health literacy and digital health literacy can contribute to public understanding and misunderstanding of health information in at least four ways.

First, health literacy helps individuals understand medical terminology and communicate effectively with healthcare professionals [19]. Simultaneously, limited health literacy fosters confusion and misunderstandings about medical procedures, diagnoses, and treatments. Second, health literacy helps individuals understand health disparities and advocate for better healthcare access and policies [20]. In contrast, limited health literacy fosters a lack of awareness about health disparities, which counters efforts to address them. Third, digital health literacy helps individuals navigate online health resources to find reliable information [15]. Similarly, limited digital health literacy fosters misinformation and inaccurate health advice. Fourth, digital health literacy helps individuals use health technology such as mobile apps, wearables, and telemedicine to manage their health [18]. Limited digital health literacy undermines the effective use of health technology effectively, which results in suboptimal health outcomes.

Overall, health literacy and digital health literacy are foundational to the public understanding of health information. They help individuals make informed decisions about their health, access reliable health information, use health technology effectively, and advocate for better healthcare policies. In contrast, limited health and/or digital health literacy fosters public confusion about healthcare and public health, health disinformation and misinformation, and less desirable health outcomes.

As Sorensen et al. suggest, health literacy also impacts people's knowledge, motivation, and competencies to access, understand, appraise, and apply information to form judgement and make decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course [21].

In addition, health literacy is sometimes called 'the silent epidemic' because limited health literacy is a public health challenge in itself [17]. International health literacy research suggests a large proportion of populations (<30%) need help to handle information to manage health [21]. Regardless of geopolitical or health care delivery systems, limited health literacy is negatively associated with adverse health outcomes and higher healthcare costs, financial deprivation, low education, and social status [22–25]. When designing the response to overcome the COVID-19 infodemic, health literacy must be considered to ensure that policies, strategies, and interventions accommodate individual, organizational, and system level health literacy needs [12,15,16,26,27].

### **3. Health literacy: why is it important?**

In terms of addressing the public understanding of health and making informed decisions, boosting health literacy skills improves the abilities of individuals to obtain, communicate, process, and understand health information and services [17]. Health literacy also helps individuals know how to describe symptoms, where to find adequate help for health issues, how to understand medical information, and how to manage the use of medication safely [28].

Health literacy additionally converges with four public and individual health care challenges around the world, which are summarized below.

*Health literacy is an independent, modifiable determinant of health.* Health literacy develops over the life course and is influenced by personal, situational, and societal factors. In turn, health literacy is associated with health service use and health costs, health behavior and health outcomes, participation and

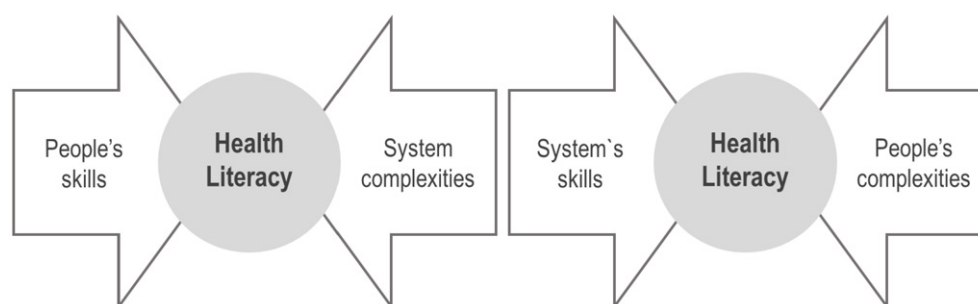


Fig. 1. Health literacy is a relational concept [38].

empowerment, equity, and sustainability. Yet, health literacy can be modified at individual and population levels [22,25,29].

*Health literacy is a relational concept.* Health literacy improves the skills of individuals to match the complex demands of health care delivery systems and a systems' capacity to reach the complex needs and characteristics of individuals (as illustrated in Fig. 1). Health literacy also is central to facilitating people-centered services regardless of settings such as health, education, media, commerce, etc. [17,30–37].

*Health literacy is a dynamic concept that is context and content specific.* Health literacy varies depending on health challenges and the content to which it is applied, e.g., vaccine literacy, diabetes literacy, and mental health literacy. Health literacy also is closely associated with similar literacies, such as digital, information, and media literacy [39]. Health literacy is culturally sensitive and needs to be tailored to audiences in all geographical settings [22].

*Low health literacy is an underestimated global-wide challenge.* There is an evidence-based significant relationship between health literacy and health outcomes found in at least three continents (Asia, Europe, and North America) [40]. Evidence of a social gradient regarding health literacy also has been suggested consistently in national population surveys. Generally, lower socioeconomic status is associated with limited health literacy [22,30]. So, health literacy follows a global social gradient in health that runs from top to bottom of the socioeconomic spectrum regardless of a nation's wealth, employment, and income status.

#### 4. Health literacy in the information age

The Information Age is grounded in the idea that access to, delivery of, and demand for information is a defining factor of human knowledge, attitude, and behavior. Recently, the digitization of information has accelerated the volume of available information throughout much of the world. Peoples offline and online life, identities, and behaviors increasingly are interconnected and codependent, and societal stakeholders provide services in real life and the digital world.

Due to the profound impact of the sheer volume of information (mostly digital) and the direct and indirect enabling and hampering effects on health, Morley et al. suggest the resulting 'Infosphere' is a core social determinant of health (See Fig. 2) [41]. The infosphere, which is illustrated in Fig. 2, suggests how the constant, evolving information to which individuals are exposed impacts health and other behaviors [42].

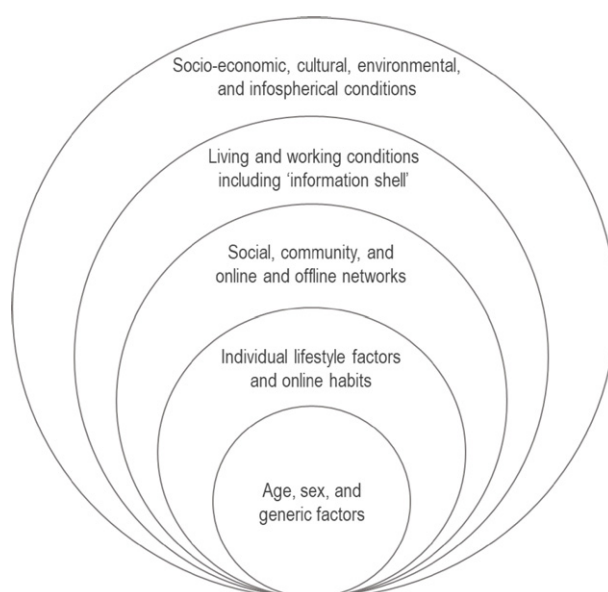


Fig. 2. Including infospherical conditions as determinants of health adapted from Morley et al. (2020) [41].

Meanwhile, the infosphere model in Fig. 2 also suggests health literacy is associated with personal, situational, social, cultural, and environmental social (and health) determinants. While health information is vital to living a healthier life, it conversely has become apparent that public exposure to and interaction with health questions, concerns, information seeking, and cultural narratives such as health-related misinformation and disinformation, can deleteriously affect individual and public health [15,43]. Overall, if information is empowering, then, a lack of credible, accurate information is disempowering. Within this process, the authors suggest that health literacy should be considered as a vital mediator.

#### 4.1. Health literacy in a plethora of information age

Before the pandemic, two political events (Brexit and the U.S. presidential election of Donald Trump) accelerated the spread of misinformation and disinformation on the Internet [44]. The growing impact of health twiplomacy - the use of Twitter and other social media sites by government agencies and officials to engage with the public, disperse information, and leverage global influence - prompted an expanded mass and interpersonal communication environment [45].

Yet, despite efforts to rapidly debunk false claims by a growing army of fact-checking organizations, the public's ability to discern accurate versus inaccurate information often is relegated to self-reliance and self-assessment [41]. To back up, the Internet foundationally is built to share information regardless of its accuracy or evidence-based veracity.

As lives transition to a digital sphere, so do human rights, obligations, and entitlements. Information technology altered communication patterns, which are taken for granted as they empower people to express their diverse identities, provide a voice to minorities, and enable collective efforts and mobilizations. However, the infodemic provides an operant example of the deleterious socio-cultural scenarios that can be generated by the expansion of legacy and digital social and mass media. To find remedies, boosting health literacy would seem to be an integral part of constructive and remedial solutions.

## 5. Pandemic phases and health literacy as a prudent social investment

The uniqueness of the COVID-19 pandemic meant that, especially at its beginning, there was a significant uncertainty about how to constructively manage and cope, even amongst officials such as public health experts, politicians, and decision-makers. The pandemic's unfortunate windfalls included panic shopping and celebrated non-adherence to public health guidance such as hand washing, physical distancing, and wearing masks.

Indeed, since spring 2020, the pandemic has engendered an acute, a protracted, and a current post-emergency phase [8]. Yet, regardless of phase, health literacy must be a fundamental part of a health crisis response for countries to successfully distribute relevant, timely, and valid life-saving information to their citizens [12,16,43,46]. Boosting social responsibility requires that people are equipped with evidence-base reasons for specific health recommendations - and they are encouraged to reflect carefully on the possible health outcomes of their actions.

However, socially responsible behaviors often are associated with other individual and social skills such as: prior knowledge; general literacy; individual self-efficacy; as well as community norms. As a comparative social investment for policy makers, health literacy may be a less expensive and more focused civic investment to help people better understand a pandemic's severity and select safety measures, such as physical distancing and hand hygiene [16,43].

### 5.1. Health literacy and other relevant literacies

While health literacy is a specific concept that explicitly addresses managing and handling health information (and associated information processes), other concepts, such as information literacy and media literacy, share similarities. These also became social markers during the infodemic [14,27,47,48].

Briefly, information literacy is the ability to think critically and make balanced judgements about any information we find and use. It empowers citizens to reach and express informed views and to engage fully with society [49].

Media literacy is understanding and using mass media in either an assertive or non-assertive way, including an informed and critical understanding of media, the techniques they employ, and their effects. Media literacy includes the ability to read, analyze, evaluate and produce communication in a variety of media forms (e.g. television, print, radio, computers etc.). Media literacy also is defined as the ability to decode, analyze, evaluate, and produce communication in a variety of forms [50].

Science and scientific literacy interventions additionally are important since these target general populations and seek to promote scientific thinking and analytical problem-solving skills, such as the ability to understand health's subtleties and nuances [51]. While science literacy often targets student scientists, engineers, and technicians and train them in scientific and technical knowledge for practical applications, some aspects of science literacy (such as boosting the public's numeracy) dovetail with health literacy intervention efforts.

To backup, UNESCO combines media literacy and information literacy within their 'Media and Information Literacy' framework, which provides a curriculum for teachers and education professionals to address media and information literacy learning in schools. Since the onset of the COVID-19 infodemic, UNESCO has combined media and information literacy with the closely associated concept of health literacy. In fact, the British Library and Information Association and their Information Literacy Group suggests that if the concept of information literacy is applied to any given health context, it is synonymous with health literacy [49].

Yet comparatively, health literacy remains an underestimated concept and health literacy research sometimes has been overlooked [16]. In response during the pandemic, researchers from diverse disciplines have encouraged the inclusion of health literacy initiatives targeted for citizens, policy makers, governments, information producers and providers as integral remedial management and information strategies [15,16,43,52–55].

### 5.2. Emerging research on COVID-19-related health literacy

Recent health literacy research suggests options for policy makers to consider when designing and executing a pandemic response [12,43,52–54].

For example, a recent study on the fear of COVID-19 among medical students suggests higher health literacy levels may ease their anxiety [56]. Higher health literacy levels also are suggested to thwart COVID-19 related depression [57].

Other studies suggest while higher education students have sufficient levels of digital health literacy (and often use online media to access health information on coronavirus and COVID-19), they experience difficulty in evaluating online health messages and recognizing health information from commercial interests [52,54]. Related research suggests how other information recipients have difficulty identifying reliable information as well as disinformation, misinformation, and misinformation [1,14,48,58].

Other research has identified a negative information bias (which is associated with “catastrophic thinking”) and a positive information bias (which is associated “unrealistic optimism”) about the pandemic’s realities [59]. In aggregate, recent research underscores health literacy’s utility as well as a scientific challenge to better understand its specific impacts on patient and public understanding, health care professionals, and public policy [14].

## 6. Recommendations for health literacy and infodemic management

While access to timely, reliable, evidence-based health information is critical, it is only helpful if the information is updated, understandable, acceptable, accurate, and tailored to individual and cultural values [60–62]. Governments and health authorities are responsible for providing the latter information through health communication and mass media campaigns. Yet, a lack of access to evidence-based health information significantly contributes to morbidity and mortality, especially in low and middle-income countries and among vulnerable groups in all countries.

In addition, there is a pressing need to target vulnerable populations with relevant and updated health information, which is why health information equity has become a significant issue in health literacy and infodemic management [8,13,63].

A sense of solidarity is needed between those who provide information to mitigate COVID-19 - and future emergencies - and those who require information to overcome the array of health threats exacerbated during an infodemic. In turn, the World Health Organization and United Nations have asked Member States to:

- develop and implement action plans to manage the infodemic by promoting the timely dissemination of accurate information, based on science and evidence, to all communities, particularly high-risk groups, and preventing the spread, combating, misinformation and disinformation while respecting freedom of expression.



- engage and listen to communities as they develop action plans and empower communities to build solutions and resilience against misinformation and disinformation.
- work with all other stakeholders, including the media and social media platforms through which misinformation and disinformation are disseminated, researchers and technologists who can design and build effective strategies and tools to respond to the infodemic, civil society leaders and influencers.
- collaborate within the UN system, with member states and with each other to further strengthen actions to disseminate accurate information and prevent the spread of misinformation and disinformation.

For Member States and other stakeholders to boost health literacy during a pandemic, the WHO's recommendations apply health literacy principles in individual and systemic efforts to ensure that health information is easy-to-understand, easy-to-access, and barrier-free.

### *6.1. Contribution of health literacy and digital literacy to public understanding and misunderstanding during the COVID-19 pandemic*

Recent research suggests health literacy was associated with understanding and following public health guidelines related to COVID-19 including social distancing, wearing masks, and health hygiene [12,16]. Individuals with higher health literacy were more likely to understand and adhere to these guidelines. Moreover, individuals with higher health literacy were more likely to know where to find trustworthy information and how to interpret it [64].

Individuals with higher health literacy also were more likely to understand the safety and efficacy of vaccines and the risks and benefits of getting vaccinated. Importantly, when addressing vaccine hesitancy, individuals with higher health literacy were more likely to understand the significance of vaccine coverage, the science behind it, and the potential consequences of non-compliance. Individuals with higher health literacy were more able to understand the impact of policies and regulations and were more prone to advocate for them in their communities [64].

In contrast, limited health literacy led to misunderstandings with significant public health consequences. Besides less adherence to vaccination and other public health efforts, intended audiences who did not understand health guidelines contributed to misinformation about COVID-19, such as conspiracy theories and inaccurate or unreliable information about tests and treatments, leading to risky behaviors and distrust of public health officials and institutions [65]. With limited health literacy, vaccine hesitancy may make people diffident or unwilling to get vaccinated against COVID-19, thereby reducing vaccine uptake and prolonging the pandemic with health risks and social and economic consequences [66–68].

### *6.2. Increasing public understanding with health literacy and digital health literacy in the future*

Increasing public understanding in a future global emergency requires a combination of clear, simple, and straightforward communication, engagement with the public, reliable and trustworthy information, tailored messages, multiple communication channels, and collaboration with relevant stakeholders. Building on the lessons learned, some research-derived recommendations include:

- (1) Using clear and simple language to communicate important information. It is recommended to avoid using technical terms or jargon that might be difficult for people to understand and use visual aids to help explain complex concepts.
- (2) Engage with the public and their local communities through the creation of opportunities for dialogue and feedback. Social media and other digital platforms can reach a wider audience.

- (3) Be transparent about any uncertainties or limitations as part of providing reliable and trustworthy information based on data and reputable sources.
- (4) Consider the audience's background, cultural values, and previous experience when tailoring messages to make them relevant and meaningful.
- (5) Use various communication channels such as social media, television, radio, and media to ensure that language and formats are accessible to people with multiple degrees of health literacy and digital health literacy.
- (6) Partner and collaborate with relevant stakeholders, such as community groups, healthcare providers, policymakers, and academics, help to create a shared understanding of current needs and concerns.

In addition, sustained strategies to promote health literacy develop should be integrated into national and international policies, strategies, and action plans. For example, the American Healthy People 2030 strategy focuses on increasing the proportion of individuals with proficient health literacy skills, promoting health literacy in healthcare settings, and improving access to health information [69]. A comprehensive national action plan on health literacy includes strategies in practice, schools, workplaces, and communities. Internationally, intergovernmental organizations like the World Health Organization, OECD, and Council of Europe have developed surveys, guidelines, and frameworks to support governments in the development of health literacy of their populations.

## **7. Health literacy responsiveness of the policy sector to build resilience to infodemics**

There are normative and persistent differences between expert and public understanding regarding health issues. Investing in health literacy and digital health literacy at individual and systemic levels helps overcome these barriers by fostering a more informed and responsive population. Increased efforts may influence the population's skills to enact and support functional, interactive, and critical health literacy and generate a more conducive environment where people are empowered to manage their own and community health based on respect and mutual trust.

### *7.1. Health literacy responsiveness from the policy sector to manage an infodemic*

At the beginning of the pandemic, UNESCO introduced four strategies and ten priorities for decision-makers to respond to the infodemic. The strategies were: (1) identify disinformation, (2) identify its producers and distributors, (3) identify its production and distribution, and (4) target audiences of disinformation. UNESCO's intent was to create an environment where people can access reliable and accurate health information and distinguish accurate information from misinformation.

In this paper, UNESCO's framework is expanded by suggesting a fifth strategy: create trust towards trustworthy sources, including three responses. Figure 3 illustrates combining all five strategies with eight previously identified elements of systemic health literacy [3,9], including the framework for health literate systems as suggested by Sørensen et al. [70]. Figure 3 conceptualizes a change in focus to shift from COVID-19 preparedness to future emergency preparedness, and encourage policymakers to create resilient systems and populations and develop future preparedness strategies [71].

In addition to these strategies, the World Health Organization recently released a report on strengthening health emergency prevention, preparedness, response, and resilience (HEPR). The WHO recommended the implementation of measures in the following areas to respond to emergencies systematically: (1)



Fig. 3. Health literacy responsiveness of the policy sector to manage the infodemic (model informed by the UNESCO framework and the Pan American Health Organization fact sheet no. 5 on the infodemic) [3,9,72].

collaborative surveillance, (2) community protection, (3) safe and scalable care, (4) access to counter-measures, and (5) emergency coordination. Strengthening HERP systems and implementation also will support developing and delivering measures to promote population health literacy [71].

## 7.2. *Leaving no-one behind*

Health literacy research suggests some population groups are more vulnerable to infodemics partially because of their limited health literacy. These groups may include people who have limited literacy, are non-native speakers, and are geographically, culturally, or socially isolated or homeless. Other vulnerable populations include: persons who live on low incomes; children, adolescents, or from older age groups; persons with mental health challenges; migrants, refugees, or asylum-seekers; and the disabled (for example, visual or hearing impairment, mobility limitations, cognitive disorders). Additional vulnerable populations include persons who require care; and who are medically or chemically dependent. Barriers need to be reduced for these groups through systemic responses to avoid structural-induced inequalities.

## 8. The way forward

Looking ahead, infodemics likely will be a long-term global challenge. New approaches are needed to meet these challenges, including managing an infodemic with health literacy strategies. While this paper focuses on personal and organizational health literacy, other infodemic mediators are important and are addressed in the World Health Organization's HEPR architecture [71].

### 8.1. *Health literacy and right to health information*

Health literacy is tied to the public's right to information. Enhancing health literacy through improved access to information facilitates more informed decisions about personal health, family, and community health. Access to health information empowers people to advocate more effectively to political leaders and policymakers. It also promotes accountability by enriching people's understanding of the health impact of governmental policies and political decisions.

Access to information held by state bodies is a fundamental human right formulated by the UN's General Assembly in 1946. It is incorporated in the freedom of expression and information. Freedom of expression and information requires the obligation of a state to refrain from actions that obstruct it, and the right of access to information requires the state's responsibility to provide access by law. Accordingly, the right to access information guarantees everyone the right of access to all information and documents related to the management of public affairs, regardless of the status of the concerned person and the purpose for obtaining the required information.

While some national governments and big technology companies are implementing laws and strategies to improve access, other (and sometimes simultaneous) international efforts to legally penalize health disinformation, ironically, may be less compatible with human rights principles. Heightened public anxiety during the pandemic has prompted legislation (in some nations) to restrict speech that spreads health misinformation and disinformation. However well-intended, these efforts create a bipolar narrative where there is a "right way" and a "wrong way" of thinking about COVID-19 - and the wrong way might be judicially culpable and liable.

The irony of the latter legislative efforts is providing health information to the public often relies heavily on government sources and official statements [73]. So, at the same time disinformation or misinformation liability is proposed in some nations, its initial violators may be the politicians and elected officials who have been disinformation and misinformation sources during the pandemic.

To remedy this quandary, one clear option is to embrace the public's right of access to information or freedom of information, which is a health literacy principle. People need to exercise their freedom of information and embrace transparency. First and foremost, all stakeholders and citizens need to have the right to obtain information about important public health and biomedical issues.

Overall, a future vision for health literacy and infodemics relies on free, open, and trusted 'Knowledge Societies' which enable people's capacity to access information resources and contribute information and knowledge to local and global communities. The latter empowers users to enhance their livelihoods and contribute to social and economic development [74]. Regarding the mass media's role, new approaches are emerging such as "constructive journalism," which provide audiences with a fair, accurate, and more contextualized insight into public affairs and information [75].

### 8.2. *Building back better based on health literacy*

The global pandemic has exposed the cracks in current health information systems in addition to the harmful social impact of infodemics. However, infodemics can instigate enhanced systems through a systemic health literacy response, which advances the functional, interactional, and critical health literacy of the public and the workforce engaged in health issues.

Health literacy is founded on inclusive and equitable access to quality education and life-long learning. It should be integral to the skills and competencies developed over a lifetime, first and foremost, through school curricula. The investment in the empowerment of citizens in schools and over a lifetime, enables engagement in collective actions against health misinformation and disinformation.

### 8.3. *Call to action*

To support countries to move effectively towards the mitigation of the infodemic while also addressing pre-existing challenges related to health literacy, some evidence-based principles and recommendations have been outlined in this paper.

The recommendations addressing health literacy strategies to manage the COVID-19 infodemic recognize that health is a political choice. Any interests detrimental to health, such as misinformation and disinformation, need to be counteracted with socially comprehensive efforts, such as recognizing the far-reaching implications of the infosphere [41]. While there are barriers to empowerment and factors inflicting disempowerment during pandemics, these can be mitigated or overcome. The determination of political leaders and levels of governance, from private, public to cultural sectors, are required to promote health literacy to counter future infodemics and respond to pandemics. The impact of health literacy as means to address or even defy an infodemic is a shared responsibility and demands coordinated action by all stakeholders.

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## **Declaration of interest**

The authors declare no conflict of interest.

## Authors' contributions

KS and OO drafted the manuscript, which was commented on, reviewed, and edited by all other authors. All authors approved the final version of the manuscript.

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