Information Services & Use 43 (2023) 143–150
DOI 10.3233/ISU-230192
IOS Press

Digital health literacy and health technology in health systems and beyond: The importance of measurement, planned action, and policy for readiness and sustainability[1]

Diane Levin-Zamir[a,b,*]
[a]*Clalit Health Services, Department of Health Education and Promotion, Tel Aviv, Israel*
E-mail: diamos@zahav.net.il
[b]*University of Haifa, School of Public Health, Haifa, Israel*

Abstract. The COVID-19 pandemic led to a sharp and distinct increase in the development and application of digital resources for public health and healthcare services. The benefits from this trajectory are dependent upon the digital health literacy skills of the public served. In this article, digital health and digital health literacy are explored, as is the importance of measurement to set the stage for policy, practice, and continued research. Intervention on individual and organization levels are necessary, taking into consideration the social gradient as an underlying determinant of digital health literacy. Future areas of research, policy, and action-based intervention are presented.

Keywords: Health literacy, digital health, digital health literacy, digital health innovation, COVID-19

1. Background

1.1. Introduction

Health information and communication technology infrastructure have grown significantly and swept international healthcare and public health systems during the past two decades. The reasons for this are many, including cost-effectiveness, information management challenges, increasing concern for risk management, and the need to reach more vulnerable populations – particularly those with less access to health services. The latter trend was accelerated during the COVID-19 pandemic due to the need to provide services during periods of lockdown, while encouraging and even regulating the need for physical distancing [1].

*E-mail: diamos@zahav.net.il.

[1]Dedicated to the memory of Andrew Pleasant, who envisioned innovative methods for promoting the public's health, even before the concepts of digital health promotion and digital health literacy were developed. Dedicated also to the memory of Prof. Jürgen Pelikan, a pioneer and visionary whose contribution to the field of health promotion and health literacy provides a legacy for generations of researchers, practitioners, and decision makers.

Interestingly, public health systems joined the digital trend at a later point, mainly due to COVID-19, to promote conveying information directly to the public through digital media, while adapting the information to culture and language, and providing direct and even personalized information regarding vaccination. Due to the latter trend, and within this context, new areas for research, practice and policy development have emerged to meet the needs of the public, while taking into consideration available and needed resources [2].

1.2. Digital health

Digital health has been defined in several ways, but it generally is considered the application of information and communication technology to support health services and resources and more specifically: "the field of knowledge and practice associated with the development and use of digital technologies to improve health" [3]. An ecosystem for digital health includes not only health information resources that are available to the public but also tools such as electronic medical records and appointment making systems, digital wearables for self-assessment of health indicators, on-line consultation platforms, group health promotion on-line, digital medication prescriptions, interactive digital opportunities for health (such as through social media) and more, as innovation expands [3].

2. Digital divide and digital development

During the initial decades of digital innovation for health, there was concern about the "haves" and "have nots" regarding accessibility to digital resources. The latter gave rise to the descriptive term "digital divide." Yet, in time, the extensive use and implementation of digital resources have led some to consider substituting the original term with "digital development" [4]. Either way, it is apparent that special skills are required to manage health through the application of digital resources, giving rise to the concept of digital health literacy.

3. Defining digital health literacy

Before defining digital health literacy, it is important to provide an overarching definition of heath literacy. A recent definition suggests: "Health literacy represents the personal knowledge and competencies that accumulate through daily activities, social interactions and across generations. Personal knowledge and competencies are mediated by the organizational structures and availability of resources that enable people to access, understand, appraise and use information and services in ways that promote and maintain good health and well-being for themselves and those around them" [5].

The earliest definition related to health literacy and electronic sources was provided by Norman and Skinner, who defined eHealth literacy through the Lily Model, as: "the ability to seek, find, understand and appraise health information from electronic resources and apply such knowledge to addressing or solving a health problem" [6]. While this definition originally was helpful and described the way health information was increasingly accessible and requested through the Internet, it did not take into consideration the skills needed for interacting with digital platforms, including social media, patient portals, etc.

In turn, the most recent definition of digital health literacy, adapted by the Action Network on Health Literacy for Measuring Population and Organizational Health Literacy (M-POHL) within the World

Health Organization, is: "the ability to search for, access, understand, appraise, validate and apply online health information, the ability to formulate and express questions, opinion, thoughts or feelings when using digital devices, and the frequency with which people use different health resources from digital sources digital sources and resources such as online video consultations, digital personal health records, social media, health related apps, etc. for promoting health" [7]. The M-POHL definition considers the skills needed for interaction with digital resources whether synchronically (online) or a-synchronically (offline).

4. COVID-19's challenges and opportunities

With the outbreak of the COVID-19 pandemic, health promotion and health literacy activities were challenged by their normative in-person and group research/practice settings. Activities were cancelled or postponed indefinitely based on a need to protect participants (and the public) from infection by implementing physical distancing.

Ironically, as the pandemic developed, international counter demands emerged to reduce infection risks, which suggested a need to reinstitute the promotion of therapeutic health behaviors – advanced by social connectiveness and face-to-face interactions. In the Socratic dialogues of Plato's *The Republic*, the notion of "necessity as the mother of invention" essentially describes what unfolded during the Covid-19 pandemic to advance the diffusion of digital health, health literacy, and health promotion [8].

The pandemic enabled the development of a wide variety of digital health technologies, which were adopted and integrated to enable and support public health planning, surveillance, testing, contact tracing, quarantine, and health care [9,10]. The latter developments began prior to the launch of COVID-19 vaccines and were reinforced when vaccines became available [9–11].

Indeed, the COVID-19 pandemic accelerated the adoption of digital health technologies and highlighted the importance of digital health literacy. From a provider's perspective, the increased importance of telemedicine as well as remote monitoring and digital health platforms underscored digital health literacy's foundational importance, especially among special populations [10]. From a patient and public health perspective, the pandemic reinforced a need for people to rely on telemedicine and other digital health tools to access healthcare services and minimize individual and community COVID infection risk [10].

Several recent studies add how the COVID-19 pandemic advanced the importance of digital health literacy and created ensuing needs for public and professional training and education [1]. Several barriers to digital health literacy were identified, including limited access to digital technologies, limited health literacy skills, and language barriers [1].

5. Vulnerable and disadvantaged populations

Interestingly and importantly, the pandemic's digital momentum initiated new possibilities to engage and promote the health of vulnerable and disadvantaged populations. Refugees and displaced populations, and among them notably women, were identified and targeted for health benefits during the pandemic and beyond, using mHealth platforms [12].

Yet, as the availability of digital tools increased, their accessibility did not necessarily improve, partly due to disparate levels of digital health literacy that reinforced existing barriers to health care and health

technologies. Vulnerable and disadvantaged groups experienced challenges in reaping the benefits of digital health resources. For populations that had not previously been exposed to these resources, studies found other barriers, such as perception of digital services as irrelevant for many situations, the inability to replace face-to-face services due to the poor communication in the digital environment, a lack of trust regarding digital platforms, as well as concerns about the security of the services.

Digital appointments with a health care professional also were considered less personal and more prone to misunderstandings comparing a digital environment to face-to-face services. Digital alternatives were not always available as desired by participants due to the issues fostered by a lack of connectivity, limited broadband width, and more. Furthermore, despite mass media efforts to inform the public, a lack of public awareness about existing digital services and their value persisted [13].

While Sambasivan et al. suggest the COVID-19 pandemic accelerated the adoption of telemedicine and other digital health technologies, they countered that patients face challenges to use these technologies effectively [14]. Sambasivan et al. identified several factors that influence digital health literacy such as: age, education level, and prior experience with digital technologies [14].

Overall, not all individuals have the same level of digital health literacy, and some may face barriers to accessing and using digital health technologies. So, by measuring digital health literacy at the population level, practitioners and policy makers can develop appropriate interventions, whether in public health, in-patient care, or elsewhere within a healthcare system.

6. Measuring digital health literacy: A foundation for context-specific interventions

Digital health literacy has been measured on a population level in a variety of ways and among different populations [15]. The most comprehensive research (that follows participants' life course and includes digital health literacy) has occurred across Europe. The latter research is part of the HLS_{19} survey on health literacy administered by the World Health Organization Action Network for Measuring Population and Organizational Health Literacy (M-POHL) [7].

As reported, 13 countries participated in the M-POHL survey in which a representative sample of more than 29,000 people responded. Eight questions were posed to examine how easy or difficult it is for respondents to access, understand, appraise, and apply digital health resources. The methods used to gather the data were varied, including online, telephone, and written surveys.

Acknowledging the survey's limitations due to the diversity of data gathering methods, and the timing of the survey (some countries prior to, and others during the COVID-19 pandemic), the results still reflect digital literacy barriers that need to be addressed. Among the survey participants, the most difficult challenges were the ability to judge whether information from digital sources was reliable and the capacity to determine whether provided information was derived from commercial interests [7]. In addition, a social gradient was evidenced regarding groups at risk for low digital health literacy – older populations and those with lower socio-economic status.

The results of the M-POHL study and others highlight the attention that needs to be given to digital health literacy when planning interventions and policies, which potentially maximize the contribution of digital health literacy to public health and patient care. In addition, intervention programs need to emphasize meeting the special needs of groups that are more vulnerable to low digital health literacy, including older adults and those with lower education achievements and financial deprivation.

7. Improving digital health literacy

To improve digital health literacy and reduce some evidence-based disparities, intervention is needed on two levels: personal and organizational.

Personal digital health literacy can be improved by providing education and training on how to use digital health technologies effectively. This includes allocating resources that explain how to access and navigate digital health platforms, as well as training on how to use specific tools and technologies, such as telemedicine software and mobile health apps.

However, the success of such interventions depends on addressing the barriers to digital health literacy, such as overcoming limited access to digital technologies or low health literacy. This may involve providing access to digital technologies and resources in underserved communities or providing targeted health literacy education and support to individuals who need it.

As healthcare services continue to shift towards digital technologies, it will be important to ensure that individuals have the knowledge and skills to use these technologies effectively and to overcome potential barriers to access and use.

Similar to health literacy, digital health literacy progress depends on improving how health care organizations address the digital resources they provide to patients and communities.

8. Specific strategies to improve digital health literacy

In order to address public needs regarding digital health and digital health literacy, specific strategies need to be adopted to enhance individual digital health literacy skills and improve the performance of healthcare and public institutions to be more sensitive and responsive to the public needs.

8.1. Improving digital health literacy on an individual level

To improve individual digital health literacy following COVID-19, it is important to provide education and training on how to use digital health technologies effectively. This includes providing resources that explain how to access and navigate digital health platforms, as well as training on how to use specific tools and technologies, such as telemedicine software and mobile health apps.

In addition, it is important to address potential barriers to digital health literacy, such as limited access to digital technologies or limited health literacy skills. This may involve providing access to digital technologies and resources in underserved communities or providing targeted health literacy education and support to individuals who need it. Research suggests interventions to improve digital health skills even among older adults can be effective, especially by emphasizing self-efficacy [16].

As healthcare services shift towards digital technologies, it is important to ensure that individuals have the knowledge and skills to use these technologies effectively and overcome potential barriers to access and use.

8.2. Addressing digital health literacy on an organizational level

The following organizational strategies can be adopted to improve digital health access and digital health literacy to achieve positive outcomes:

- **Provide access to technology**: Governments, healthcare organizations, and community groups can provide access to technology, such as smartphones or tablets, to people who lack them. They can also provide internet access through public Wi-Fi or mobile hotspots.
- **Provide digital skills training**: Organizations can provide training on digital skills, such as how to use websites, apps, and video conferencing tools. This training can be provided through online resources, webinars, or in-person workshops.
- **Provide health literacy training**: Organizations can provide training on health literacy, such as how to interpret health information and communicate with healthcare providers. This training can be provided through online resources, webinars, or in-person workshops.
- **Address concerns about digital health technologies**: Organizations can address concerns related to trust – about privacy, security, and the accuracy of information by providing clear information about how data is collected and used, how security is maintained, and how information is verified.

Other policy recommendations furthered by the work of M-POHL and others suggest health care organizations should [7]:

- **Strengthen digital health literacy** for all and **prioritize populations** with financial deprivation, less education, and in some countries, senior populations.
- **Advance** interventions and policies to promote digital health literacy for all with a focus on **critical** digital health literacy skills.
- **Consider** expanding **quality-assured health information** on the Internet and in social media for general populations, community/opinion leaders/ journalists via mechanisms that encourage an evidence-based foundation.
- **Provide** seasonally adapted health information in clear language.
- **Develop** communication strategies to **reach specific groups of the population** best via digital media.
- **Acknowledge** the lack of research on digital health literacy and allocate more resources to advance knowledge and praxis.
- **Expand** research on digital health literacy **to include children and adolescents**.
- **Share** research results with **policy makers and health system managers** to promote digital health literacy.

9. Future areas of research, practice and policy

9.1. Providers' digital health literacy

The extent to which the public health and healthcare workforce have digital health literacy skills and the association with the degree to which digital health resources are and will be adopted has yet to be investigated comprehensively. While some initial studies suggest the importance of providers' health literacy and its influence on their communication skills, the digital health resource explosion may require increased digital health literacy among providers to increase resource accessibility and instill patient (and community) trust in digital tools [17]. As artificial intelligence (AI) receives increased development and implementation for health and healthcare (and elsewhere), little is known about the extent to which it may replace personal, face-to-face, in person contact [12].

9.2. AI and the patient experience

The open access availability of ChatGPT *potentially* makes it easier for the public to receive information about health in simple, clear terms and target populations with influential messages through appropriate mass media channels. In terms of public and community health, ChatGPT may expand the available information on infectious and chronic diseases and environmental hazards, support health promotion and disease prevention efforts, and offer updates on local and accessible services – all tailored to more segmented and diverse audiences.

In addition, it is expected that AI *might*: promote appropriate translation of materials; communicate with cultural sensitivity in multiple languages; and facilitate interactive personalized, and responsive communications tailored to individual needs and preferences [18].

However, AI's promise depends on the accuracy of the health information it provides and the capacity of audiences to identify fake sources impersonating as qualified authorities as well as disinformation; and misinformation [19]. The latter suggests a pressing need to assess the public's digital health literacy skills and provide data for evidence-based health information intervention practices.

9.3. Personalizing the patient experience digitally

Turning to clinical practice, a case has been made to personalize patient experience through digital technology and focus on the following four elements.

First, clearly identify patients' needs based on their demographic, clinical, and psychosocial data as well as past behaviors, and offer the most appropriate set of services. Second, communicate with patients with personalized and appropriate calls to action, through patients' preferred communication channel(s). Third, offer patients access to relevant digital health tools to support clinical care needs, such as coaching programs, monitoring devices, or digital therapeutics and incorporating them into a care plan to enhance in-person services. Fourth, promote the use of digital tools for patients who are not in need of immediate clinical support.

These tools can help self-monitor symptoms and track ongoing behavioral progress, so new needs are quickly identified then fed back into patient data [20].

10. In conclusion

Finally, while digital health resources and services are constantly increasing and expanding their reach, traditional face-to-face services will need to be offered alongside digital efforts to ensure equal and appropriate access to services and resources. Overall, improving digital health literacy following COVID-19 is an important step to ensure that individuals can access and use digital health technologies to improve their health outcomes and quality of life.

References

[1] F. Magrabi, E. Ammenwerth, C.K. Craven et al., Managing pandemic responses with health informatics – challenges for assessing digital health technologies, *Yearbook of Medical Informatics* **30**: (2021), 56–60.

[2] A. Sundelson, J. Hopkins Bloomberg and N. Huhn, Infodemic management approaches leading up to, during, and following the COVID-19 pandemic infodemic. in: *Johns Hopkins Center for Health Security Project Team* 2023.

[3] World Health Organization. Global Strategy on Digital Health 2020–2025, 2021. http://apps.who.int/bookorders.
[4] D. Levin-Zamir and I. Bertschi, Media health literacy, Ehealth literacy, and the role of the social environment in context, *Int. J. Environ. Res. Public Health* **15**. Epub ahead of print 2018, doi:10.3390/ijerph15081643.
[5] World Health Organization. Health Promotion Glossary of Terms 2021, 2021.
[6] C.D. Norman and H.A. Skinner, eHEALS: The eHealth literacy scale, *J. Med. Internet. Res.* **8** (2006), e27.
[7] The HLS19 consortium of the WHO Action Network M-POHL. *International Report on the Methodology, Results, and Recommendations of the European Health Literacy Population Survey 2019–2021 (HLS19) of M-POHL*. Vienna, 2021.
[8] A.K. Bloom, *The Republic of Plato*. Basic Books, New York, 1968.
[9] J. Budd, B.S. Miller, E.M. Manning et al., Digital technologies in the public-health response to COVID-19, *Nature Medicine* **26**: (2020), 1183–1192.
[10] S. Whitelaw, M.A. Mamas, E. Topol et al., Applications of digital technology in COVID-19 pandemic planning and response, *The Lancet Digital Health* **2**: (2020), e435–e440.
[11] D. Levin-Zamir, Communication, health literacy and a systems approach for mitigating the COVID-19 pandemic: The case for massive vaccine roll-out in Israel, *J. Health Commun.* **25**: (2020), 816–818.
[12] S. Sarbadhikari and S.N. Sarbadhikari, The global experience of digital health interventions in COVID-19 management, *Indian Journal of Public Health* **64**: (2020), S117–S124.
[13] A.M. Kaihlanen, L. Virtanen, U. Buchert et al., Towards digital health equity – a qualitative study of the challenges experienced by vulnerable groups in using digital health services in the COVID-19 era, *BMC Health Serv. Res.* **22**. Epub ahead of print 1 December 2022, doi:10.1186/s12913-022-07584-4.
[14] N. Sambasivan, S. Kapania and H. Highfill, Everyone wants to do the model work, not the data work: Data cascades in high-stakes AI. in: *Conference on Human Factors in Computing Systems – Proceedings* Association for Computing Machinery, 2021, Epub ahead of print 6 May 2021, doi:10.1145/3411764.3445518.
[15] K. Yang, Y. Hu and H. Qi, Digital health literacy: Bibliometric analysis, *J. Med. Internet. Res.* **24**. Epub ahead of print 1 July 2022, doi:10.2196/35816.
[16] S. Pourrazavi, K. Kouzekanani, S. Bazargan-Hejazi et al., Theory-based E-health literacy interventions in older adults: A systematic review, *Archives of Public Health* **78**. Epub ahead of print 10 August 2020, doi:10.1186/s13690-020-00455-6.
[17] S. Mor-Anavy, S. Lev-Ari and D. Levin-Zamir, Health literacy, primary care health care providers, and communication, *Health Lit. Res. Pract.* **5**: (2021), e194–e200.
[18] S.S. Biswas, Role of Chat GPT in public health, *Annals of Biomedical Engineering*. Epub ahead of print 1 May 2023, doi:10.1007/s10439-023-03172-7.
[19] T. Abel and D. McQueen, Critical health literacy and the COVID-19 crisis, *Health Promot. Int.* **35**: (2020), 1612–1613.
[20] A. Bucher, The patient experience of the future is personalized: Using technology to scale an N of 1 approach, *J. Patient Exp.* **10**. Epub ahead of print 1 January 2023, doi:10.1177/23743735231167975.