

A global call to action on the digital determinants of health

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Abstract

The integration of established and emerging digital technologies into the institutions and activities of daily life produce important digital transformations that have profound impacts on health and wellbeing. In this Perspective we articulate the urgent need for close attention to the health-related impacts of the diverse uses of digital technologies and the transformations they bring about on a global scale. We provide a conceptual summary of definitions of the Digital Determinants of Health published in the peer-reviewed literature and present progress toward a conceptual framework for understanding the Digital Determinants of Health as operating through primary (individual and community health), secondary (domestic institutions), and tertiary (global political economy) mechanisms. We call for dialogue and collaboration to deepen work on the Digital Determinants of Health for more just and equitable impacts of digital transformations for global population health.

Main Text

Digital technologies and the transformations arising from their development, distribution, and use are having profound impacts on human lives and human health. Not only are digital technologies reshaping how people engage with their health and health care,¹⁻⁴ but through impacts on other domains of social life, they are also reshaping social interactions and public institutions that influence health and wellbeing.⁵⁻⁷ The impacts of digital technologies, the data they generate, and the processes transformed by their use are also accelerating along with advances in digital capabilities, as seen especially in fields such as artificial intelligence (AI).⁸⁻¹⁰ In this context of immense change, nation states have expressed their commitment to deeply divergent approaches to the governance of digital transformations, with some taking more permissive and other more preventive approaches to addressing risks.¹¹ In this Perspective, we aim to describe a way of understanding the impacts of these digital transformations on health and wellbeing, and to call for deeper engagement from research, policy, and practice in the effort to promote the benefits and address the harms of digital transformations for human and planetary health.

In this article, we comment on the emerging body of literature on the Digital Determinants of Health (hereafter, the “digital determinants”) and present a way of understanding the digital determinants that is inclusive of a broader range of benefits and harms for human health than is typically acknowledged in this literature. We then present a framework for understanding the impact of the digital determinants and conclude with a call for greater attention to this important field in the coming years. Ultimately, we aim to contribute to the growing call for global collaboration on research, advocacy, and governance that promotes the health-related benefits and prevents the health-related harms of digital technologies and the broader transformations they bring about. Important terms used in our paper are defined in the glossary (Box 1).

Our work is built on the large and growing body of research that documents the impacts of social, political, and commercial determinants of health. These bodies of literature respectively explore the impacts of various social circumstances, political contexts, and corporate practices on health and wellbeing.^{12–14} Although a detailed summary of these bodies of literature is beyond the scope of this paper, we build on work that aims to advance the determinants of health by pushing the conceptual boundaries of existing theories and frameworks. For example, classic models of the social determinants of health, such as the Dahlgren and Whitehead “rainbow model” depicting a range of social influences on health and wellbeing (published in 1991), have been identified as requiring further work to adequately capture the complexity of social pathways that impact health.¹⁵ Here we explore the ways that digital technologies interface with social, political, and commercial contexts to constitute a new and profound set of influences on health and wellbeing.

Box 1. Glossary of Terms

Digital Health: In the context of this paper, where we refer to “digital health”, we are referring to the World Health Organization’s definition: “the field of knowledge and practice associated with the development and use of digital technologies to improve health”.¹⁶

Digital Transformations: Where we use the phrase “digital transformations”, we refer to the concept as defined in the Lancet and Financial Times Commission on Governing Health Futures 2030: “The multiple processes of integration of digital technology and data into all areas of everyday life, including health, and the resulting changes that they bring about.”¹⁷ This definition is notably broader than many conventional definitions of digital health.

Digital Technologies: Where we use the term “digital technology” or “digital technologies”, we are referring to *the use of* a large and diverse group of digitised processes, devices, and platforms that support the generation, exchange, and use of digitised data.¹⁷ The most salient such technologies for many people are smartphones and computers, which are increasingly central to social and economic activities for those in high-income countries, with many low- and middle-income countries making infrastructural investments necessary to enable their widespread use as well.¹⁸ However, we take a broad view of digital technology. In our definition we include “lower tech” devices such as early generation cellular telephones without Internet access capabilities, as well as emerging technologies such as applications of AI, wearables, and Internet of Things (IoT) technologies.

Digital Determinants of Health: Digital technologies serve as mediators of the relationships between the material realities of peoples’ life circumstances and their health and wellbeing. In this way, uses of digital technologies amplify social, commercial, and political structures and practices. Where digital technologies are designed in ways that amplify positive structures and practices, their effects on health are positive. Where they amplify the negative effects of structures and practices, their effects on health are negative. These amplifications represent the digital determinants of health.

Conceptual Review of Literature

Digital determinants of health remains a relatively new concept in the literature, with attention in academic discussion growing only recently.^{4,6} In an effort to understand the way this literature has conceptualized the digital determinants, we sought to categorize the literature into distinct types of contributions that convey the digital determinants in unique ways. Instead of repeating a systematic search of this literature, we synthesized existing literature reviews and highly cited primary sources to map different conceptual approaches to the digital determinants. We drew upon four systematic searches of the literature reported in published articles,^{4,19-21} and the broad and deep survey of the literature provided in the Lancet and Financial Times Commission,⁷ to explore the scope of literature relevant to our effort. We also searched for articles that had cited these papers and other included papers since their publication to ensure our sample of published works was as current as possible. We supplemented this search using a Google Scholar search of the phrase “digital determinants of health” and an AI literature search (using the tool “Undermind.ai”) in February 2026 to ensure the most recent articles were included. The prompt to generate the AI search of this literature is reported in Box 2. We then grouped articles according to the way in which they conceptualized the digital determinants, ultimately generating four distinct groups (Box 3). Acknowledging that several articles include conceptual overlap between these groups, we see the categorization as conceptually useful and have summarized the definitional categories below. From these groups, we pulled the definitions provided by exemplar articles to illustrate the range of conceptual considerations incorporated into each group of contributions (available in Table 1). The four contributions are briefly stated in Box 3 and elaborated in the paragraphs that follow.

Box 2. Prompt for AI-Based Literature Search

Please retrieve articles that consist of commentary, conceptual discussions, editorials, or empirical reports that propose definitions, comment on, further develop, or empirically study the concept of the “digital determinants of health”. This literature most often uses the exact phrase “digital determinants of health” in the title, abstract, and/or full text, but can also use phrases such as “digital health equity”, “digital inclusion”, and “digital literacy” in relation to health, health care, and public health. Articles should be in peer-reviewed literature published after the year 2010 and should be published in the English language. We are most interested in articles that directly address “digital determinants of health”.

Box 3. Four Conceptual Categories of Definitions of the Digital Determinants

Group 1: Conceptualizes digital determinants in relation to the impacts of digital technologies within health systems.
Group 2: Conceptualizes digital determinants by viewing digital technology as a standalone determinant of health.
Group 3: Conceptualizes the digital determinants by viewing digital technologies as having diffuse, complex impacts on a variety of determinants of health.
Group 4: Conceptualizes the digital determinants by shifting away from examining the impact of digital technologies individually to examining the impacts of *collective digital transformations* as determinants of health.

The first group of contributions we refer to conceptualizes *digital determinants in relation to the impacts of digital technologies within health systems*. This body of work builds on important contributions related to the roles of digital technologies in health care delivery and governance. For example, Chidambaram et al (2024) situate their proposed definition of digital determinants explicitly in relation to “digital health”, which they define as “the use of technology to deliver healthcare services” (p. 2).⁴ They build their commentary on global calls for more strategic and purposeful planning for digital technologies in health care systems, referring to trans-national guidance from groups like the WHO and OECD, and domestic policy efforts in countries such as India and Australia. Holmes Fee et al (2023), also grouped in this first category of contributions, presented a closely related definition of the digital determinants in relation to the impacts of digital technologies specifically on health care delivery, which we highlight as an exemplar of this category in Table 1.¹⁹ Although the focus on health care delivery and health systems is extremely important, we suggest that work on the digital determinants must also consider impacts that extend beyond health care services and systems.

The second group of contributions conceptualizes *digital determinants by viewing digital technology as a standalone determinant of health*. This body of work conceptualizes digital determinants in relation to the independent impacts of digital technologies on health and wellbeing. Contributions grouped into this category extend their perspective beyond health care systems, bringing digital technologies together with other models of the determinants of health. For example, Rice and Sara (2019) position their article as providing an “update” to the seminal Dahlgren and Whitehead (1991) model of the social determinants of health.²² Rice and Sara (2019) proposed that “virtual world; information and communication technologies” be added as a separate layer to the Social Determinants of Health (SDoH) model, which they justify by describing the independent impacts of digital technologies on physical, mental, and social health (p. 1245).²²

Although contributions in this domain describe the impact of digital technologies on health as a separate category of influence from other determinants of health (e.g., employment or education), they also point toward the complexity of teasing apart those influences. This approach has the benefit of emphasizing the strong influence of technology, paired with the drawback of perhaps unintentionally underemphasizing the web of connections between digital technologies and the other determinants that shape health and wellbeing.

The third group of contributions conceptualizes the *digital determinants by viewing digital technologies as having diffuse, complex impacts on a variety of determinants of health*. Contributions in this category explicitly explore the ways that digital technologies modify the impacts of other determinants of health. Instead of treating digital technologies as having direct independent impacts on health, as in the second category of contributions, these works describe how digital technologies shape the way that determinants such as employment, education, social networks, living conditions, and lifestyles have their impacts on health. For example, Jahnel et al

(2022) explained that digital technologies have “arguably permeated into most aspects of everyday life and therefore into most of the layers and levels in the Dahlgren and Whitehead model” of the SDoH (p. 2).⁶

Several contributions in this third category explore the way that a specific feature of digital technologies impacts a wide range of other determinants of health. For example, Benda et al (2021) argued that broadband internet access ought to be understood as a social determinant of health because of its widespread impact on issues such as access to services, accurate information, and economic opportunity.²³ One absence from these approaches is the explicit recognition of the comprehensive impacts of digital transformations on global contexts of social, commercial, and political activity; we turn to our final category of contributions for insights into this issue.

The final group of contributions *conceptualizes the digital determinants by shifting away from examining the impact of digital technologies individually to examining the impacts of collective digital transformations as determinants of health*. In so doing, this shift encourages attention to the ways in which the entire digital ecosystem produces a diffuse set of impacts upon health and wellbeing. These impacts are both primary, in the sense of having a direct impact on an individual’s health and wellbeing, and secondary, in the sense of shaping other contexts that in turn exert impact on an individual’s health and wellbeing (e.g., by concentrating corporate power or producing pressure to engage in “gig work”, which impact health in myriad ways). This shift emphasizes the multiple pathways through which digital transformations influence health.

The most compelling representation of this final group of contributions is the Lancet and Financial Times Commission on Governing Health Futures 2030. The Commission described the impact of digital transformations as follows:

Digital transformations are embedded into, and negotiated within, broader political, societal, and economic processes. This means that different societal preferences, socioeconomic contexts, and political and institutional configurations might lead to several ways through which digital technologies are integrated into people's lives and sociotechnical systems.⁷

The commission described the importance of lines of mutual influence between digital transformations and the digital infrastructures, policy contexts, innovation practices, and social expectations in a given jurisdiction. The commission articulated how digital transformations impact these broadest contexts in which the determinants of health are situated, thereby shaping not only individual determinants but the broader global environments in which they are embedded.⁷ Related, researchers have pointed toward the importance of the ways digital industries are intertwined with broader legal environments in their impacts on health.²⁴ We suggest that understanding this broadest, and at times most abstract, level of influence is essential to understanding the most important targets for research, policy, and advocacy related to the digital determinants of health.

Table 1. Categories and Definitions of the Digital Determinants of Health in the Literature

Category of Digital Determinants of Health	Definition	References
Impacts of digital technologies within health systems	Digital Determinants of Health (DDOH) are the factors intrinsic to technology that when applied to the provision of healthcare services can have a major impact on health outcomes. The factors influencing DDOH include but are not limited to aspects such as ease of use, usefulness, interactivity, digital literacy, accessibility, affordability, algorithmic bias, technology personalization, data poverty, and information asymmetry	(Holmes Fee et al., 2023, p.2) supported by other sources. ^{4,21,25-39}
Digital technology as a standalone determinant of health	The digital determinants are conditions in the digital environment that affect a wide	(Richardson et al., 2022, p.2) supported by other sources. ^{20,40-45}

	range of health, functioning, and quality of life outcomes and risks. The digital determinants includes access to technological tools, digital literacy, and community infrastructure like broadband internet and operates at the individual, interpersonal, community, and societal levels	
Conceptual Break		
Digital technologies as having diffuse, complex impacts on a variety of determinants of health	Rather than constructing a novel, separate layer of influence, we suggest that the existing levels provide a usable framework to describe, examine, and modify digital determinants of health inequities—by specifying the digital influences within the existing levels. This allows hypothesizing and examining within-and between-layer interactions: for example, differences between countries in popular opinion to which extent digital patient records are deemed acceptable (an example of a “general socioeconomic, cultural and environmental” condition on the outermost layer)	(Jahnel et al., 2022) supported by other sources. ^{6,23,28,46–56}
Impacts of digital transformations as determinants of health	Digital transformations, which we define as the multifaceted processes of integration of digital technologies and platforms into all areas of life, including health, are embedded into, and negotiated within, broader political, societal, and economic processes... (p. 1727) [Digital transformations] might soon become a dominant prism through which we can understand and address health and wellbeing dynamics. Digital technologies are already driving health transformations both directly (through their application in health systems, health care, and self-monitoring of health status and behaviours) and indirectly (through their influence on the social, commercial, and environmental determinants of health)... (p. 1727) ...Due to the influence that dynamics of digital access and	(Kickbusch et al., 2021) supported by other sources. ^{24,57–65}

	literacy might have on health and wellbeing outcomes, we can consider the digital ecosystem itself as an increasingly important determinant of health (p. 1727)	
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Resisting Simplicity in Definitions of the Digital Determinants

In our reading of the literature presenting definitions of the digital determinants, we observe a conceptual break between the first two and latter two categories. Specifically, in the first two categories we observe the intent to offer clear, specific definitions that present the use of technologies as having an independent causal power to directly impact health and health care. Conversely, in the latter two categories, we observe the intent to convey that the use of digital technologies serves to amplify or reduce the impacts of other influences on health. In this way, the latter categories make space to generate a deeper conceptual understanding of the digital determinants by positioning digital technologies as mediating the impacts of more fundamental causes of health. For example, the profound digital transformations we are observing in health and society are shaping the impacts of politics,²⁴ commerce,⁶⁶ and social relationships,⁶⁷ and have been recognized as a “mega-trend” influencing the character of all determinants of health.¹² We channel the insights of many researchers before us to point out that, at the root of these fundamental causes, are intersecting inequities in resources that shape peoples’ opportunities and experiences of health and wellbeing.^{68–72}

Aligned with the intent to encourage deeper conceptual understandings of the digital determinants, we treat digital technologies as mediators of the relationships between the material realities of peoples’ life circumstances and their health and wellbeing. Beliefs and assumptions about people and the world are designed into technologies that influence how technologies shape the impact of material realities and transform institutional processes in particular ways;^{73,74} these material

realities and institutional processes represent the conditions in which health is achieved.⁷⁵ The material realities we refer to here are the social, environmental, commercial, economic, and political circumstances that are produced by longstanding inequities and shape the health-related opportunities and challenges people experience in their lives.^{70,76} Digital technologies serve to amplify or reduce the impacts of these circumstances on peoples' lives, thereby mediating their influences on health. Where digital technologies amplify the positive effects and reduce the negative effects of these circumstances, they are positive determinants of health. Where digital technologies amplify the negative effects and reduce the positive effects of these circumstances, they are negative determinants of health.

Toward a Conceptual Framework of the Digital Determinants of Health

We aim to present foundational considerations that should be built into efforts to refine theory, research, and practice on the digital determinants. Specifically, we suggest that at the center of the digital determinants of health is the complex, cyclical relationships between pre-existing inequities, the development of digital technologies, their multiple effects on health and health-related institutions (i.e., digital transformations), and the onward reinforcement of inequities. The mediating effects of digital technologies and industries on health can be understood through three layers of impacts, which we describe as primary, secondary, and tertiary. Each type of impact shapes the conditions in which health and wellbeing are achieved with different degrees of proximity to health outcomes. We present a visual way of understanding the digital determinants in Figure 1 and elaborate here. In a world characterized by the inequitable distribution of power and resources,^{77,78} digital technologies and the transformations they enable hold high risk of reinforcing cycles of global inequities in health. However, this does not need to be the case.

Primary Effects: Individual and Community Health

At a primary level, digital technologies directly interface with decisions and practices of people and their communities that impact health. Technologies enable a range of tasks that directly relate to health and wellbeing, including the acquisition of information (e.g., through AI summaries and chatbots), enhancing sensor-motor capabilities (e.g., digitally controlled hearing aids), accessing health-related services (e.g., online counselling), and building social relationships and networks (e.g., social media). These uses of digital technology can function in ways that amplify positive health-related structures and practices, such as searching for and acquiring *accurate* health information from a trusted source. However, these uses can also function in ways that amplify negative health-related structures and practices, for example by leading people to health-related misinformation that is re-shared by other users on a social media platform. Where technologies have the effect of promoting health and access to health care at the individual and community level, they serve to enhance peoples' capabilities to engage with the world, develop resilience against inequities in power and resources, and in some cases generate active resistance to such inequities.^{79,80} However, where technologies have the effect of reducing health and access to health care at the individual and community level, they reinforce the cycle of power and oppression that characterizes global health inequities.⁸¹⁻⁸³

Secondary Effects: Domestic Institutions

At a secondary level, digital transformations influence the functioning of domestic institutions such as health and welfare service delivery organizations that amplify the positive or negative impacts of these institutions on health and wellbeing. The rationale for digitizing processes in these organizations tends to arise from the intent to serve more people with the same or fewer resources, thereby enhancing the efficiency of public services.^{84,85} In other cases, the rationale is to enhance quality. The way institutional processes and practices are re-shaped can vary, including digitization

(converting analogue data into digital forms), digitalization (converting analogue processes into digital processes) and digital transformation (reshaping organizations).⁷ The impacts of digital technologies on domestic institutions such as governments and businesses have not been universally positive. In some cases, such as with electronic health record systems, there have been foundational gains made in the quality or coordination of care.⁸⁶ However, in other cases, commentators have warned about the erosion of public and welfare services through issues such as algorithmic bias and the high costs of digitalisation, thereby reducing the capacity of these services to have positive impacts on health.⁸⁷ As such, in the same way as seen through the primary effects of technologies on health, these secondary effects can also either amplify or reduce health-promoting effects of existing structures and practices (i.e., through domestic institutions), thereby producing either positive or negative health-related impacts on the conditions in which health is achieved.

Tertiary Effects: Global Political Economy

At a tertiary level, digital transformations influence global policy and corporate activity, creating new or expanding existing concentrations of power and resources in ways that amplify the impacts of the structures and practices that determine health. The wide-ranging impacts of the global digital technology industry are a primary consideration at this level, as technology corporations engage in practices such as lobbying governments to influence policy, scaling up platforms that demand precarious work internationally, building high-risk technologies such as generative AI, and acquiring data from LMICs to use in the development of new digital products and services without reciprocal benefit.^{79,81,88,89} These business practices then shape opportunities for health and wellbeing around the world as people engage with digital platforms, for example, by experiencing suicidality after interacting with AI chatbots,⁹⁰ developing negative views about public health

institutions arising from social media use,⁹¹ or engaging in precarious labor through food delivery platforms.⁹² Even for those who do not engage with digital technologies, their health and wellbeing is shaped by changes to the global economy, policy environment, and geopolitics connected to digital transformations.

The demand to build a policy infrastructure to protect residents against the harms of digital technologies also means that governments are spending substantial resources on technology policy at the expense of other pressing health-related policy issues, such as sustainable health care systems or the climate crisis.³⁹ Universities and academic health sciences centres also play a role in this global political economy, competing for funding and attention while reinforcing the immense concentrations of power among large technology companies and reinforcing their role in health care and public health.⁹³ This complex global reality that we refer to as “the global political economy of the digital determinants of health” reinforces the inequitable distribution of power and resources that is amplified by digital transformations, creating a cycle of positive and negative onward impacts on health.

[Figure 1. The Digital Determinants of Health (to be inserted here)]

Conclusion

In this paper we have described three layers of impacts of digital transformations on health, outlining how uses of digital technologies in various ways can amplify or reduce the impacts of structures and practices on health and wellbeing. We suggest that efforts to refine, study, and govern the digital determinants of health should acknowledge the complex processes through which digital technologies and industries shape human and planetary health, pushing the boundaries of this concept. This literature will also need to explicitly acknowledge that digital

technologies and industries are built on top of pre-existing inequities that arise from generations of concentration of wealth and power and the exploitation of some communities for the gain of others.²⁴ Such inequities represent root causes of health inequities, which are being coded into digital technologies and the business practices through which they spread across the globe.⁷²

Ultimately, we call for investment and collaboration to build deeper understandings of the many pathways through which digital transformations impact health, identifying opportunities to enhance health-promoting structures and practices and reduce health-damaging ones. Doing so will require a strong critical perspective on persistent efforts to develop technologies that present profound risk to large portions of the population (e.g., existential risks),⁹⁴ and a much more democratic and inclusive approach to building, distributing, and governing digital technologies. Furthermore, we propose that conceptually stronger approaches to the digital determinants depend on interdisciplinary and inter-sectorial collaborations, synthesizing diverse expertise into clearer understandings of this complex topic. Finally, we propose that where possible, people in positions of power move slowly with digital transformations, offering greater opportunity to understand, anticipate, and mitigate health-related risks associated with the widespread presence of digital technologies in our lives. We suggest that action is needed in each of these domains if digital transformations are to be health-promoting in the longer term, and we call for deeper investment in these directions to advance the growing literature on the digital determinants of health.

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James Shaw contributed to study design, literature review, analysis, project administration, visualization, writing, review, and editing.

Caesar Atuire contributed to study design, analysis, review, and editing.

Leo Anthony Celi contributed to study design, literature review, analysis, project administration, visualization, writing, review, and editing.

Sara L.M. Davis contributed to study design, analysis, visualization, writing, review, and editing.

Tiyondah Fante-Coleman contributed to study design, literature review, analysis, visualization, writing, review, and editing.

Kadija Ferryman contributed to study design, analysis, visualization, writing, review, and editing.

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Juan Sebastian Osorio contributed to study design, analysis, review, and editing.

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Competing Interest

The authors declare no competing financial or non-financial interests.

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Figure 1. A Conceptual Framework for the Digital Determinants of Health.

