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Bridging the Digital Divide: Transforming Healthcare for Universal Access and Well-Being

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A B S T R A C T

The approach to digital transformation in the healthcare industry aims to bridge the gap in access to technology by integrating digital solutions into all aspects of an organization. This entails a shift in operations and value delivery. In healthcare, the focus of digital transformation is on enhancing the well-being of everyone by expediting the development and acceptance of digital innovations. The World Health Organization recognizes digital health as a crucial element in achieving universal health coverage, safeguarding against health emergencies, and promoting better overall health for a billion individuals worldwide. To achieve this, digital transformation in healthcare should encompass the consideration of digital determinants of health, which are new factors that contribute to inequality alongside traditional social determinants. It is vital to address these digital determinants of health and bridge the digital divide to ensure that all individuals have equal access to the advantages of digital technology for their health and well-being.

Keywords: Digital transformation; healthcare industry; access to technology; digital solutions; digital innovations; digital determinants of health; social determinants; digital divide

1. Introduction

For decades, the implementation of information and communication technologies (ICT) in healthcare systems has been a slow and progressive process, filled with successes but not without failures. As early as 2005, the World Health Assembly, through its resolution WHA58.28 on eHealth, urged member states to "consider the possibility of developing a long-term strategic plan to develop and implement electronic health services and develop information and communication technology infrastructure for health" [1].

However, it was not until 2020 that the COVID-19 pandemic drastically and suddenly modified the care model in developed countries, shifting from primarily in-person healthcare to a virtual care model to protect patients with chronic diseases and manage the high demand for acute conditions in healthcare facilities. COVID-19 served as a catalyst for digital transformation, with implications that affected all aspects of daily life in nearly every corner of the world [2][3]. In this context, non-pharmaceutical digital interventions, such as contact tracing apps, proximity tracking devices, and QR code-based admission systems, emphasized the growing importance of digital tools in public health [4].

During the initial weeks of the state of emergency, the use of digital tools by the population experienced a significant increase in Catalonia. In just two months, the number of users doubled, from 384,000 in December 2019 to 649,992 in March 2020, according to data [5].

The absence of adequate planning in digital transformation can lead to the emergence of the digital divide, which refers to inequalities in access, use, and skills related to ICT among different groups of people [6].

2. Digital Transformation

A We understand digital transformation as the integration of digital technology into all areas of an organization, which entails a change in the way of operating and delivering value to professionals and users of the system. Digital transformation goes beyond simply digitizing internal processes within organizations, as it also involves developing and offering digital services to users, completely transforming value propositions. This transformation represents an organizational cultural shift that requires systems to explore new ways of thinking, executing, and interacting [7].

Digital transformation in healthcare should be focused on improving health for people worldwide by accelerating the development and adoption of appropriate, accessible, affordable, scalable, and sustainable digital health solutions to prevent, detect, and respond to epidemics and pandemics. It involves developing infrastructure and applications that enable countries to utilize health data to promote health and well-being [8].

The World Health Organization's "Global Strategy on Digital Health 2020-2025" considers ICT as determinants for the future of global health and essential for digital transformation in the healthcare sector. This project views digital health as a facilitating factor in ensuring that an additional billion people worldwide benefit from universal health coverage (UHC), an additional billion people are better protected against health emergencies, and an additional billion people enjoy improved health and well-being. To achieve this, the WHO outlines four key strategies, described in Table 1 [8].

Table 1 Key strategies in digital transformation to improve health outcomes and mitigate risks associated with the digital divide, according to the WHO

• Promote research in digital health, creating and sharing scientific evidence and best practices

• Digital health literacy for healthcare professionals and the general public

• Establish an agenda for digital health: create working networks, promote dialogue and knowledge exchange

• Promote inclusive digital societies: monitor and evaluate the implementation of digital technologies to identify person-centered solutions with a focus on gender equality and health equity

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2.1 Social Determinants of Health

Social determinants of health (SDH) refer to the various factors that influence the health of individuals and populations, including personal, social, political, and environmental factors. The World Health Organization (WHO) defines SDH as "the circumstances in which people are born, grow up, work, live, and age, including the wider set of forces and systems shaping the conditions of daily life" [9]. There are multiple factors that influence SDH, and various models, such as Lalonde's model [10] and the rainbow model by Dahlgren and Whitehead [11], are used to explain them.

2.2 Digital Determinants of Health and the Digital Divide

The digital transformation in the field of health requires expanding the model of social determinants of health (SDH) with the so-called digital determinants of health (DDH). Similar to traditional determinants, DDH can create differences in the health outcomes of individuals and communities. Therefore, digital literacy and the digital divide should be included as additional axes of inequality, alongside social class, gender, age, ethnicity, and geographical location. The commission established by The Lancet and the Financial Times is working along these lines, providing recommendations for the integration of digital technologies in healthcare and helping to measure and determine the impact of digital inequality on health outcomes [12].

DDH, therefore, not only influence the classic determinants described by Dahlgren-Whitehead but also create new determinants that give rise to a digital divide. It is important to consider the digital divide when proposing community activities and intervention policies in the healthcare domain. Action should be taken at an individual level with our patients and on a global level within the population to avoid widening this divide and, if possible, attempt to reduce it [13].

Following Dahlgren and Whitehead's rainbow model, in the first level of socioeconomic, cultural, and environmental conditions, the most important points to consider for the digital transformation of the healthcare system are data protection legislation, acceptance of electronic health records, and infrastructure provision [11][13].

In the second level, which refers to living and working conditions, the use of biometric sensors or digital assistants for task monitoring has been associated with increased work-related stress, intention to rotate jobs, and poorer mental health. The digitalization of housing is closely related to socioeconomic conditions, affecting factors such as internet bandwidth, which is also interconnected with difficulties in accessing telemedicine in rural areas.

In the third level, we find aspects of equity in social and community networks. The difference is mainly seen in the technical and digital literacy to combat health misinformation spread through social media and the ability to critically evaluate content, which tends to be lower among older individuals, those with lower education levels, and lower incomes.

Lastly, in the final level, individual factors and lifestyle are related to health promotion through digital tools. However, as mentioned earlier, it is important to exercise judgment based on knowledge when consuming information. There is also the concept of digital sedentary behavior, which can increase due to physical inactivity during digital device use. However, it can also be reduced by promoting physical activity through these devices. It is important to highlight the excessive screen exposure, especially among young age groups, which has been associated with an increase in mental disorders.

The digitalization of social determinants of health (SDH) can bring significant benefits to individuals, professionals, and communities. However, healthcare professionals often do not adequately document SDH in digital format, despite the existing evidence of their usefulness [14].

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3. Proposals for addressing digital determinants of health

The Digital Health group of the IMAS Foundation (composed of 35 members from different organizations, including SEMFyC and various professional profiles) suggests ten key measures to accelerate the digital transformation of the Spanish healthcare system. They emphasize the importance of focusing on health and its determinants, involving patients, citizens, and professionals in the co-design of digital projects, and ensuring equity while reducing the

digital divide. Additionally, they provide ten recommendations of what not to do, including avoiding digitization without investing in the development of digital competencies for professionals, neglecting patient education, and failing to validate the exploitation of health Big Data and the use of artificial intelligence [15]. In summary, these recommendations help minimize the impact of the digital divide.

An article published in 2021 in the Pan American Journal of Public Health analyzed the barriers and facilitators for the implementation of digital health in South America [16]. It emphasized that improving government funding, rather than international funding, was crucial for enhancing resources and technical capacity, leading to better acceptance of telemedicine. Empowering patients in healthcare through ICT has been achieved, especially in preventing the transmission of COVID-19 cases, thanks to the development of university telemedicine networks. Overcoming digital divides has relied on the formation of interdisciplinary teams that have facilitated cultural change, involving relevant stakeholders such as healthcare professionals, administrative staff, users, technical personnel, technology specialists, and cybersecurity experts.

To ensure that measures to address the digital divide are not just empty declarations, it is essential to identify evidence-based approaches. Regarding the digital divide resulting from difficulties in accessing the internet, it is crucial for governments and regulatory bodies to address this issue through laws and decrees. Table 2 presents some examples of countries that have legislated on this aspect.

Table 2 International examples to minimize the internet access gap17

• Estonia: In the year 2000, Estonia became the first country in the world to declare internet access as a basic human right, and it remains a leader in this field. This was achieved by incorporating a telecommunications law.

• France: In 2009, the Constitutional Council guaranteed this right, stating that cutting off internet access constitutes an unconstitutional restriction on the right to freedom of expression and communication, through the "loi HADOPI" law. In 2016, Article 108 amended the social action and family code to introduce the obligation for internet service providers to maintain access despite non-payment.

• Finland: In 2010, Finland became the first country in the world to recognize broadband internet access as a fundamental right of citizenship, establishing the right to have a "fast" connection of one megabit per second. This is described in Section 60c of the Communications Market Act of July 2009.

• Italy: In 2015, Italy made a declaration of internet rights to promote it in international forums, including the Internet Governance Forum.

• Chile: A law enacted by the Chilean Parliament in 2010, Law 20.453, establishes the principle of net neutrality for consumers and internet users, although some experts have considered it a flawed example of regulation.

• Brazil: In 2014, Brazil passed a law to guarantee equal internet access to all its citizens

• Costa Rica: In 2010, the Supreme Court of Costa Rica recognized internet access as a fundamental right, linking it to the right to participate in democratic life and freedom of expression.

• India: In 2020, India declared internet access as a fundamental right regulated in the constitution, within the framework of the right to freedom of expression, privacy, and the right to education.

3.1 Gender Digital Divide

In 2020, the Spanish Ministry of Equality published the report "Women and Digitalization: From Gaps to Algorithms" [18], which provides a detailed analysis of the gender digital divide and related issues. The report proposes national and international public policies to address the gender digital divide, including the need for longitudinal studies that analyze the factors influencing gender gaps throughout life. It suggests the involvement of the entire society in this task. Aligning schools and families is essential to disseminate and transform the idea that science and technology create multiple opportunities for women. Providing educational professionals at different stages of education with training support and other resources is necessary to achieve this objective. Science and technology content should be developed from a more social and humanistic perspective. Additionally, the media plays a crucial role in conveying to society models of women in technological fields that do not reproduce gender roles. One of the challenges faced by the technology sector is the lack of female role models at different stages of the academic and professional careers.

On February 24, 2023, UN Women published an article addressing the importance of advancing towards an equitable digital future to ensure the meaningful presence of women in the digital world [19]. To achieve this, it is essential to address aspects such as accessibility, access to electricity, online privacy and security, as well as digital literacy and skills. Collaboration between governments, businesses, civil society, and women's organizations is recommended, and there is an urgent call to investigate the access barriers that women face in order to design effective policies.

3.2 Digital Divide in Persons with Disabilities

In 2020, the ONCE Foundation and ILUNION Tecnología published the first two phases of a project that analyzed the use of information and communication technology (ICT) services in the Spanish healthcare sector, focusing on the needs of people with disabilities [20]. While the data predates the COVID-19 pandemic, the project titled "Accessibility and Social Innovation in Healthcare. ICT as Facilitators for Efficient Use of Healthcare"

highlights the lack of participation of people with disabilities in the design processes of healthcare technology. It suggests that their inclusion should be regulated, similar to how companies are required to hire a certain percentage of individuals with disabilities in their workforce.

3.3 Digital Divide in Socially Disadvantaged Individuals

In collaboration with the Barcelona City Council and the Mobile World Capital Barcelona Foundation, the Government of Catalonia created the M4Social21 project in 2016, focusing on digital innovation in the social field under the "Taula del Tercer Sector." One of its areas of work is "Public Advocacy," which aims to prevent new inequalities arising from ICT through collaborative efforts. Among the projects carried out are the report "The Digital Divide in People Assisted by Social Entities" and the report "Internet, a Fundamental Right: Proposals to Reduce the Digital and Social Divide."

3.4 Digital Divide by Age

The Centre for Ageing Better in the United Kingdom published an article in 2018 that describes the eight key points for good practice in digital training for older people [22]. These eight points are detailed in Table 3.

Table 3 Key points for best practices in digital training for older adults

Flexibility and relevance: It is better to focus on courses that help people do the things they need and want to do online rather than skills-focused courses.

Right pace: Older adults studying digital topics will have different abilities to grasp information and progress in their learning at different rates. It is important for support to be responsive to the individual needs of the learners

Repetition and reflection: Creating space for repetition is essential to allow people to consolidate learning and build confidence in completing tasks. It is important to recognize and reflect on successes achieved at each stage of learning.

Right language: Excessive use of technical terms can be confusing and counterproductive. Simple language should be used that focuses on the task being completed

Mutual support: A strong teacher-learner relationship is key to building trust.

Time for building relationships: Teaching teams that dedicate time to building communication and trust can better maintain learners' interest in digital topics and increase their self-efficacy.

Ongoing support: Support should be continuous and structured within an open framework, allowing learners to return with questions and problems

Co-design: It is essential to involve users in the configuration and design of all services.

3.5 Digital Divide in Rural Areas

According to Miguel Ángel Sánchez Vidales, a technologist and professor of Industry 4.0 at the International University of La Rioja, the first step to reducing the digital divide in rural areas is to provide them with fiber optic and 5G infrastructure [23]. In this regard, in February 2023, the Spanish Ministry of Economic Affairs and Digital Transformation published a report announcing the allocation of broadband extension to Hispasat, with the aim of achieving 100% connectivity in rural, remote, and sparsely populated areas. This initiative is part of the Universalization of Digital Infrastructures for Cohesion (UNICO) Rural Demand Program, which aims to facilitate universal access to affordable flat-rate broadband and the extension of 5G in Spain [24].

It is crucial to develop ICT research clusters in rural or remote areas where population distances are significant or where climate-related challenges hinder access to the healthcare system. This would enable the development of technologies that facilitate telemedicine and reduce the rural digital divide. An example of this is found in Northern Norway, where the Norwegian Centre for Telemedicine (NST) in Tromsø has been operating since the late 1980s. Since 2002, the NST has been a collaborating center of the World Health Organization (WHO) for telemedicine [25].

4. Conclusion

It is essential to consider digital determinants of health (DDH) as factors of inequality, alongside social determinants of health (SDH), when implementing digital transformation in healthcare. Addressing these factors and the digital divide is crucial to ensure that everyone has access to the benefits of digital technology in their health, regardless of their geographic origin, age, gender, sexual identity, socioeconomic or cultural background, and physical, mental, and intellectual abilities. (1)

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