

Introducing the concept of digitally smart health facilities: a vision for the future

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The adoption of the digitally smart health facilities (DSHFs) concept introduces a new paradigm in today's public health environment, potentially opening possibilities for addressing many challenges. This editorial explores the concept, emphasizing its potential to revolutionize the health care landscape by integrating digital infrastructure, tools, services and digital literacy within the planning and construction or renovation of health facilities at all levels of care. This innovative concept could pave the way for transformative changes in health care delivery, and improve patients' outcomes and operational efficiencies, bringing health care closer to patients not only during day-to-day operations but also during health emergencies and disasters. This editorial highlights the significant contributions made by digital health solutions to the safe hospitals initiative led by the Pan American Health Organization (PAHO), emphasizing the role of information and communication technologies in enhancing access to care. A safe hospital is one in which services remain accessible and is able to function at maximum capacity and within its usual infrastructure immediately following a natural disaster. The term includes all health facilities, regardless of the level of care they offer (1). The digital age offers the potential to better navigate public health emergencies and disasters through the innovative application of digital health solutions, supported by appropriate information and communication technologies infrastructure, such as connectivity and bandwidth (2, 3). Embracing such technological advancements not only enhances the quality of health services but also boosts their resilience and ensures their accessibility, including in times of global health crises. The concept of DSHFs holds the potential to be a critical element in the development of more

resilient health systems that are grounded in the principles of primary health care (4-6).

In an era characterized by the United Nations Secretary-General's High-Level Panel on Digital Cooperation as the age of digital interdependence (7), in which technology continually redefines the limits of what is possible, the health care sector stands at the edge of a revolutionary transformation. The introduction of DSHFs offers a preview into a future in which health care delivery, patient care and operational efficiency are fundamentally redefined.

The genesis of DSHFs: envisioning a new paradigm in health care

At its core, the concept of DSHFs encapsulates the integration of cutting-edge digital technologies – such as the Internet of Things, artificial intelligence, blockchain technology, mobile apps and telehealth, among others – into the infrastructure and operations of health facilities. This vision extends beyond the current scope of digital enhancements in health care, proposing a comprehensive transformation that not only optimizes health care delivery but also ensures resilience against public health emergencies and disasters. Inspired by PAHO's safe hospitals initiative (1, 8), which advocates for ensuring continuity of care during and after emergencies, the DSHFs concept aims to push the envelope further. It envisions facilities that leverage a wide array of digital health solutions to enhance diagnostic accuracy, personalize patient care, ensure equitable access to care and continuity of care, and streamline decision-making processes, for example, by using drones to deliver medicines, among other technologies (9, 10).

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The promise of transforming health care delivery and more

The advent of DSHFs could herald a new era in health care delivery. These digitally transformed facilities could offer unprecedented levels of personalized care, significantly reduce the incidence of medical errors, and facilitate timely and effective interventions. The potential benefits extend to improving patients' outcomes and access to quality care, and providing a more engaging health care journey for them. Moreover, DSHFs could drive substantial operational efficiencies across the health system at all levels of care. Digital technologies promise to simplify administrative processes, eliminate inefficiencies and optimize workflows, contributing to the sustainability of health care facilities by reducing waste and maximizing the utilization of resources. From the patient's perspective, DSHFs can offer tremendous benefits that could reduce the cost barriers associated with accessing health care, including costs for transportation, time away from work and frequent return visits. The incorporation of electronic prescription management, and mobile monitoring and follow up of patients, as well as targeted prevention messages delivered through natural language interfaces in health messaging apps, could also improve patient-provider communications as well as overall self-care by patients (11).

A technical perspective on DSHFs

The DSHFs concept integrates advanced digital solutions into the health care infrastructure, such as interoperable electronic health records (12), telehealth platforms, digital public goods (13, 14), and artificial intelligence tools (15). At its core, the DSHFs concept aims to enhance data interoperability and the continuity of patient care across different levels of the health system. By introducing fully digital medical records that are easily accessible both to health care providers and patients, DSHFs can facilitate more cohesive tracking of patient care, promoting adherence to treatments and reducing the risk of treatment abandonment. Additionally, the deployment of digital tools within DSHFs enables real-time health monitoring and personalized patient engagement strategies, establishing a foundation for a health system that prioritizes patient safety, the quality of care, the personalization of care and efficiency.

For the DSHFs concept to be effectively realized, several enabling factors must be in place. The foundation of any digitally transformed health care facility is its digital infrastructure. The ability of digital tools to enhance patient care and operational efficiency relies on strong bandwidth and connectivity. Additionally, it is also critical to consider the necessity for satellite connections in instances in which traditional physical infrastructure cannot be implemented (16, 17).

High-quality internet access, appropriate bandwidth and stable connectivity are essential components of telehealth services and real-time data exchange, and for accessing cloud-based resources. In conjunction with the technological infrastructure, cybersecurity measures are of utmost importance (18). The digital evolution of health care facilities demands new protocols and strategies to safeguard sensitive patient- and health-related data. Comprehensive cybersecurity practices are critical to protect the health care ecosystem from dangers and vulnerabilities that could threaten patients' privacy or disrupt health

care operations. International standards play a crucial role in ensuring that digital health technologies and platforms can work together effectively, promoting interoperability and a unified health care experience (19, 20). Additionally, transforming health care facilities into digitally advanced spaces requires a workforce skilled in these capabilities and competencies. Implementing ongoing digital literacy programs is essential for preparing health care professionals to efficiently use digital tools, from clinical decision support systems to electronic health records. Ensuring the proficiency of staff in these technologies is crucial for elevating patient care and operational efficiency. All of these enabling factors should be integral to the design or modernization of a health care facility. Their inclusion ensures that the facility not only meets current digital health standards but also is prepared to adapt to future advances in health care technology, thereby fully realizing the potential of the DSHFs concept.

The path forward

While the concept of DSHFs offers an innovative vision, its realization comes with important challenges. The transition to this new paradigm demands substantial investments in technology and infrastructure alongside dedication to training health care professionals to use digital tools, as well as the implementation of road maps to strengthen the capacities of health authorities and other social actors to embrace the essential public health functions (21). Additionally, safeguarding the privacy and security of patients' data becomes a top concern, requiring robust cybersecurity measures not only at the facility level but as nationwide strategies for preventing cyberattacks on health-related data sets and applications. Achieving equitable access to DSHFs also presents a critical challenge that calls for concerted efforts to bridge the digital divide and ensure that all segments of a population benefit from digital advances in health care, especially those in situations of vulnerability and facing structural, social and economic barriers to accessing health services. Furthermore, ensuring interoperability among diverse digital health systems and adhering to universal standards will be crucial for ensuring the smooth integration of technology within health care facilities. The concept of DSHFs invites us to reimagine the future of healthcare as a future in which digital innovation and health care converge to create a system that is not only more efficient and effective but also more adaptive and responsive to the needs of patients and health care providers alike. On the brink of this transformative vision, it is imperative for stakeholders across the health care ecosystem to engage in dialogue, collaboration and innovation. Developing supportive policies, fostering technological advancements, and investing in education and training are essential steps towards realizing the potential of DSHFs.

A new horizon in public health

The potential introduction of the DSHFs concept marks an important step towards breaking down existing barriers to accessing health services, especially for the most vulnerable populations. The digital transformation within these facilities will revolutionize access to care, with innovations such as mobile health apps and telehealth playing crucial roles in overcoming geographical, financial, cultural and social obstacles.

Additionally, the adoption of platforms for electronic health records and fully digital medical records becomes crucial for tracking patients' care across all levels of a health system, offering an efficient and secure method to manage health information. Such an advance will ensure the continuity of care and reduce the chance of patients abandoning treatments by facilitating the sharing of information among different health care providers, and it will support access to, the quality of and the delivery of personalized care. The health sector's embrace of this concept may open the path to a future characterized not only by improved health care delivery and enriched patient experiences but also by expanded access to care, ensuring no one is left behind. This is critical for its promise to enhance accessibility to essential health services, which will help make significant progress towards equity in health care. DSHFs can address disparities in health service accessibility, which is important for reaching underserved communities. Moving forward into implementation requires the united efforts of technology developers, health care professionals, policy-makers, water and sanitation experts, and patients. Together, they will play crucial roles in crafting a health care system that meets the demands of the 21st century and beyond, with a strong commitment to inclusivity and equity.

The concept of DSHFs holds the potential to be a critical element in the development of more resilient health systems that

are fundamentally grounded in the principles of primary health care (5). Utilizing digital innovations to enhance health care accessibility, continuity and quality places public health on the path of realizing that health systems are not only more responsive to the needs of their populations when they implement these innovations but also are stronger in their capacity to face future public health challenges.

Conclusions

While the concept of DSHFs embodies an innovative vision for the future of health care, its realization is entangled with a range of significant challenges, both long-standing and new. To approach this vision with realism, it is crucial to acknowledge the current state of health services infrastructure across many countries in Latin America. A substantial number of health care posts and facilities are struggling with fundamental deficiencies, such as limited or a lack of staff and a lack of access to running water, electricity and sanitation systems. Addressing these basic infrastructure needs must remain the foremost priority as we navigate the path towards implementing digital health solutions. Without this foundation, the ambition for DSHFs risks becoming an aspiration disconnected from the immediate realities and needs of the communities they aim to serve.

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