Digital Health Innovations to Catalyse the Transition to Value-Based Healthcare

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Abstract

The healthcare industry is currently going through a transformation, due to the integration of technologies and the shift towards value-based healthcare (VBHC). This article explores how digital health solutions play a role in advancing VBHC highlighting both the challenges and opportunities associated with adopting these technologies. Digital health, which includes mhealth, wearable devices, telehealth and personalized medicine shows promise in improving diagnostic accuracy, treatment options and overall health outcomes. The article delves into the concept of transformation in healthcare by emphasizing its potential to reform care delivery through data communication, patient engagement and operational efficiency. Moreover, it examines the principles of VBHC with a focus on patient outcomes. Emphasizes the importance of measuring what matters most to patients using Patient Reported Outcome Measures (PROMs). The article discusses challenges that come with implementing VBHC such as stakeholder engagement and standardization of PROMs. It also highlights the role played by health innovators in facilitating the transition towards VBHC models. Through real life case examples this article illustrates how digital platforms have had an impact on efficiencies, patient outcomes and empowerment. In conclusion it envisions directions for solutions in VBHC by emphasizing the need for interoperability, standardization, and collaborative efforts among stakeholders to fully realise the potential of digital transformation in healthcare. This research highlights the impact of digital health, in creating a healthcare system that focuses on providing high quality, efficient and patient centered care.

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Abstract

The healthcare industry is currently going through a transformation, due to the integration of technologies and the shift towards value-based healthcare (VBHC). This article explores how digital health solutions play a role in advancing VBHC highlighting both the challenges and opportunities associated with adopting these technologies. Digital health, which includes mhealth, wearable devices, telehealth and personalized medicine shows promise in improving diagnostic accuracy, treatment options and overall health outcomes. The article delves into the concept of transformation in healthcare by emphasizing its potential to reform care delivery through data communication, patient engagement and operational efficiency. Moreover, it examines the principles of VBHC with a focus on patient outcomes. Emphasizes the importance of measuring what matters most to patients using Patient Reported Outcome Measures (PROMs). The article discusses challenges that come with implementing VBHC such as stakeholder engagement and standardization of PROMs. It also highlights the role played by health innovators in facilitating the transition towards VBHC models. Through real life case examples this article illustrates how digital platforms have had an impact on efficiencies, patient outcomes and empowerment. In conclusion it envisions directions for solutions in VBHC by emphasizing the need for interoperability, standardization, and collaborative efforts among stakeholders to fully realise the potential of digital transformation in healthcare. This research highlights the impact of digital health, in creating a healthcare system that focuses on providing high

quality, efficient and patient centered care.

Keywords: Digital Health, Value-Based Healthcare (VBHC), Patient-Reported Outcome Measures (PROMs), Digital Transformation, Healthcare Innovation, Patient-Centric Care, Health Technology

Introduction

In the last few decades, the healthcare landscape has undergone changes due to the rapid advancement and integration of technology. This technological progress has transformed how healthcare is managed both for individuals and on a scale by providing insights into patient health and experiences through digital recording and data collection methods.

Nowadays these advancements in technology are collectively known as “digital health". According to the Food and Drug Administration (FDA), digital health encompasses a range of technologies, including mobile health (mHealth), health information technology (HIT), wearable devices, telehealth, telemedicine, and personalised medicine [1]. The adoption of health technologies is increasingly common in the healthcare industry offering prospects for improved diagnostic accuracy, treatment options and overall health outcomes [2].

These innovations in health are driving a shift towards a value-based approach (Kokshagina & Keränen). This places patients at the center of care delivery and marks a departure from healthcare models. However, navigating the complex digital health ecosystem poses challenges transformations in healthcare.

This article aims to explain the role that digital health solutions play in advancing value-based healthcare. It will examine the challenges that come with adopting these technologies and highlight the work of health startups that are committed to assisting healthcare organisations in their shift towards value-based care models.

Digital Transformation

Digital transformation refers to “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” [3]. Digital transformation is reforming the modern-day healthcare system. Propelled by the COVID-19 pandemic, we have witnessed a surge of technology innovation to assure continuity in care delivery [4].

However, in the context of the health industry, digital transformation not only refers to managing clinical data flows and using advanced technologies but also a wider philosophical framework of business and operation transformation via digital innovations and technologies to increase stakeholder satisfaction. Its aim goes beyond digitising the organisational environment to facilitate the use of data and leverage the value of data insights for improving clinical governance and performance evaluation, supporting clinical decision-making and operation efficiency, as well as ensuring the highly efficient utilisation of health resources [4]. Ultimately, the process of digital transformation for the healthcare system needs to consider how to increase the quality of care and patient satisfaction via enhancing clinical data communication and patient engagement [5].

The digital transformation of the healthcare industry has leveraged a range of digital solutions in each part of the patient journey, including patient assessment, treatment, and management. These digital innovations arose out of the need for treatment and patient care, but toward multi-dimensional well-being and multi-disciplinary health support. The digital transformation enables healthcare professionals and other stakeholders in the health system to accomplish VBHC value-based healthcare more efficiently and sustainably [6].

Value-Based Healthcare

Value-based healthcare (VBHC), defined as a healthcare activity that highlights value as patient-centric outcomes over the cost invested to treat patients [7,8], is one of the dominant trends in the global health industry [9-11]. Due to the high costs and growing inefficiency of healthcare in many nations, as well as the growing agreement that the existing healthcare paradigm is essentially unsustainable [12,13], advocating and implementing a VBHC model has become a strategic imperative for many health systems [14,15].

What is value? A definition proposed by The European Commission broadens the interpretation of “value” from a single variable based solely on monetary value in the context of cost-effectiveness to a more inclusive concept. The proposed definition of “value” includes the following four components [16]:

1. Allocative "value": Equitable distribution of resources across all patient groups.
2. Technical “value”: Achievement of best possible outcomes with available resources.
3. Personal "value": Appropriate care to achieve patients' personal goals.
4. Societal "value": Contribution of healthcare to social participation and connectedness.

A system-level model and framework may be necessary to determine "value" within the many components connected by complex processes inside a healthcare system [17].

Under VBHC, the focus shifts from volumes (the number of physician visits, hospitalizations, procedures, and tests) to outcomes (the patients’ prioritised health outcomes, such as an increase in functional independence, and quality of life [18]. With focusing on the quality of patient care, the aim is to reduce the time spent in the healthcare sectors, avoid the development of chronic diseases, and minimize deterioration of medical conditions [18]. VBHC empowers patients and enables caregivers to provide better care at a lower cost, resulting in benefits for all stakeholders: patients, providers, payers, suppliers, and society [18].

Patient-Reported Outcome Measures (PROMS)

An important element of VBHC is measuring outcomes that matter to patients, including their symptoms, functionality, and their satisfaction with their healthcare experience. This led to the introduction and adoption of patient-centred outcomes assessments, which take into account aspects of cure and survival, as well as recovery and quality of life retained [19,20]. A patient-report outcome (PRO) is “an outcome reported directly by patients themselves and not interpreted by an observer.” PROs bring “patient’s voice” to the care journey and identify conditions or symptoms that matter the most to a patient's daily life and quality of life [21].

To measure PRO, instruments known as Patient-Reported Outcome Measures (PROMs) have been developed. These instruments are typically self-reported questionnaires that measure symptom burden, functional status, health-related quality of life and health-related behaviours such as anxiety [22]. They are generally categorized into two groups: general health-related quality of life PROMs and disease-specific PROMs [22]. General PROMS focus on general well-being, mental state, and quality of life, across a range of medical conditions [22], whereas disease-specific PROMS capture a combination of symptom severity and impact resulting from a specific condition or treatment [23].

PROMS are an essential part of VBHC because they measure what matters most to patients, and this drives the healthcare system to take a more holistic and comprehensive view of the physical, mental, and social impacts of illness. Research has found PROMS can be used in different ways to contribute to VBHC, such as Enhancing patients and clinicians' communication for identifying treatment plans; quantifying and monitoring symptoms and illness impact on life; reflecting patients’ preference on treatment and care; evaluating the quality of care and improvement of health; facilitating patient adherence and satisfaction with care; and promoting informed utilisation of health resources and services [24].

Traditionally, PROMS were administered and distributed on paper throughout a patient's care journey, requiring manual efforts to distribute, collect, and calculate patient scores. This can be a time consuming and inefficient process, with additional administrative burden for clinical teams. However, web-based softwares, platforms and apps are now being used for end-to-end management of PROMS, from automation of distributing, capturing, analyzing, and reporting these data. Features include automatic scoring of PROM data, interpretive dashboards and reports for clinicians, alerts to notify clinical teams of patients' acute needs for symptom management, integration with electronic health records and notification reminders tailored for patients [25].

One example of a fully digital PROMS system is The Symptom Tracking and Reporting (STAR) system used to assess a patient's functional recovery after radical prostatectomy at Memorial Sloan-Kettering Cancer Center [26]. The web-based system is used to collect PROMS on urinary function, sexual function, bowel function, and overall quality of life. Patients are automatically emailed a unique link with access to a web-based portal for symptom reporting. Clinicians and patients can view numerical and graphical summaries of patients' reported PROM scores, with prediction models of a patient's future functional status. Tell Us, a web-based system designed for advanced cancer patients in palliative care, has similar functionalities to STAR, but with the additional ability to trigger real-time alerts to clinical teams when intervention is necessary. The field is growing rapidly [4,27].

Key challenges

Although digital transformation facilitates the transition of traditional health models toward VBHC, implementation and adaptation are also needed from the many different stakeholders [28]. A shift in the overall cultural and behavioural environment requires a transition in clinical governance, management, and policymaking, which in turn needs the joint contributions of healthcare professionals, payers, policymakers, caregivers, and, crucially, patients.

One of the key challenges of implementing VBHC in a health system is to facilitate and incentivise stakeholders to commit to capturing and reporting of PROs along with clinical outcomes. Taking insights generated from PROs into decision-making processes (e.g., care plan development, selection of treatments or therapies) unleashes the power and value of PROs and other patient-generated health data (PGHD), such as objective data captured by wearable devices. However, the applications of PROs and other PGHD into routine patient care will lead to a disruption of the healthcare governance and clinical practice.

Despite a growing consensus of utility of PROs in clinical care, most of its applications remain in research or academic initiatives [29]. One major barrier to integrating PROs into clinical practice is the lack of standardization of how PROs are measured [30]. Measurement of PROs can range from unstructured patient diaries, to structured clinically validated questionnaires as PROMs. More sophisticated questions, such as when to disseminate PROMs to patients, how often to send these PROMs, and what data analysis should be done with the data, are usually raised once the appropriate PROMs are identified for a target patient group. These questions highlight the importance of standardizing the method of PROMs selection and implementation.

Even if there are incentives and standardized PROMs, leadership, resources, and support are needed to encourage current health systems and physicians to change. Introducing an additional workflow of PRO data collection and application may present significant increases in workload for healthcare providers. This is where a professionally developed and validated digital solution can play its role in the process of digital transformation of the health system toward VBHC. Not only can digital solutions reduce the burden of collecting and using PRO data, but they should also support healthcare providers in their routine workflow (e.g. enabling patient screening, follow-up care, support of self-management, etc.), which will further incentify healthcare providers to use the

platform.

Digital Health Approach

Digital health Innovators are at the forefront of advocating for the adoption of VBHC, particularly in addressing the challenges of real-world implementation. Their mission is to assist healthcare organizations globally transition to a VBHC model by providing tools that promote a patient-centred care approach.

Typically, digital solutions involve cloud-based Software as a Service (SaaS) digital platforms with automated and streamlined digital care pathways, reducing manual and costly processes. Digital care pathways use digital technologies to coordinate the monitoring, engagement, and support of patients throughout their care continuum, consolidating these processes into a unified system that collects, analyses, and manages PGHD, including PROs, and wearable/medical device data. They also deliver educational information to patients and providers.

Moving beyond traditional Electronic Data Capture (EDC) systems and generic Customer Relationship Management (CRM) platforms, digital platforms can seamlessly combine clinical and non-clinical data through integration with Electronic Medical Records (EMR) and clinical workflows. Thus, with a fully configurable, disease and device-agnostic platform, health professionals are equipped with a single, patient-centric system for managing communication, data collection, and analysis, providing real-time actionable information and insights to inform and improve patient care and management.

For each medical condition and treatment, there are four broad phases in developing value-based digital care pathways: 1) defining schedules, 2) content creation, 3) automated patient engagement, 4) insight generation. In developing new digital care pathways, they assist healthcare organizations in identifying areas of digitization that best benefit individual organizations and align with best practice recommendations, such as the frameworks set up by The International Consortium for Health Outcomes Measurement (ICHOM). Every touchpoint within a patient's care journey is digitally transformed and automated from their admission to discharge, including communication sent out to patients, the type and frequency of health data collected, the educational material delivered, and reports to be generated. For each digital interaction, a patient's health data is automatically captured and presented with actionable insights, ensuring providers have access to the right information for delivering high-quality care.

All four key components of value (allocative, technical, personal, and societal) can be enhanced through adopting digital health platforms [16]. The digital platform helps in the following ways: First, by improving Data Collection: Digital innovations transform the way data is collected, shared, and analyzed, significantly enhancing clinical decision-making, improving quality of care, and reducing healthcare costs [31]. The digital platform enables efficient collection of patient-generated data (e.g., PROMs) through automation, thus overcoming barriers like time constraints and resource limitations. This leads to a broader scope of data collection beyond clinical data, reducing the time spent administering assessments.

Second, by enhancing Clinical Outcomes: To improve clinical health outcomes, both healthcare providers and patients need access to specific tools for the collection and analysis of patient data: assessment forms, wearables, or medical devices. In this way healthcare providers gain a holistic understanding of each patient's unique health status and needs, leading to better-informed diagnosis and treatment decisions.

Third, by implementing Improving Performance and Standardization of PROMs: Addressing the challenge of standardization in value-based care is crucial. The digital platform aids in implementing a structured and standardized approach to collecting and processing PROMs. By adopting digital and automated condition-specific care pathways, healthcare providers can obtain high-quality data that

drives personalization of patient diagnostic and treatment plans and achieves cross-organizational benchmarking for performance and quality of care improvement.

Case Example: Implementation of Digital Platform for PROMS

Lung cancer patients undergoing chemotherapy commonly experience a range of symptoms that vary in severity, with some indicative of critical oncological emergencies. To monitor patients' symptoms and progress, traditional care processes can take up to 30 minutes, which includes having a nurse practitioner call patients for a weekly check-in, manually noting and transferring this information to an EMR, and then working through required interventions. However, this is a time and resource intensive process, inefficient for the management of increasing workloads and patients.

Working with a hospital in Brisbane, Australia, the authors used a digital health platform to monitor and address post-chemotherapy side effects in lung cancer patients. The platform was used to configure a digital care pathway that enabled the automation of the collection and analysis of 12 key post-treatment chemotherapy-related symptoms using PROMs, with real-time alerts when oncological emergencies were reported. This initiative has had positive impacts for both clinical teams and patients: improved clinical efficiencies, patient outcomes and patient empowerment.

Capturing patient responses allowed clinical teams to effectively analyse patient outcomes, contributing to improved and personalized treatment decisions. Clinical teams have noted significant time and cost savings, with an average reduction of 10 post-treatment phone calls, spanning 20 minutes per call, to identify patients requiring clinical interventions [32]. Improved operational efficiency has allowed the oncology team to handle an increasing workload while maximising patient outcomes.

Additionally, real-time data on patient conditions, improves clinical decision-making and reduces unnecessary hospitalization and travel costs for patients. Clinical teams have noted that employment of the digital health platform has allowed the effective identification of patients suitable for treatments without hospital consultations compared to those requiring a doctor’s review. By including patients' voices in the decision-making process, it empowers patients to actively engage in their treatment plans and feel confident in reporting their outcomes using the digital service.

Future directions

Digital solutions have played a growing role in the accomplishment of value-based healthcare. In the near future, digital solutions with strong interoperability and accreditation from academic/standardization development bodies (e.g. ICHOM), will have their competitive advantages. With the increasing number of digital solutions and systems to be used by a health system, interoperability plays a vital role in determining how easily a digital solution can work across different systems. Working closely with academic/standardization development bodies will ensure digital solutions are more usable and adaptable by healthcare providers with measures developed / co-developed by providers and validated in real-world settings. Due to the lack of standardized regulatory and coding standards with the provision of PROMS, revision, and development of policies to support standards for PROMS usage and interoperability needs to be better developed for the successful adoption of value-based models. With better regulation and policies in place, this would encourage more funding opportunities for value-based initiatives. While it has been a complex healthcare process, we have seen the accelerated growth and adaptation enabled by the COVID pandemic [33], with many more untapped needs to be addressed.

Conclusion

The paradigm shift towards VBHC represents a shift not merely in healthcare delivery metrics but a fundamental transformation in how healthcare value is perceived and measured. Central to this transformation is the role of digital technology, which has become a cornerstone in the global pursuit of VBHC.

Digital transformation in healthcare involves far more than just the adoption of new technologies. It encompasses the standardization of measures to ensure consistency and comparability across different systems and regions. This standardization is crucial for accurately assessing and comparing healthcare outcomes, which is a fundamental aspect of VBHC. Additionally, innovation in data applications plays a pivotal role. The ability to effectively collect, analyze, and utilize vast amounts of health data can drive improvements in patient care, enhance operational efficiency, and inform policy decisions.

Engagement with stakeholders is another critical element in this transition. VBHC requires the active participation of all parties involved in healthcare, including providers, patients, payers, policymakers, and technology developers. Each stakeholder brings unique insights and expertise, contributing to a more holistic approach to healthcare reform. Collaborative efforts are essential in addressing the challenges and leveraging the opportunities presented by digital transformation.

The execution of digital transformation in healthcare offers numerous opportunities for stakeholders to work together towards a common goal. This collaboration can lead to the development of innovative solutions, the optimization of resource allocation, and the delivery of care that truly meets the needs and expectations of patients. Moreover, it can ensure that the benefits of VBHC are realized broadly, leading to tangible improvements in healthcare outcomes, patient satisfaction, and system sustainability.

In conclusion, the journey towards value-based healthcare is complex and challenging, yet it is filled with immense potential. By embracing digital transformation and fostering collaboration among all stakeholders, the healthcare sector can achieve a system that not only values quality over quantity but also delivers care that is equitable, efficient, and truly patient-centred. The future of healthcare lies in harnessing the power of digital innovation to create a system where value and quality are at the forefront of every decision and action.

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Conflicts of Interest

None declared

Abbreviations

CRM: Customer Relationship Management
EDC: Electronic Data Capture
EMR: Electronic Medical Records
FDA: Food and Drug Administration
HIT: health information technology
ICHOM: International Consortium for Health Outcomes Measurement
mHealth: mobile health

PGHD: patient-generated health data
PRO: patient-report outcome
PROMs: Patient Reported Outcome Measures
SaaS: Software as a Service
STAR: Symptom Tracking and Reporting
VBHC : value-based healthcare

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