Structural Inefficiencies in the U.S. Healthcare System

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Abstract

The United States healthcare system is characterized by high expenditures, systemic inefficiencies, and persistent outcome gaps. This narrative review adopts a systems lens to analyze the structural features of this system, including overuse, underuse, misuse, administrative complexity, misaligned pricing policies, and high spending. We analyze the role of innovative health technologies in the system, their dual nature, and how they can enhance outcomes or exacerbate fragmentation depending on implementation. Synthesizing insights from health economics, we identify actionable approaches for reform, such as stakeholder-aligned payment models, contract mechanisms, and patient-centered adoption strategies. We discuss that successful technology integration demands more than innovation; it requires systems-level governance and aligned pricing policies based on value-based contract mechanisms. The paper concludes with a research agenda emphasizing the empirical and system-informed evaluation of digital health tools across diverse contexts to achieve equitable, efficient, and sustainable transformation.

Keywords: System-Level Perspective, U.S. Healthcare System, Health Technology, Digital Health, Healthcare Innovation, Operations Management, Healthcare Spending, Value-Based Care, Payment Models, Stakeholder Engagement

1. Introduction

The United States (U.S.) healthcare system spends more per capita than any other nation, yet it consistently underperforms in delivering superior health outcomes. Despite dedicating over 17% of its GDP to health expenditures, far exceeding peer countries, the system remains plagued by pervasive inefficiencies and wastes. This persistent paradox of high spending and dissatisfactory outcomes has spurred widespread inquiry into the U.S. healthcare system's structural issues [1, 2, 3, 4].

Mounting evidence suggests that these inefficiencies arise not from a single cause but from a complex interplay of overuse, underuse, misuse, administrative waste, inflated prices, and low-value care delivery. At the same time, digital health technologies, once seen as panaceas, have shown mixed results. While certain innovations enhance care quality and efficiency, others contribute to rising costs, disruptions, and inequities in access. The double-edged nature of technology adoption in healthcare underscores the need for more nuanced, system-level evaluation frameworks.

Healthcare systems require a systems-oriented approach that integrates insights from management, health economics, and policy design. In this context, systematic reform involves more than controlling expenditures; it requires rethinking how stakeholders interact, how pricing mechanisms are structured, and how innovation is evaluated, managed, and sustained.

Distinct from other studies, this paper employs a narrative review to examine the systemic drivers of inefficiency: overuse, underuse, misuse, administrative waste, inflated prices, and low-value care delivery. It further analyzes the dual nature of innovative health technologies, highlighting their potential to both enhance and undermine value in

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U.S. healthcare spending.

2. Methods

This paper employs a narrative review approach [5] to examine the systemic inefficiencies, economic drivers, and technological challenges shaping the U.S. healthcare system, with comparative references to international experiences. The goal is to synthesize diverse strands of literature across health economics, healthcare operations, policy analysis, and technology adoption, offering a system-level perspective on cost control and innovation strategy.

Scope and purpose

Unlike systematic reviews that focus on aggregating empirical findings within a narrowly defined question, this review is conceptual and integrative. It aims to:

- Identify root causes of inefficiency and waste in U.S. healthcare
- Explore the structural dynamics of overuse, underuse, and misuse
- Analyze the economic and operational implications of digital health technologies
- Assess stakeholder-specific perspective (patients, clinicians, enterprises, and system leaders)

Source Selection

This review draws on a targeted search of peer-reviewed journal articles, policy reports, interviews and conceptual frameworks. Sources were selected based on their relevance to the following domains:

- Healthcare cost trends and waste
- Administrative complexity and its implications for operations management
- Technology adoption frameworks
- Payment reform and contract design
- Case studies from global health systems

Searches were conducted using Google Scholar, PubMed, and Scopus, supplemented by references from high-impact journals such as Health Affairs, The Milbank Quarterly, Journal of Health Economics, and Health Policy and Technology. Key terms included: “healthcare inefficiency,” “digital health adoption,” “value-based payment,” “health systems reform,” and “healthcare operations management.”

Organization of Evidence

To guide synthesis, we used a systems lens grounded in operations management and policy analysis. Findings were organized thematically around:

- Systemic inefficiencies in the U.S. healthcare system
- The double-edged role of technology
- Reform strategies and payment redesign
- Stakeholder-specific implementation challenges

This framework enables a holistic view of healthcare transformation considering structural factors.

Limitations

As a narrative review, this paper does not aim to exhaustively catalog all empirical findings on each topic. Rather, it seeks to synthesize key insights, identify conceptual linkages, and inform a strategic agenda for value-oriented, system-level reform. While the focus is on the U.S., selective global comparisons are used to highlight policy alternatives and contextual variation [6].

3. Literature

Overview of high spending in U.S. healthcare

The United States has long been recognized as having the most expensive healthcare system in the world, with per capita expenditures significantly exceeding those of any other developed nation [1]. In 2006, healthcare spending reached $2.1 trillion, accounting for 16% of GDP, yet 47 million people remained uninsured, highlighting a disconnect between spending and coverage outcomes [3]. By 2018, expenditures rose to $3.6 trillion ($11,172 per person), driven by factors such as the proliferation of costly medical technologies, limited price regulation, administrative inefficiencies, and the market power of providers and pharmaceutical companies [4, 7, 8, 9]. Fragmented financing and a market-oriented structure, in contrast to the centralized negotiation and budgeting seen in other countries, have facilitated high prices and utilization in the U.S. system. These rising costs have increasingly outpaced household incomes, straining affordability, suppressing wage growth, and contributing to the growing number of uninsured or underinsured individuals [1, 2, 7, 3].

Rising trends in national health expenditures in the U.S.

Although government responses to COVID-19 caused temporary surges in healthcare spending in 2020 and 2021, expenditure patterns have largely reverted to pre-pandemic norms. In 2022, healthcare spending accounted for 17.3% of GDP, closely aligning with the 2019 level of 17.5%. The American Medical Association (AMA) reported a 4.1% increase in national health expenditures that year, reaching $4.5 trillion ($13,493 per capita), consistent with pre-pandemic growth rates. Recent data from 2023 and projections for 2024 continue to reflect a rising trend. U.S. healthcare spending reached 16.6% of GDP in 2023 and is expected to exceed 17% in 2024, with per capita costs around $12,555. In stark contrast, developed nations such as Germany (12.7%, $8,011), Switzerland (11.9%, $6,517), France (11.2%, $6,600), and the Netherlands (11.2%, $7,275) maintain significantly lower spending levels. Others, including Canada (10.0%, $6,596), Japan (10.9%, $4,499), Australia (10.0%, $5,676), and the United Kingdom (10.2%, $5,676), also operate at more moderate levels. These disparities reflect fundamental structural differences between the U.S. healthcare system and those of its economic peers [1, 10, 11, 12, 13, 14, 15].

U.S. healthcare spending growth outpacing GDP

In the U.S., healthcare expenditures have consistently outpaced overall economic growth, raising concerns about long-term sustainability. Health spending has increased from just 5% of GDP in 1960 to over 17% in 2023, with projections indicating it could reach 19.7% by 2032. This persistent upward trend underscores growing concerns about the efficiency and viability of the current system, especially when compared to more restrained approaches adopted by other high-income countries. For instance, peer nations such as the UK, Canada, and Switzerland have generally maintained healthcare spending in closer alignment with GDP growth [1, 15, 16].

Main challenges of the U.S. healthcare system: overuse, underuse, misuse, waste, and high prices

The high and rising cost of healthcare in the U.S. stems from a complex interplay of factors, including overuse, underuse, waste, and, most significantly, high prices [1]. In the sections that follow, we examine these issues and explore some of their underlying drivers.

Moral hazard as a driver of overuse

One key economic mechanism contributing to overuse is moral hazard, the tendency for patients and providers to overutilize healthcare services due to insurance coverage [17, 18, 19, 20, 21]. When individuals are insulated from the full cost at the point of care, demand may rise regardless of clinical necessity. On the supply side, fee-for-service payment models create financial incentives for providers to deliver more care, even when it offers limited value [1, 22]. This dynamic fuels the widespread use of low-value services, escalates system-wide expenditures [23], and contributes to inefficiencies such as overtreatment, elevated out-of-pocket costs, and inequitable access to essential care in the U.S. context [24, 25].

Moreover, when insurance schemes fail to distinguish between necessary and discretionary services, they may inadvertently exacerbate disparities and strain public budgets [26]. Addressing these challenges requires targeted reforms, such as value-based insurance design, evidence-based utilization management, and better incentive alignment,

to enhance both the efficiency and equity of healthcare delivery [27].

Supplier-induced demand and overuse

Another critical driver of overuse is supplier-induced demand, in which healthcare providers influence patients' use of services beyond what is clinically necessary, often due to financial or structural incentives [1]. This phenomenon stems from information asymmetry between patients and providers, as well as the agency relationship that defines medical decision-making. Richardson and Peacock (2006) argue that physicians may shape demand without acting unethically, given the inherent uncertainty in clinical choices [28].

In the U.S., this issue is compounded by entrenched clinical norms and systemic inertia. A comprehensive review by Korenstein et al. (2012) identified antibiotics for upper respiratory infections, coronary angiography, and carotid endarterectomy as among the most frequently overused services [29].

Importantly, the issue is not unique to the U.S. healthcare system. In Norway, Sørensen and Grytten (1999) found that increased competition among physicians under a fixed-fee system did not lead to more procedures per patient. In contrast, in Belgium and the Netherlands, fee-for-service payment models have been shown to encourage supplier-induced demand [30, 31, 32].

Supplier-induced demand has also been documented in lower- and middle-income countries. For instance, in Iran, weak regulation, limited ethical oversight, and expansive insurance coverage have facilitated unnecessary procedures such as angiography [33, 34]. In China, Shen et al. (2024) observed seasonal overutilization in hospitals, attributed to financial incentives embedded in current hospital funding models [35]. Despite the global relevance of this issue, research on overuse remains limited and fragmented, particularly in terms of designing scalable, effective interventions. Addressing supplier-induced demand thus requires a multifaceted approach: reforming payment systems, strengthening regulatory oversight, fostering accountability, and shifting clinical culture and education [36].

Underuse

Conversely, underuse occurs when patients fail to receive appropriate, recommended, or necessary care. This can result from barriers such as cost, limited access, lack of awareness, or systemic inefficiencies [1]. Underuse reflects the failure to deliver effective, evidence-based services even when they offer clear clinical benefits, leading to preventable harm, increased disease burden, and missed opportunities for public health improvement. In the U.S., many high-risk veterans missed timely COVID-19 antiviral treatments due to operational and communication failures [38].

The issue manifests in varied ways internationally. In China, the uptake of preventive services like cancer screening is influenced by individual risk preferences and access to information [37]. In Germany, both general practitioners and patients report underuse in specialist and inpatient care due to systemic and guideline-related barriers [39]. Middle-income countries face similar challenges. Thailand, for example, struggles with access to migraine therapies due to cost and regulation [40], while broader integration of artificial intelligence into clinical care remains hindered by infrastructural, legal, and cultural obstacles [41].

These examples underscore how underuse contributes not only to avoidable morbidity and mortality but also to growing healthcare inequities, necessitating reforms in education, financing, and system design [42, 43, 44, 45].

Misuse

Overuse, underuse, and misuse, including waste and medical errors, often coexist, reflecting deeper systemic dysfunctions. These problems rarely occur in isolation. As multiple studies have shown [46, 47, 48], some populations are exposed to excessive, unnecessary interventions, such as redundant tests or low-value procedures, while others lack access to essential care. Notably, the U.S. healthcare system exemplifies this imbalance, marked by the overuse of low-value services and the underuse of evidence-based care, twin failures that drive inefficiency and misuse without improving outcomes [1].

Consequences of overuse, underuse, and misuse in healthcare system

Overuse, underuse, and misuse represent a triad of inefficiencies that significantly undermine the value of healthcare. Kwiatkowski et al. documented how the overuse of laboratory tests coexisted with poor chronic disease control and limited clinical value [46]. At the same time, the underuse of effective services exacerbates health disparities, leaving vulnerable populations without access to proven interventions. Misuses, such as diagnostic errors or inappropriate treatments, waste resources and directly compromise patient safety [1, 47].

Together, these inefficiencies divert resources from high-need areas, erode public trust, and diminish the overall effectiveness of care. They reflect a broader systemic failure to allocate healthcare resources based on value and need. Addressing these issues systematically, rather than in isolated policy or clinical silos, is essential for building a more equitable, efficient, and outcome-oriented healthcare system.

Waste

A substantial portion of U.S. healthcare spending is attributable to waste [1]. According to Shrank et al. (2019), the U.S. system wastes between $760 billion and $935 billion annually, approximately 25% of total spending, across categories such as overtreatment, failure of care delivery and coordination, pricing failures, and fraud [49]. A global scoping review by Olivares-Tirado and Zanga (2024) corroborates these findings, identifying administrative complexity and pricing failure, especially prevalent in the U.S., as some of the most systemic and avoidable sources of inefficiency [50]. The review highlights that the fragmented multi-payer system, burdensome bureaucracy, and lack of price regulation make the U.S. particularly vulnerable to excessive waste. Even conservative estimates place total waste at $600 to $900 billion, with upper-bound estimates as high as $1.9 trillion. These numbers underscore that reducing waste is not only a fiscal imperative but also an ethical necessity for advancing equity and improving health outcomes.

Administrative complexity and its consequences in operations management

Among these categories, administrative complexity alone contributes over $265 billion in avoidable waste each year. As a central challenge in healthcare operations management, it affects how resources are allocated, services are coordinated, and performance is monitored. Inefficient processes, such as redundant paperwork, fragmented information systems, and poorly designed workflows, increase administrative burdens and inflate costs without improving value. From an operations management perspective, tools like workflow redesign, capacity planning, and process standardization offer pathways to reduce inefficiencies while supporting care delivery. Beyond financial losses, administrative complexity imposes substantial burdens on patients: nearly one in four insured, nonelderly adults report delaying or forgoing care due to difficulties with scheduling, billing, or navigating prior authorizations [51]. These obstacles disproportionately affect individuals with disabilities, lower incomes, or limited education, deepening existing inequities. In addition to targeting administrative waste, interventions addressing other inefficiencies could generate savings of $191 to $286 billion, making a compelling case for evidence-based, patient-centered reforms that enhance both efficiency and access [1, 49].

U.S. doesn't use more, just pays more!

Several studies have shown that while the U.S. does not necessarily use more healthcare services than other countries, it pays considerably more for nearly every component of care, including hospital stays, diagnostic tests, medical procedures, and prescription drugs [1].

Consequences of high spending in healthcare system

The consequences of high healthcare spending in the U.S. extend across individuals, businesses, and the broader economy. For patients, elevated costs often translate into substantial out-of-pocket expenses, reduced access to necessary care, and greater financial hardship, particularly among the uninsured or underinsured. Employers face rising insurance premiums, which suppress wage growth and shift more healthcare costs onto workers. At the national level, healthcare consumes an expanding share of GDP, diverting public resources from sectors such as education, infrastructure, and social services. Despite these expenditures, the U.S. does not consistently achieve superior health outcomes, underscoring inefficiencies in the system. A detailed analysis of 2015 expenditures found that only $1.4 trillion to $2.86 trillion, between 44% and 89% of total spending, delivered direct care or tangible benefits to pa-

tients, with the remainder lost to administrative overhead, fraud, defensive medicine, and overpriced services [52]. A comparative study of 12 developed nations found that Americans receive 40% less care per capita, pay 129% higher prices, and incur $1,977 more in administrative costs, operating within a system that is 27% less efficient overall [53]. These findings reveal not just underperformance, but significant misallocation of resources, making it imperative that efficiency and waste reduction be central to any healthcare reform agenda [1].

Technology as a double-edged sword

Health technology, as used throughout this paper, refers to both technological innovations and the digitalization of healthcare. While often viewed as a key lever for addressing systemic inefficiencies and rising costs, technology remains a double-edged sword, offering both promise and pitfalls [1, 2, 54, 55]. Digital tools and medical technologies can enhance provider performance, improve clinical outcomes, lower costs, and streamline workflows. However, without rigorous evaluation and thoughtful integration, they may also introduce new layers of complexity, exacerbate disparities, and inadvertently inflate costs.

Similar and dissimilar cases to that of the U.S. can be observed in other countries. A case in point is India, where technology in healthcare, particularly pediatric cardiac care, has made treatment more expensive rather than more accessible. As R. Krishna Kumar (2011) argues, prioritizing high-end technologies over affordability has excluded much of the population from life-saving care. He advocates instead for low-cost, simple interventions that can improve outcomes more equitably [56]. In contrast, countries like Sweden, the Netherlands, and Japan have shown that selectively integrating cost-effective innovations, rather than adopting technology indiscriminately, can yield better outcomes relative to spending. This underscores how technology is implemented and aligned with delivery goals is more important than its mere availability.

Short- and long-term impacts of technological innovation on healthcare system

According to the Congressional Budget Office (2008), even when technologies improve health outcomes, they often lead to higher overall expenditures [57]. This pattern is driven by both short- and long-term effects [15]:

- **Short-term effects**: In the U.S., many technologies are adopted without rigorous cost-effectiveness evaluation. As a result, expensive diagnostics and treatments are frequently used even when lower-cost alternatives exist. Moreover, new technologies often supplement rather than replace existing methods, compounding rather than containing healthcare spending.
- **Long-term effects and cascade effects:** Even cost-saving or efficiency-enhancing innovations can increase total spending. Expanded access may bring more individuals into the healthcare system, while improved longevity, though a positive outcome, extends the period over which care must be delivered. Additionally, cascade effects, in which one diagnostic tool triggers a series of follow-up procedures, can further escalate costs. These ripple effects emphasize the need for a system-level perspective when evaluating the long-term consequences of technological innovation.

Reform strategies: targeting high-need populations and overuse

A range of strategies have been proposed to curb the growth of healthcare spending in the U.S. without compromising quality of care. A key focus is the 10% of patients who account for 70% of total healthcare costs, often individuals with multiple chronic conditions or frequent hospitalizations [58]. Disease management programs, particularly for conditions such as heart failure and diabetes, have demonstrated success in improving outcomes and reducing repeat hospital admissions. Additional reforms include expanding access to primary care, which is associated with reduced emergency department utilization, and improving care coordination to minimize medical errors [58]. Technological overuse remains a persistent cost driver; thus, promoting evidence-based diffusion of innovation and shared decision-making between patients and providers is essential to avoid low-value services [8, 58]. On a broader scale, systemic reforms such as transitioning from fee-for-service to value-based payment models, adopting global budgets, and regulating provider prices offer long-term potential for expenditure control [9]. However, these strategies require physician engagement, sustained policy-level commitment, and a shift in public and media discourse

from individual responsibility to systemic accountability [59].

From fee-for-service to value-based payments

A central challenge lies in how healthcare is paid for [1]. Conventional fee-for-service models continue to reward volume over value, encouraging unnecessary or low-impact interventions. Cielo et al. (2024) report that reverting to such models led to increased inefficiencies, reduced payment transparency, and weakened the purchasing power of public insurers [60]. In contrast, value-based payment models seek to align reimbursement with care quality, coordination, and measurable outcomes. Yet, as Parikh et al. (2022) caution, even value-based systems can perpetuate overuse or misaligned incentives if poorly designed, especially when technology adoption is not explicitly tied to clinical benefit [61].

Incentive alignment challenges

Fernández-Salido et al. (2024) emphasize that effective payment reform requires more than financial incentives, it demands organizational restructuring into integrated care units, systematic measurement of patient-centered outcomes, and modern IT infrastructure to ensure data transparency and accountability [62]. However, as Rooke-Ley et al. (2024) caution, the infrastructure required for participation, such as capital investment, analytics capacity, and regulatory compliance, may disproportionately burden small, independent practices. This could accelerate corporate consolidation, raising concerns about equity, provider diversity, and patient choice [63].

Payment model matters more than payment amount

Research shows that the structure and form of payment often influence provider behavior more than the payment amount itself. This insight underscores a critical role for insurers and payers: designing incentive systems that promote efficient clinical decision-making and support the thoughtful integration of technology [1].

Payment reform for value-oriented technology adoption

Addressing these payment distortions is essential to realizing the full potential of healthcare technologies [1]. Since payment flows are often governed by contract mechanisms, aligning those mechanisms with health outcomes is critical to ensuring that technology enhances value rather than drives unnecessary expenditures. Well-designed contracts can simultaneously improve social utility, support stakeholder profitability, and foster collaboration between public and private actors to strengthen the healthcare system [64]. One promising model is performance-based contracting, which ties reimbursement to the quality rather than the quantity of services provided. These models help mitigate technology-driven overuse by rewarding evidence-based, cost-effective care [65, 66, 67, 68, 69, 70, 71, 72, 73].

Promoting high-value care through population- and episode-based payments

Population-based payment is a model in which providers receive a fixed per capita amount to cover all healthcare needs for a defined population, typically within a region or for specific chronic conditions. This shifts financial responsibility from payers to providers, encouraging coordinated, preventive, and high-quality care while discouraging unnecessary or low-value services [1, 74, 75, 76]. In parallel, episode-based payment (or bundled payment) is gaining traction as a mechanism to promote high-value care by holding providers accountable for the total cost and quality of care related to a specific condition, acute event, or treatment period [1, 77, 78, 79, 80]. Under this model, a single, predetermined reimbursement is provided for an entire episode, incentivizing efficiency, integration, and outcome-driven care across services [81, 82].

Differentiated payment mechanisms for sustainable technology adoption

A systems perspective enables the development of differentiated payment mechanisms that reflect stakeholders' long-term behaviors, interdependencies, and priorities. For example, differentiated cost-sharing allows technology owners, such as governments, to subsidize services based on clinical value, offering greater support for high-impact technologies while limiting incentives for low-value interventions [83, 84]. These tailored approaches improve access for underserved populations, direct resources toward interventions with the highest utility, and support more sustainable healthcare spending.

Aligning payment models with system-wide innovation goals

Population-based, episode-based, performance-based, and differentiated payment models aim to move away from fee-for-service structures by aligning financial incentives with value rather than volume. These approaches also promote the adoption of technologies that enhance outcomes without driving up costs. However, their success hinges on a systems perspective that considers how innovations interact with broader structural, behavioral, and financial dynamics [2].

The need to understand stakeholder requirements for a system-level perspective

Achieving this vision, however, requires moving beyond the recognition that technology is a double-edged sword. A core challenge lies in designing and implementing innovations that reflect the complex realities of the healthcare ecosystem, including the interdependent needs of patients, providers, payers, enterprises, and regulators. Ensuring that technological adoption enhances value without unintended consequences demands a deep understanding of these stakeholder dynamics and thoughtful alignment of incentives, infrastructure, and care priorities [2].

Resistance as a barrier to health technology implementation

Historically, many now-standard technologies encountered significant resistance at the outset, and the healthcare sector continues to lag behind others in embracing innovation. A system-level approach can help overcome this resistance by aligning incentives and addressing specific stakeholder requirements. As healthcare increasingly shifts toward a digital and hybrid ecosystem, the thoughtful evaluation, alignment, and integration of technologies, anchored in stakeholder needs, will be critical to realizing their full potential [1, 2].

Patient-centered adoption within a systems approach to behavioral barriers

From the patient's perspective, addressing behavioral barriers is essential to realizing the full potential of digital health technologies. The Unified Theory of Acceptance and Use of Technology (UTAUT) and its extension, UTAUT2, offer structured frameworks for evaluating adoption, focusing on factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions. UTAUT2 adds dimensions like hedonic motivation, price value, and habit, especially relevant for consumer-facing healthcare tools. Similarly, the Technology Acceptance Model (TAM) emphasizes perceived usefulness and ease of use as core determinants of adoption. As Carroll et al. (2025) argue, even technologically advanced tools like orthoses and prostheses are unlikely to be embraced if perceived as difficult to use, regardless of the user's technical aptitude [85]. This reinforces the importance of intuitive design and patient-perceived value in driving real-world utilization.

Patient-centered design to address engagement barriers

Empirical research further shows that barriers such as limited digital literacy, lack of trust, or inadequate support systems can hinder engagement with technologies like telemedicine, remote monitoring, and AI-enabled health assistants. For example, older adults are more likely to adopt personalized, user-friendly tools supported by robust infrastructure and social encouragement. Large language model-based conversational agents have demonstrated value in enhancing communication, medication adherence, and care coordination, particularly in emergency and home care settings. To ensure these innovations deliver meaningful impact, providers must begin by identifying unmet medical needs, access issues, and emotional concerns, prioritizing the lived patient experience before introducing technological solutions [1, 2, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95].

Enterprise-level barriers to digital health innovation

From the enterprise perspective, innovators must navigate a complex and risk-averse environment, where demonstrating economic value, maintaining regulatory compliance, and responding to shifting policy landscapes are essential for success. Digital health companies, in particular, face unique hurdles compared to other tech sectors, due to constantly evolving regulatory requirements [96]. These challenges are compounded by legacy systems, such as electronic health records (EHRs), which often hinder integration and delay innovation [97]. Successfully implementing digital health solutions thus demands careful balancing of regulatory obligations and technological progress, making the process both technically and strategically complex [98].

Key challenges for implementation include adapting to frequently changing reimbursement models, which can directly affect the viability and scalability of new technologies. At the macro level, healthcare systems require digital solutions that support interoperability, enable care coordination, and promote long-term sustainability. Increasingly, retailers, pharmacies, and providers are blending digital tools with traditional services to create integrated models of care, a trend that is reshaping healthcare delivery and reinforcing the need for digital tools to function seamlessly across diverse settings [99].

However, realizing this vision presents several hurdles. A major barrier is achieving data interoperability across siloed platforms that often lack standardization. Effective coordination also requires aligning diverse stakeholders, providers, payers, and digital health companies, each with different systems, incentives, and priorities. To thrive at scale, digital solutions for patients should enhance the medical experience without interfering with their regular activities.

Ultimately, the successful deployment of health technologies depends on balancing the distinct needs of patients, providers, enterprises, and system leaders within a unified, system-level strategy. Only by addressing these stakeholder-specific challenges through an integrated and collaborative approach can digital innovations meaningfully reduce costs, enhance care quality, and contribute to the long-term sustainability of healthcare systems.

System-level barriers to implementing patient- and clinician-centered digital health

However, implementing this patient-centered, systems-oriented approach presents several challenges. These include resisting the push for innovation for its own sake, ensuring that tools are grounded in actual care needs, and avoiding the introduction of technologies that encourage unnecessary utilization. Moreover, it is essential that data collected by digital tools serve well-defined patient goals, such as improving convenience, access, and care quality, while supporting sustained engagement over time [2].

Clinicians and healthcare organizations require digital tools that support clinical decision-making, preserve workflow efficiency, and uphold data privacy and usability standards. Digital tools must offer timely, actionable insights while integrating seamlessly into existing workflows to avoid clinical disruption [2, 55]. This underscores the importance of technologies that integrate seamlessly into clinical environments, rather than disrupt them.

Implementing such solutions presents multiple challenges. Ensuring seamless system integration is essential to avoid workflow disruption and promote provider adoption. Equally important is fostering trust in data security, particularly in shared environments where multiple organizations access patient information [100]. Developers must also establish a robust evidence base demonstrating both clinical effectiveness and long-term sustainability of these tools.

4. Conclusion and Future Work

Unlike prior studies, we conduct a narrative review from a systems-oriented perspective to examine the persistent paradox at the heart of the U.S. healthcare system: exceptionally high spending paired with undesired outcomes and systemic inefficiencies. We explore how structural drivers, such as overuse, underuse, administrative complexity, and payment mechanisms, contribute to this imbalance. While digitalization and innovation in health technologies offer substantial promise, their benefits remain contingent on careful integration, alignment with patient and provider needs, and system-level readiness.

One of the key insights from this study is that technology is not inherently value-enhancing. Its impact depends on the context of implementation, the structure of payment and managerial models, and the extent to which stakeholders are engaged. Strategies such as differentiated cost-sharing, performance-based contracts, and value-based payment models can support more responsible adoption, but only when grounded in the lived realities of patients, clinicians, enterprises, and health system leaders. Operational challenges must be addressed through evidence-based reforms rooted in operations management and health services research, including data integration and regulatory burden [1, 2].

Policymakers and healthcare leaders must ensure that new tools and delivery models are aligned with broader system goals. By embracing a more integrated, stakeholder-informed, and data-driven approach, the U.S. healthcare system can move toward a future where spending is not only controlled but also directed toward interventions that maximize both health outcomes and equity.

Future work

Future research will evaluate technology adoption through a systems lens, emphasizing empirical studies integrating multi-stakeholder impact assessments across care settings and model system dynamics, particularly patterns of overuse, underuse, misuse, and waste.

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