

Telemedicine in Saudi Arabia: Applications, Enabling Technologies, Challenges, and Strategic Pathways

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Abstract

Telemedicine has become a vital part of healthcare transformation in Saudi Arabia, driven by rapid technological progress, national digital health strategies, and the need to improve access to patient-centered care. This paper provides a detailed narrative review of telemedicine in the Kingdom, exploring its current uses, enabling technologies, main challenges, and future strategic directions. Using the World Health Organization (WHO) digital health classification framework, the review maps key Saudi telehealth applications across interventions for patients, healthcare providers, health system management, and data services. The results show significant progress in teleconsultation, appointment management, public health surveillance, and tele-pharmacy, mainly supported by government-led platforms and Vision 2030 initiatives. However, ongoing barriers such as regulatory fragmentation, data privacy issues, digital literacy gaps, infrastructure disparities, and limited integration of advanced analytics continue to restrict widespread and effective adoption. Looking ahead, the paper highlights strategic priorities for advancing telemedicine in Saudi Arabia, such as strengthening governance and interoperability, expanding intelligent and data-driven services through artificial intelligence and connected technologies, improving digital capacity building, and ensuring equitable access across regions. Overall, the review provides policy-relevant insights to support the sustainable integration of telemedicine into Saudi Arabia's healthcare system, aligned with Vision 2030 goals.

Keywords: Telemedicine, Digital Health, Healthcare Applications, Artificial Intelligence, Saudi Arabia; Vision 2030

Introduction

Telemedicine, characterized by the use of information technology to deliver healthcare services remotely, has emerged as a transformative force in global healthcare (Aljohani, 2023). This topic has become increasingly important due to the growing global demand for accessible, efficient, and patient-centered healthcare services. Telemedicine has proven especially valuable in increasing accessibility, boosting efficiency, and providing cost-effective

solutions across various medical settings, particularly following the COVID-19 pandemic (Zahidah & Al-haimi, 2024). The study of telemedicine is therefore essential, as it represents one of the most practical and sustainable approaches to overcoming limitations of traditional healthcare delivery systems.

In Saudi Arabia, the strategic implementation of telemedicine aligns with the ambitious goals of Saudi Vision 2030, aiming to reduce healthcare disparities caused by geography and to modernize the national healthcare infrastructure (Almutairi et al., 2023; Al-Wathinani et al., 2024). Understanding the development and impact of telemedicine in this context is highly significant, as it directly supports national priorities related to healthcare quality, accessibility, and digital transformation. The effectiveness of telemedicine solutions has experienced significant growth, particularly following the COVID-19 pandemic, which accelerated the adoption of digital health services to ensure safe and continuous access to healthcare for both patients and providers (Bashir et al., 2023).

The Ministry of Health (MOH) has played a central role in promoting telemedicine by launching national projects such as the Saudi Telemedicine Network (STN) and developing a centralized electronic health record database. Telemedicine is now integrated across various healthcare specialties, including tele-emergency and tele-pharmacy, and is supported by widely used mobile applications such as Seha, Sehhaty, Mawid, Tawakkalna, Tabaud, and Tetamman (Al-Samarraie et al., 2020). These initiatives demonstrate the practical utility of telemedicine in improving service delivery and enhancing patient experiences. Furthermore, this commitment is reflected in major national initiatives such as the Seha Virtual Hospital, which began operations in February 2022, clearly illustrating the government's investment in effective digital health solutions (Alabdulaali et al., 2025). The outcomes of such initiatives are beneficial not only to patients, but also to healthcare providers, policymakers, and the overall healthcare system.

Despite these developments, research in telemedicine, especially within the Saudi Arabian context, remains limited and fragmented. There is a clear need for comprehensive studies that evaluate its real-world applications, effectiveness, and long-term sustainability. Therefore, this review is important for multiple stakeholders, including healthcare professionals seeking improved service models, policymakers aiming to optimize national health strategies, and researchers interested in advancing digital health knowledge. This review seeks to systematically explore current applications of telemedicine in the Kingdom, analyze technological advances enabling its growth, identify key challenges to its widespread adoption, and outline future paths for its sustainable integration into the national healthcare system.

This review addresses a critical gap in the existing literature by providing a comprehensive and integrated perspective. Prior studies have largely focused on specific aspects, such as barriers or individual applications, while overlooking broader issues of utility, effectiveness, and strategic future directions. By synthesizing existing evidence and offering practical recommendations, this study aims to contribute meaningful insights that can enhance decision-making and guide the future development of telemedicine in Saudi Arabia. Therefore, this study will be guided by the following research questions to address this gap:

RQ1: What are the current applications of telemedicine in Saudi Arabia across different medical specialties and healthcare settings?

RQ2: What technological advancements are fueling the growth of telemedicine in Saudi Arabia, and how do they compare with global trends?

RQ3: What are the main barriers, including regulatory, technological, and socio-cultural factors, that hinder the widespread adoption and effective implementation of telemedicine in Saudi Arabia?

RQ4: What strategic recommendations and future directions can be proposed to enhance the integration of telemedicine into Saudi Arabia's healthcare system, aligned with Vision 2030 objectives?

The current applications of telemedicine in Saudi Arabia across different medical specialties and healthcare settings align with the WHO Digital Health

Telemedicine applications in Saudi Arabia encompass a broad spectrum of medical specialties and healthcare settings, ranging from virtual consultations and remote monitoring to digital health platforms for disease management (Al-Hazmi et al., 2021). These applications have been significantly bolstered by initiatives such as the Seha Virtual Hospital, which has demonstrably expanded service delivery and improved patient outcomes since its establishment in 2022 (Alabdulaali et al., 2025). Beyond specialized virtual hospitals, telemedicine is increasingly integrated into primary healthcare centers and various governmental healthcare entities, including referral hospitals, medical services of security forces, and universities (Aldekhyyel et al., 2024). The integration of telemedicine extends to both the public and private health sectors, facilitating teleconsultations, remote diagnostics, and treatment options to overcome geographical barriers and enhance access to healthcare (Aldekhyyel et al., 2024).

The Ministry of Health has reported a substantial adoption of virtual consultations, with over one million consultations recorded between January 2021 and June 2022, highlighting the increasing reliance on digital health platforms for patient care (Alomar et al., 2024). This rapid adoption underscores a national commitment to leveraging technology for healthcare transformation, as outlined in Saudi Vision 2030, and is further evidenced by substantial investments in digital infrastructure, telecommunications networks, and data centers to support these initiatives (Almutairi et al., 2023). A recent study by (Alharthi, S. A., 2025) reviewed telemedicine applications in Saudi Arabia. In this research, we categorized these applications into major groups based on their core functionalities. Additionally, we mapped the telemedicine applications to the WHO Digital Health Classification to identify gaps in Saudi Arabia, informing future implications and strategies (see Table 1.1, Table 1.2, and Figure 1.1).

Table 1.1

Classification of Telemedicine Applications in Saudi Arabia

THEMATIC CATEGORY	DESCRIPTION	REPRESENTATIVE APPLICATIONS	CORE FUNCTIONALITIES
1. TELEMEDICINE & VIRTUAL CARE	Platforms enabling remote medical consultations and diagnosis	Altibbi, Sehhaty, Cura, Sanar	Video consultations, e-prescriptions, clinical advice
2. APPOINTMENT & CARE MANAGEMENT	Systems facilitating patient scheduling and care coordination	Mawid, Sehhaty, My Clinic, NahdiCare	Appointment booking, reminders, visit management
3. HOSPITAL & CLINICAL SERVICE PLATFORMS	Integrated hospital-based digital health services	MNGHA Care, iKFMC, Dr. Sulaiman Al Habib	Electronic medical records, inpatient services, and diagnostics
4. HEALTH MONITORING & TRACKING	Applications supporting continuous health monitoring and reporting	Tawakkalna, Wateen	Health status tracking, vaccination records, alerts
5. MENTAL HEALTH & WELLNESS	Platforms focusing on psychological wellbeing and therapy	Labayh, Sanar	Mental health consultations, wellbeing programs
6. INSURANCE & ADMINISTRATIVE SERVICES	Applications managing healthcare financing and claims	Tawuniya, Bupa, Arabia	Insurance verification, claims processing, billing
7. PUBLIC HEALTH & GOVERNMENT SERVICES	National-level platforms supporting public health management	Tawakkalna, Sehhaty	Disease surveillance, vaccination tracking, health certification
8. COMMUNITY & SUPPORT SERVICES	Digital platforms facilitating social and volunteer engagement	Qariboon, Health Volunteering	Community support, volunteering coordination
9. EMERGENCY & CRITICAL RESPONSE	Systems designed for urgent medical intervention	Al-Mostajeeb	Emergency alerts, rapid response coordination

Table 1.2

Mapping of Telemedicine Applications to WHO Digital Health Classification

WHO HEALTH CATEGORY	DIGITAL DESCRIPTION	REPRESENTATIVE SAUDI APPLICATIONS	KEY FUNCTIONALITIES OBSERVED
1. INTERVENTIONS FOR CLIENTS (WHO 1.0)	Digital services supporting individuals in managing their health	Sehhaty, Tawakkalna, Altibbi, Labayh, Cura	Appointment booking, teleconsultation, health education, medication reminders, symptom checking
2. INTERVENTIONS FOR HEALTHCARE PROVIDERS (WHO 2.0)	Tools supporting healthcare professionals in diagnosis, treatment, and care coordination	Dr. Sulaiman Al Habib, MNGHA Care, iKFMC, NahdiCare	Clinical documentation, patient management, teleconsultation, decision support
3. INTERVENTIONS FOR HEALTH SYSTEM MANAGEMENT (WHO 3.0)	Applications supporting administrative, operational, and managerial functions	Tawakkalna, Sehhaty, Tawuniya, Bupa Arabia	Insurance processing, health data aggregation, reporting, policy monitoring
4. DATA SERVICES & HEALTH INFORMATION SYSTEMS (WHO 4.0)	Platforms enabling data storage, interoperability, analytics, and privacy	Sehhaty, Tawakkalna, Al-Mostajeeb	Electronic health records, secure data exchange, privacy management, analytics dashboards

The review shows that telemedicine in Saudi Arabia has developed into a complex digital ecosystem, mainly driven by government programs and accelerated by the COVID-19 pandemic. Features like appointment scheduling, teleconsultation, and public health monitoring are highly mature, while advanced tools such as AI-powered decision support, personalized analytics, and long-term disease management are still limited. When mapped to the WHO Digital Health Classification, these applications mainly fall within the WHO 1.0 and 2.0 categories, emphasizing service delivery and patient engagement. Conversely, areas like system integration, interoperability, and data intelligence, found in WHO 3.0 and 4.0, are less developed. Overall, Saudi Arabia has laid a strong digital health groundwork, but further growth depends on shifting focus toward interoperable, data-driven, and intelligence-enabled health systems to unlock the full potential of digital health transformation.

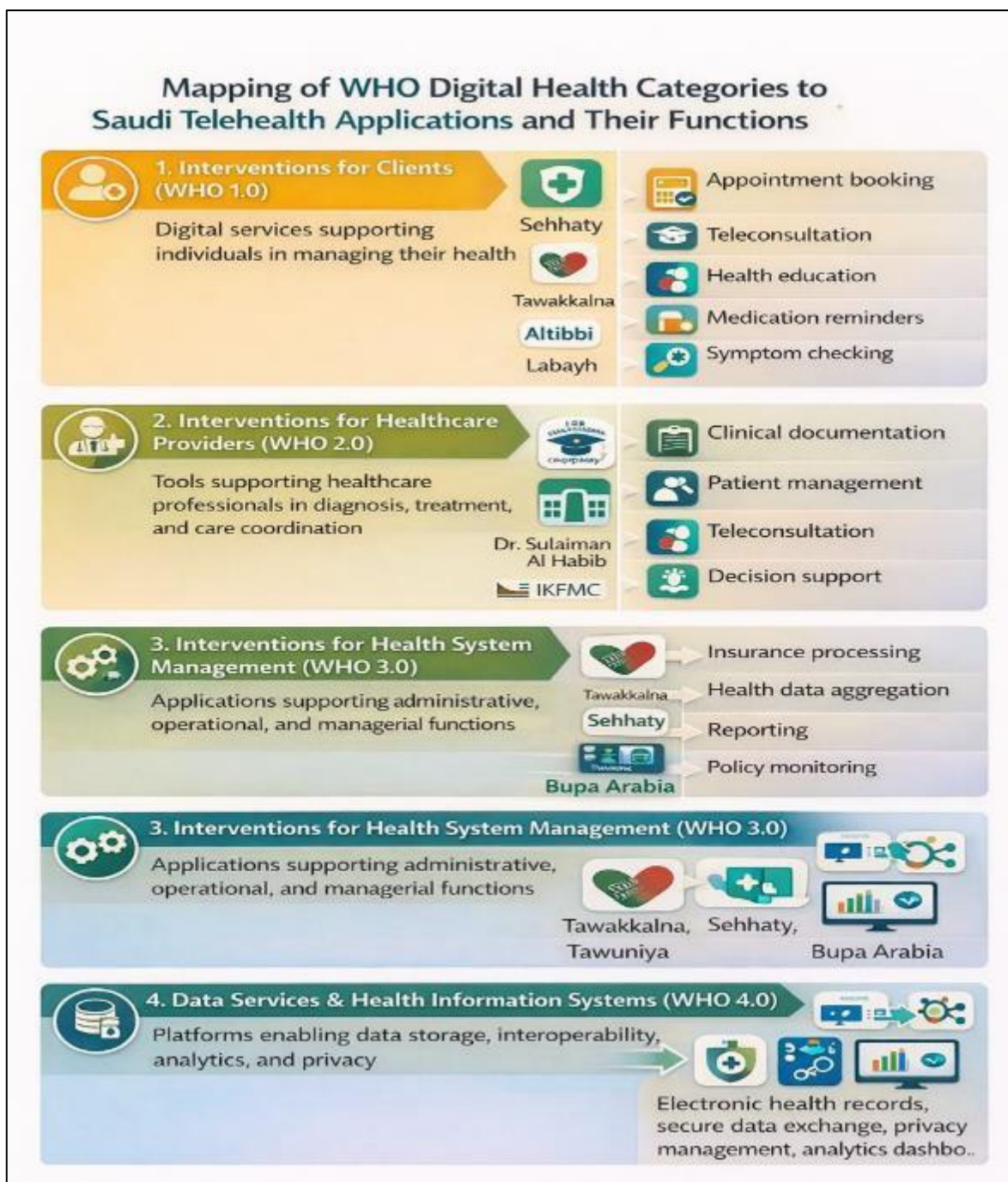


Figure 1.2 : Mapping Saudi Arabia Telemedicine Applications to WHO Digital Health

Source: Authors

Technological Advancements Driving Telemedicine in Saudi Arabia

The rapid expansion of telemedicine in Saudi Arabia has been driven by ongoing investments in digital infrastructure, including advanced telecommunications networks, integrated digital platforms, and centralized data systems that support teleconsultations, remote patient monitoring, and electronic health records (Almutairi et al., 2023) (see figure 2.1). These developments closely align with the Health Sector Transformation Program under Vision 2030, which highlights digital health and telemedicine as key priorities for improving healthcare access, increasing efficiency, and delivering patient-centered services (Aldosari et al., 2025; Abou Hashish & Alnajjar, 2024).

Beyond basic electronic health records, Saudi Arabia's digital health ecosystem includes a wide range of advanced technologies, such as mHealth apps, wearable health devices, artificial intelligence (AI), data analytics, virtual and augmented reality, and blockchain systems (AlWatban et al., 2024). Government-led digital platforms like Sehhaty, Tawakkalna, Tataman, and Mawid have been key in implementing these technologies, allowing remote consultations, contact tracing, appointment scheduling, and ongoing patient engagement, especially during and after the COVID-19 pandemic (Al-Samarraie et al., 2020; Arbaein et al., 2024; Alsaywid et al., 2023; Kanaan et al., 2025). Compared to global trends, Saudi Arabia aligns with leading digital health systems by focusing on large-scale platform integration and population-wide deployment, though advanced AI-driven features are still in early stages of development.

The integration of AI and data-driven technologies is increasingly seen as essential for achieving Vision 2030 objectives, especially in optimizing patient data management and supporting healthcare delivery (Aljehani & Al Naweess, 2025). The integration of e-health, m-health, and telemedicine platforms enables real-time information sharing among patients, healthcare providers, researchers, and government agencies, thereby improving system-level coordination and continuity of care (Aldosari et al., 2025; Alshoumr et al., 2025). However, while global telemedicine leaders are making progress toward predictive analytics, personalized decision support, and digital twins, these features remain limited within the Saudi context, suggesting a system that is still mostly service-oriented rather than driven by intelligence (Alshoumr et al., 2025).

Tele-pharmacy has become a key part of Saudi Arabia's telemedicine system, allowing the delivery of pharmaceutical care through secure audio-visual communication and digital platforms (Almeman, 2024; Mohiuddin et al., 2021). Initiatives by the Ministry of Health and mobile consultation apps have greatly enhanced continuity of care, with survey data showing high user engagement and widespread use of online pharmacy services (Almeman, 2024).

Despite strong technological readiness, user acceptance of telemedicine remains affected by digital literacy, privacy concerns, and the lack of physical physician–patient interaction (Mohamed et al., 2023; Saifan et al., 2025; Alqahtani et al., 2025). Higher adoption rates among younger, urban, and more educated groups highlight the need for targeted education, health informatics training, and digital literacy programs to promote equitable and ongoing use of telemedicine technologies (Abou Hashish & Alnajjar, 2024).

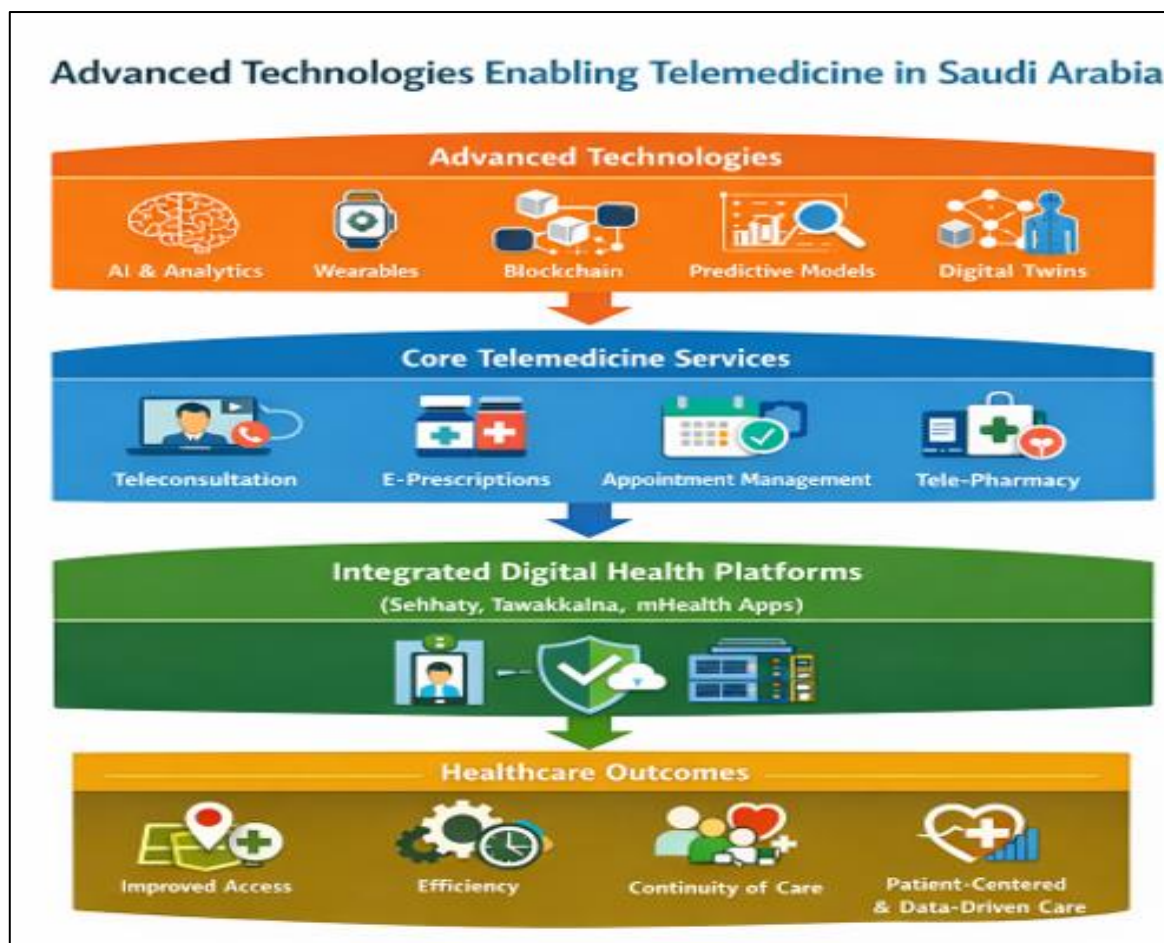


Figure 2.1: Advanced Technologies enabling Telemedicine in Saudi Arabia. **Source:** Authors

Barriers to the Widespread Adoption and Effective Implementation of Telemedicine in Saudi Arabia

Despite notable advances in digital health infrastructure and national telemedicine programs, various structural, regulatory, and socio-technical obstacles still impede the widespread adoption and effective deployment of telemedicine in Saudi Arabia. Figure 3.1 illustrates these barriers and challenges, which are based on various reported research.



Figure 3.1: Current barriers to Saudi Arabia's Telemedicine Adoption. **Source:** Authors

One of the most persistent issues is the lack of a fully unified national protocol for telemedicine practice, especially regarding legal accountability, regulatory oversight, data management, and standardized privacy frameworks (Alqahtani et al., 2021). Although regulatory definitions exist, inconsistencies in their application across platforms and institutions diminish interoperability and trust among organizations.

Concerns about data privacy and information security remain major barriers, with users expressing greater apprehension about virtual consultations than about traditional face-to-face care (Saifan et al., 2025; Dantas et al., 2023). These worries are worsened by the increasing use of digital platforms and health data systems, which raise perceived risks of data breaches, misuse of personal information, and cybersecurity threats.

From a socio-technical perspective, disparities in digital literacy significantly influence telemedicine adoption. While usage remains relatively high among younger, urban, and more educated populations, older adults and those in rural or underserved areas continue to encounter challenges due to limited technology literacy and access (Farid, 2019; Alqahtani et al., 2025). Infrastructure limitations and financial constraints in some regions further exacerbate these inequalities, impeding equitable access to telemedicine services (Farid, 2019).

Clinical and relational barriers also remain. Several studies raise concerns about the quality of patient–physician relationships in virtual care, mainly due to reduced physical interaction, limited nonverbal cues, and perceived decreases in clinical empathy and trust (Dantas et al., 2023). These issues can negatively impact patient satisfaction and ongoing engagement with telemedicine.

At the institutional level, the Ministry of Health (MOH) defines telemedicine as medical practice conducted through information and communication technologies that enable remote, real-time interaction, with video consultations necessary for services to qualify as telemedicine (Alkhalifah et al., 2022). While platforms like Sehhaty proved highly effective during the COVID-19 pandemic, supporting millions of virtual appointments, they also revealed gaps in governance, standardization, and sustainability (Alkhalifah et al., 2022). The National Health Information System, launched in 2013 to connect healthcare providers into a single telemedicine network, marked a major advance; however, interoperability, regulatory alignment, and data integration issues persist (Alshareef et al., 2021).

Overall, the evidence indicates that although Saudi Arabia has built a strong foundation for telemedicine, ongoing progress depends on comprehensive national guidelines, improved privacy and security measures, targeted digital literacy programs, and investments in equitable infrastructure. Tackling these barriers is crucial to transforming telemedicine from an emergency response solution into a resilient, inclusive, and patient-focused component of the national healthcare system, aligned with Vision 2030 goals (Bashir et al., 2023; Albarrak et al., 2021; Alomar et al., 2025).

Strategic Recommendations and Future Directions for Advancing Telemedicine in Saudi Arabia

Aligned with Saudi Arabia’s Vision 2030 and the National Transformation Program, telemedicine is positioned as a strategic pillar for modernizing the healthcare system and improving equitable access to care (see Figure 4.1). Key future directions emphasize the nationwide expansion of telemedicine services across all healthcare facilities, supported by the development of a fully integrated national electronic medical system that enables seamless data sharing, continuity of care, and system-wide interoperability (Bashir et al., 2023; Albarrak et al., 2021). In parallel, the establishment of dedicated research centers for e-health and telemedicine implementation is critical to support evidence-based innovation, evaluation of digital health outcomes, and the localization of global best practices within the Saudi healthcare context (Mohiuddin et al., 2021; Alsaywid et al., 2023).

From a capacity-building perspective, enhancing digital literacy and targeted education programs remains essential for increasing telemedicine adoption, particularly among older adults, rural populations, and culturally diverse communities (Alqahtani et al., 2025; Bashir et

al., 2023). These initiatives should extend beyond patients to include healthcare professionals, ensuring that telemedicine is embedded into routine clinical workflows rather than treated as a supplementary service.

Strategically, the sustainability of telemedicine integration also depends on addressing systemic gaps in infrastructure readiness, governance, and regulatory standardization. Prior studies highlight the need for more robust digital infrastructure in underserved regions, alongside the development of comprehensive national guidelines governing telemedicine quality standards, data privacy, cybersecurity, and legal accountability (Farid, 2019; Alqahtani et al., 2021; Alsaywid et al., 2023). Strengthening these frameworks will enhance institutional trust, reduce fragmentation across platforms, and support the transition toward data-driven and intelligence-enabled healthcare services.

Overall, advancing telemedicine in Saudi Arabia requires a coordinated, long-term strategy that integrates policy reform, infrastructure investment, digital skills development, and research-driven innovation (see Figure 4.1). Such an approach will ensure that telemedicine evolves from a pandemic-responsive solution into a resilient, scalable, and patient-centered healthcare model aligned with Vision 2030 objectives.



Figure 4.1: Strategic Framework for Telemedicine Advancement in Saudi Arabia. Source: Authors

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