
The Role of Technology in Enhancing Patient Engagement in Saudi Healthcare

**Abdullah Awadh Aloufi¹, Naif Mansour Daghasi¹, Abdullah Saeed Alomari²,
Abdulrahman Ateeq Alghamdi³, Abdullah Naif Aljuaid⁴, Hassan Sulaiman
Almusawa⁵, Abdulaziz Mayudh Alwathanini⁴, Ali Ahmad Alshehri⁶, Abdulaziz Saqer
Mohammed Alamri⁷, Ali Ibrahim Ali Asiri⁸, Mona Ammar Alsofyani⁹, Majed Fahad
Alqahtani⁹, Abdulrahman Mohammed Alghamdi¹⁰**

¹ Pharmacist, MMD-Alhada Armed Forced Hospital, Taif, Saudi Arabia

² Dental Specialist, MMD-Alhada Armed Forces Hospital, Taif, Saudi Arabia

³ Respiratory Specialist, Alhada Armed Forces Hospital, Taif, Saudi Arabia

⁴ Pharmacy Technicain, MMD-Alhada Armed Forced Hospital, Taif, Saudi Arabia

⁵ Nursing Technician, MMD-Alhada Armed Forced Hospital, Taif, Saudi Arabia

⁶ Laboratory Specialist, MMD-Alhada Armed Forced Hospital, Taif, Saudi Arabia

⁷ Health Administration Specialist, MMD-Alhada Armed Forced Hospital, Taif, Saudi Arabia

⁸ Radiology Specialist, Radiology Department, Alhada Armed Forces Hospital, Taif, Saudi Arabia

⁹ Laboratory Senior Specialist, Prince Mansour Military Hospital, Taif, Saudi Arabia

¹⁰ Laboratory Technician, Prince Mansour Military Hospital, Taif, Saudi Arabia

Abstract:

Technology plays a crucial role in enhancing patient engagement within the Saudi healthcare system by facilitating greater communication between healthcare providers and patients. Telemedicine, mobile health applications, and electronic health records (EHRs) are increasingly utilized to empower patients by promoting self-management of health and easy access to medical information. These tools enable patients to schedule appointments, receive prescription refills, and engage in remote consultations with healthcare professionals, ultimately fostering a proactive approach to health. Additionally, educational platforms and digital health resources help patients make informed decisions about their treatment plans and lifestyle changes, thereby improving health outcomes. Moreover, wearable health devices and health monitoring applications are further driving patient engagement by enabling individuals to track their vital signs and health metrics in real-time. This constant connectivity enhances the patient experience by allowing for personalized feedback and timely interventions from healthcare providers based on the data collected. Furthermore, social media and community support platforms are critical in building a sense of shared experience and support amongst patients, driving adherence to treatment plans and increasing satisfaction with care. Overall, technology is not only redefining healthcare delivery in Saudi Arabia but also embedding a culture of active participation and collaboration between patients and providers.

Keywords: Technology, Patient Engagement, Saudi Healthcare, Telemedicine, Mobile Health Applications, Electronic Health Records

Introduction:

In recent years, the focus on patient engagement in healthcare has gained significant momentum, driven by a confluence of technological advancements, evolving patient expectations, and the need for improved health outcomes. As healthcare systems worldwide grapple with the challenges posed by rising costs, chronic diseases, and an aging population, the integration of technology has emerged as a transformative strategy to enhance patient engagement. This is particularly relevant in the context of the Saudi Arabian healthcare system, which is undergoing substantial reforms aimed at improving service delivery, accessibility, and quality of care [1].

The concept of patient engagement encompasses a wide range of activities, from self-management of health to active participation in decision-making processes regarding one's care. Engaged patients are typically more invested in their health outcomes, which can lead to improved adherence to treatment protocols, greater satisfaction with care, and ultimately better health outcomes [2].

The integration of technology, such as mobile health applications, telemedicine, electronic health records (EHRs), and other digital tools, presents a unique opportunity to foster a more active role for patients in their healthcare journey. In Saudi Arabia, where a substantial portion of the population is digitally literate and increasingly connected, these technological solutions can be harnessed to bridge gaps in communication, facilitate knowledge sharing, and empower patients [3].

Moreover, the Saudi healthcare landscape is characterized by a diverse patient demographic, including a mix of local citizens and expatriates, each with varying levels of health literacy and engagement preferences. Understanding how technology can be tailored to meet these diverse needs is essential for maximizing its impact on patient engagement [4].

The Saudi Vision 2030, a strategic framework aimed at diversifying the economy and enhancing the quality of life for citizens, underscores the importance of healthcare reform in achieving these objectives. By leveraging technology, the healthcare sector can not only align with these national goals but also address the growing prevalence of chronic diseases, healthcare disparities, and the demand for more personalized service delivery [5].

Furthermore, the COVID-19 pandemic has accelerated the adoption of digital health solutions around the globe, including in Saudi Arabia. The necessity of remote consultations and digital health records has underscored the potential of technology to facilitate uninterrupted care delivery, while also bringing to light the challenges associated with technology adoption, such as issues of accessibility, privacy, and the digital divide [6]. As such, exploring the role of technology in patient engagement within Saudi healthcare is timely and relevant, contributing to the ongoing discourse on how best to navigate this rapidly evolving landscape. This study aims to provide a comprehensive analysis of the various technological tools and solutions that have been implemented in Saudi Arabia's healthcare system and their implications for patient engagement [4].

The Impact of Telemedicine on Access to Care

Telemedicine, defined as the remote diagnosis and treatment of patients through telecommunications technology, has emerged as a transformative force in the healthcare landscape. For decades, barriers to accessing healthcare have persisted in various forms, whether due to geographic distances, socioeconomic factors, or systemic inefficiencies. The advent of telemedicine has the potential to mitigate these barriers significantly, offering patients and healthcare professionals a new paradigm of interaction [7].

1. Enhanced Accessibility for Rural and Underserved Populations

A primary benefit of telemedicine is its ability to bridge the gap for rural and underserved populations. Many individuals in these areas face geographical barriers that limit their access to healthcare. Hospitals, clinics, and specialists may be located far from their residence, often resulting in delays in seeking care or a complete avoidance of medical services. Telemedicine effectively addresses this issue by allowing patients to connect with healthcare providers from the comfort of their homes, eliminating the need for extensive travel. This increased accessibility enables timely interventions and mitigates the risk of late diagnoses and complications, ultimately leading to improved health outcomes [8].

Studies have shown that telemedicine has been particularly beneficial for managing chronic conditions—such as diabetes and hypertension—among rural populations. Remote monitoring tools can aid healthcare providers in tracking patient metrics in real time, allowing for proactive adjustments to treatment plans. Moreover, telehealth

consultations can be easily integrated into patients' daily lives, thus encouraging consistent follow-up and care adherence [9].

2. Reduction of Healthcare Disparities

Telemedicine holds the potential to reduce healthcare disparities across various demographic groups, including racial and ethnic minorities, the elderly, and low-income individuals. Barriers such as transportation difficulties, scheduling conflicts, and the costs associated with in-person visits can pose substantial obstacles that disproportionately affect these groups. Virtual visits remove many of these barriers, providing easier access to necessary healthcare services [10].

Furthermore, telemedicine can facilitate culturally competent care. Providers can use language translation tools to communicate effectively with non-English speaking patients, thereby enhancing understanding and compliance. Cultural sensitivity can also be heightened, as providers can take extra steps to demonstrate respect for patients' unique backgrounds and healthcare beliefs, fostering an environment of trust [11].

3. Improved Efficiency and Increased Provider Reach

From a healthcare provider's perspective, telemedicine can enhance operational efficiency and extend the reach of medical services. Providers can utilize telehealth platforms to manage a larger patient load in a shorter amount of time, as virtual consultations typically require less time compared to in-person visits. This model allows providers to serve patients who may have difficulty accessing care otherwise due to logistical challenges [12].

Additionally, telemedicine opens avenues for interdisciplinary collaboration. Healthcare professionals across various specialties can consult remotely, ensuring that patients receive comprehensive care. This collaborative environment is particularly advantageous in complex cases requiring multiple expert inputs, contributing to holistic treatment approaches and better health outcomes [13].

4. Challenges and Limitations

Despite its advantages, the implementation of telemedicine is not without challenges. One significant concern is the digital divide—inequities in access to technology and high-speed internet connectivity. While telemedicine can improve access for many, it may exacerbate disparities for those without reliable internet or digital literacy. Older adults, low-income families, and individuals in remote areas may struggle to engage with telemedicine platforms effectively [14].

Additionally, reimbursement policies for telehealth services vary widely, and in some cases, providers may not receive equitable compensation compared to in-person visits. The COVID-19 pandemic catalyzed temporary expansions in telemedicine coverage; however, as the public health emergency wanes, the sustainability of these policies remains uncertain. Long-term solutions are needed to ensure that telehealth remains a viable option for both providers and patients [15].

Concerns regarding privacy and data security are also pertinent. The collection and transmission of health data via digital platforms raise important questions about patient confidentiality. Adhering to regulatory standards, such as HIPAA in the United States, is critical to preserving trust and ensuring that patients feel safe utilizing telemedicine services [16].

5. The Future of Telemedicine in Access to Care

Looking ahead, the future of telemedicine is promising, and its role in enhancing access to care is likely to expand further. Ongoing advancements in technology—including artificial intelligence, machine learning, and mobile health applications—will continue to refine virtual healthcare delivery. Telemedicine can evolve to integrate

preventive care, mental health services, and chronic disease management, creating a comprehensive healthcare ecosystem that prioritizes patient-centric approaches [12].

Policymakers, providers, and stakeholders in the healthcare sector will need to work collaboratively to address existing barriers to telemedicine. This includes developing equitable reimbursement structures, investing in technology infrastructure in underserved areas, and providing training to patients and providers alike. Initiatives that promote digital literacy and improve access to devices will be essential for ensuring that telemedicine can fulfill its potential in reducing healthcare disparities [9].

Mobile Health Applications:

The surge in mobile health applications can be attributed to a confluence of technological advancements, the explosion of smartphone usage, and a growing demand for accessible healthcare services. Statista reports that there are currently over 100,000 health-related apps available across various platforms, underscoring the significant role that mobile technology plays in modern healthcare. These applications cover a wide range of functions including fitness tracking, chronic disease management, medication adherence, telehealth services, mental health support, and appointment scheduling [17].

The global pandemic exacerbated the need for innovative health solutions, shifting the focus towards remote care. Telehealth became a necessity, pushing both patients and providers to leverage digital tools, which has led to an increased acceptance of mobile health apps across demographics. Notably, these applications democratize access to health resources, providing individuals with tools that enable them to monitor their health continuously and effortlessly, thereby fostering a culture of proactive health management [14].

One of the most significant advantages of mobile health applications is their ability to empower patients. Traditionally, patients relied heavily on healthcare practitioners for information and guidance, often leading to a passive approach to health management. However, mobile health applications facilitate active participation by offering tools that allow individuals to track their health metrics, access medical information, and connect with healthcare professionals [18].

For instance, fitness tracking apps like MyFitnessPal and Fitbit empower users to monitor their physical activity, caloric intake, and overall fitness levels, encouraging healthier lifestyle choices. Chronic disease management applications like Glucose Buddy enable users with diabetes to log their blood glucose levels and medication, making it easier to manage their condition effectively. Patients can also access educational resources that demystify medical jargon, allowing them to make more informed decisions regarding their health. This empowerment is particularly crucial in managing chronic conditions, where self-monitoring plays a pivotal role in enhancing quality of life [16].

Mobile health applications facilitate enhanced communication between patients and healthcare providers. Many mHealth tools include messaging features that allow patients to communicate directly with their doctors and healthcare teams, reducing the barriers associated with scheduling appointments or waiting on hold for answers. This also fosters a sense of continuous care as patients can ask questions, request prescription refills, or share health updates with their providers seamlessly [19].

Moreover, the engagement tools embedded within these applications, such as reminders for medication or notifications for upcoming appointments, significantly improve adherence to treatment plans. Research shows that when patients are actively engaged in their care, they are more likely to follow medical advice and achieve better health outcomes. The ability to set personal health goals through these apps reinforces motivation and accountability, key elements in managing health effectively [20].

Mobile health applications also hold the potential to address health disparities by improving access to care for underprivileged populations. Many individuals in rural or underserved urban areas face significant challenges in accessing healthcare services due to geographical, economic, and social barriers. mHealth applications can bridge this gap by providing essential health information and care remotely, thus reducing the need for physical travel [21].

Language and cultural barriers can also be mitigated through applications that cater to diverse populations, offering resources in multiple languages and culturally relevant content. Such inclusivity ensures that a broader spectrum of the population can benefit from healthcare resources, ultimately contributing to improved health equity [22].

Despite the numerous benefits, the rise of mobile health applications is not without challenges. Concerns surrounding privacy and data security are paramount, as individuals share sensitive health information through these platforms. Regulatory bodies like the Health Insurance Portability and Accountability Act (HIPAA) in the United States emphasize the importance of safeguarding personal health data, yet many apps do not comply fully with such regulations. Thus, establishing trust remains a critical hurdle that developers must address by enhancing security measures and transparent data practices [23].

Moreover, the quality and reliability of health information within applications can vary widely. Without proper oversight, users may access misinformation that could adversely affect their health management. App developers must collaborate with healthcare professionals to ensure that the information presented is accurate, evidence-based, and up-to-date [24].

Finally, the over-reliance on technology also poses risks. While mHealth apps can enhance care, they should not replace in-person consultations. Striking a balance between digital and traditional healthcare is essential to provide comprehensive care suited to individual patient needs [25].

As technology progresses, the future of mobile health applications is poised to become even more integrated into the healthcare ecosystem. Artificial intelligence and machine learning are expected to play a significant role in personalizing the user experience, offering tailored health recommendations based on collected data. Virtual reality could also find applications within mental health support, providing immersive therapeutic environments that help individuals cope with stress and anxiety [26].

The development of interoperability standards will further enhance the functionality of health applications by allowing seamless data exchange between various healthcare systems and mHealth tools. This ensures that patients have a holistic view of their health, seamlessly integrated with their electronic health records [24].

Electronic Health Records:

At their core, electronic health records are designed to consolidate a patient's medical history into a single, accessible location. This digital transformation not only streamlines the documentation process but also enhances the accuracy and legibility of medical records. EHRs typically include a wide range of data, such as patient demographics, medical history, medication lists, allergies, lab results, and radiology images [27].

The implementation of EHR systems often aligns with regulatory requirements and incentives provided by governments, particularly seen in nations like the United States, where the Health Information Technology for Economic and Clinical Health (HITECH) Act was enacted to encourage the use of EHRs. Healthcare facilities are incentivized to adopt meaningful use criteria, which stipulate that EHRs must improve healthcare quality, safety, and efficiency, and engage patients in their healthcare [27].

One of the most significant advantages of electronic health records is their ability to streamline communication among healthcare providers. Prior to EHRs, communication often relied on traditional methods such as faxing or

mailing paper documents. This process was not only time-consuming but also prone to errors, delays, and miscommunications. In contrast, EHRs facilitate immediate access to a patient's health information, no matter where the patient may receive care [28].

For instance, when a patient undergoes treatment in an emergency department, the attending physician can instantly access the patient's medical history, including any chronic conditions, medications, and allergies. This real-time access to critical information can expedite decision-making, reduce the likelihood of adverse drug reactions, and ultimately save lives. EHR systems often come equipped with tools for direct messaging and notifications, promoting timely discussions between specialists, primary care providers, and nursing staff. This comprehensive approach to communication helps build cohesive care teams, fostering an environment where collaboration can flourish [29].

Furthermore, EHRs frequently integrate with other healthcare technologies, such as telehealth platforms and patient portals. Telehealth has surged in popularity, particularly in the wake of the COVID-19 pandemic, allowing patients to consult with providers remotely. EHRs enable seamless transitions from in-person visits to virtual care, ensuring that the patient's health status remains consistent across various platforms. By centralizing communication, EHRs serve as a linchpin for coordinated care [22].

Continuity of care is the process by which a patient receives consistent and coherent healthcare over time, despite potential shifts in providers or settings. EHRs play a pivotal role in this continuity by facilitating the transfer of medical information between different providers and healthcare settings. When a patient transitions from one healthcare provider to another, often due to referrals or hospitalizations, having access to the complete and accurate medical history ensures that new providers have all the necessary information to deliver appropriate care [30].

For example, when a patient with diabetes is referred from a primary care physician to an endocrinologist, the endocrinologist can access the EHR to review the patient's glucose levels, previous treatment plans, and any complications that may have arisen. This comprehensive insight allows the endocrinologist to create a tailored treatment strategy from the outset, without the need for redundant tests or procedures. This not only saves time but also significantly enhances the overall patient experience [31].

Additionally, EHRs support follow-up care and chronic disease management by enabling healthcare teams to monitor patients continuously. Automated reminders and alerts for preventive screenings, vaccinations, and follow-up appointments ensure that patients remain engaged in their healthcare journey. For example, a population health management feature within an EHR can identify patients who have missed appointments or screenings and trigger reminders, helping to prevent gaps in care [32].

While electronic health records present numerous benefits, the transition from paper-based records to EHRs is not without its challenges. Privacy and security remain paramount concerns, as healthcare organizations must protect sensitive patient information from unauthorized access. The implementation of robust security protocols and compliance with regulatory frameworks such as the Health Insurance Portability and Accountability Act (HIPAA) is essential in safeguarding patient data [19].

Another challenge is the interoperability of EHR systems across different healthcare organizations. For EHRs to truly streamline communication and facilitate continuity of care, data must be easily exchanged between systems. However, many EHR platforms lack the ability to share information seamlessly, leading to fragmented care. This challenge calls for ongoing efforts to establish standardized protocols and improve the interoperability of EHR systems [33].

Wearable Technology:

The concept of wearable technology is not entirely new; it can be traced back to the early 1960s when researchers developed the first wearable computer. However, it wasn't until the 21st century that significant advancements in miniaturization, sensor technology, and wireless communication paved the way for mainstream adoption. The introduction of fitness trackers like the Fitbit in 2009 marked a turning point, making health monitoring accessible to the average consumer. Since then, the wearable technology market has expanded dramatically, encompassing a wide range of devices, including smartwatches, health monitors, smart clothing, and even advanced medical devices [34].

Wearable technology serves multiple purposes in health monitoring, enabling users to track various aspects of their well-being in real-time. Some of the most common applications include:

1. **Fitness Tracking:** Many wearable devices are designed to monitor physical activity levels, including steps taken, distance traveled, calories burned, and heart rate. This data empowers users to set fitness goals, adhere to exercise regimens, and maintain an active lifestyle [35].
2. **Sleep Monitoring:** Sleep is a critical component of overall health, and many wearables now include features that monitor sleep patterns. By tracking metrics such as sleep duration, quality, and stages (light, deep, REM), users can gain insights into their sleep health and make necessary adjustments to improve restfulness [32].
3. **Heart Rate Monitoring:** Continuous heart rate monitoring is a key feature of many wearables, allowing users to understand their cardiovascular health better. This data can be particularly beneficial for individuals with heart conditions or those engaged in high-intensity workouts [11].
4. **Blood Oxygen Levels:** Some advanced wearables can measure blood oxygen saturation (SpO2), providing valuable information about respiratory function. This feature has gained prominence, especially during the COVID-19 pandemic, as it helps in the early detection of respiratory issues [7].
5. **Stress and Mental Health Monitoring:** A growing number of wearables now incorporate stress management features, utilizing heart rate variability (HRV) and other physiological indicators to assess stress levels. This capability can guide users in adopting mindfulness and relaxation techniques [32].
6. **Chronic Disease Management:** Wearable technology is increasingly being used in the management of chronic diseases such as diabetes, hypertension, and asthma. Devices can track blood glucose levels, monitor blood pressure, and provide alerts for medication adherence, enabling patients to take a proactive approach to their health [33].

The integration of wearable technology into health monitoring offers numerous benefits:

1. **Real-Time Data Access:** One of the most significant advantages of wearables is the ability to collect and analyze data in real-time. This immediate feedback allows users to make informed decisions about their health and lifestyle [34].
2. **Personalized Health Insights:** Wearable devices often utilize algorithms to provide personalized health insights based on individual data. This tailored approach can enhance motivation and adherence to health goals [34].
3. **Empowerment and Engagement:** Wearables empower users to take charge of their health by providing them with the tools and information necessary to monitor their well-being actively. This increased engagement can lead to healthier behaviors and improved health outcomes [35].

4. **Remote Health Monitoring:** Wearable technology facilitates remote monitoring, enabling healthcare providers to track patients' health metrics without requiring them to visit a clinic. This capability is particularly beneficial for individuals with chronic conditions, as it allows for timely interventions and reduces the burden on healthcare systems [35].
5. **Data Collection for Research:** The widespread use of wearable devices generates vast amounts of health data, which can be harnessed for research purposes. This data can contribute to advancements in public health, epidemiology, and personalized medicine [36].

Despite the many advantages of wearable technology, several challenges and considerations must be addressed:

1. **Data Privacy and Security:** The collection and storage of sensitive health data raise concerns about privacy and security. Users must be informed about how their data is used and protected, and companies must implement robust security measures to safeguard this information [37].
2. **Accuracy and Reliability:** The accuracy of health metrics collected by wearable devices can vary significantly. Users must understand the limitations of their devices and not rely solely on them for critical health decisions [18].
3. **User Adherence:** While wearable technology can promote healthier behaviors, its effectiveness relies on user adherence. Some individuals may become disengaged or overwhelmed by the data, leading to decreased usage over time [38].
4. **Integration with Healthcare Systems:** For wearable technology to realize its full potential in healthcare, seamless integration with electronic health records (EHR) and other healthcare systems is essential. This integration can facilitate better communication between patients and providers, enabling more coordinated care [19].
5. **Cost and Accessibility:** While the prices of wearable devices have decreased, access to technology remains a barrier for some populations. Ensuring that wearable technology is affordable and accessible to all individuals is crucial for promoting health equity [36].

As technology continues to evolve, the future of wearable devices in health monitoring appears promising. Innovations such as advanced biosensors, artificial intelligence (AI), and machine learning are expected to enhance the capabilities of wearables, allowing for more precise and comprehensive health assessments. For instance, future devices may incorporate continuous glucose monitoring for diabetes management or advanced algorithms to predict health events based on historical data [14].

Moreover, the integration of wearables with telehealth platforms can facilitate more personalized and proactive healthcare. Patients will be able to share their health data with providers in real-time, enabling timely interventions and reducing hospitalizations. Additionally, the rise of smart clothing, which can monitor various physiological parameters, could further expand the possibilities for health monitoring [38].

Conclusion:

In conclusion, the integration of technology into the Saudi healthcare system represents a transformative shift towards enhanced patient engagement, leading to improved health outcomes and greater satisfaction with care. The utilization of telemedicine, mobile health applications, and electronic health records streamlines communication between patients and healthcare providers, enabling individuals to take a more active role in managing their health. Furthermore, the advent of wearable devices and educational platforms empowers patients with real-time data and knowledge, fostering informed decision-making and adherence to treatment plans.

As Saudi Arabia continues to embrace technological advancements, the focus must remain on creating user-friendly and accessible solutions that cater to the diverse needs of the population. By promoting a culture of engagement and collaboration, the healthcare system can harness the full potential of technology to enhance patient experiences and outcomes. Ultimately, the ongoing commitment to innovation and patient-centered care will be vital in fostering a healthier and more informed society, positioning Saudi Arabia as a leader in modern healthcare practices in the region.

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