

Roles of Pharmacy, Medicine, Nursing, Laboratory, Anesthesia, Urology, Public Health, and Occupational Health, Infection Control, and Hospital Management, in the Integration of Telehealth in Saudi Arabia: A Comprehensive Review

Yasser Mohammed Hanbashi¹, Mohammed Hassan Alessa², Ibrahim Mohammed Dighriri³, Jaamil Ali Hussain Al Kulayb⁴, Marzooq Hadi Marzooq Alyami⁵, Hamad Saleh Faraj Almohamedh⁶, Mutared Mohammed Mutared Alyami⁷, Khalid Ghazi Badr⁸, Ahmed Homoud Almufadhili⁹, Suhaib Talal Al-Sulimani¹⁰, Abdullah Fawzi Al-Moqren¹¹, Abdullatif Adnan Huldar¹², Ali Ahmed Al- Ghamdi¹³, Ali Abdullah asiry¹⁴, Alaa Sami Barhamain¹⁵, Sultan Faris Almutairi¹⁶, Ahmed Zakaria Ghulam¹⁷

Abstract

Different sectors have contributed to successfully integrating telehealth services into the Saudi healthcare system during the emergent need for high-quality health services. Hence, this review attempts to assess different sectors and their professionals for their contribution toward the implementation and sustainability of telehealth services, including pharmacy, medicine, nursing, laboratory services, anesthesia, urology, public health, occupational health, infection control, and hospital management. Each sector offers a unique contribution to the emergence and continuity of telehealth services, and physicians have implemented telehealth for diagnosis while maintaining chronic patients at home with distant control. Pharmacists have started providing medication support through telehealth, and physicians have extended their use by treating chronic patients through teleconsulting. Hospital nurses have improved their professional access by providing virtual education and consulting to treat chronic patients. Laboratory services enable fast and accurate diagnosis, and anesthesiologists have begun to use it for preoperative and postoperative assessments. Urologists have integrated telehealth into the management of chronic patients. Public health professionals provide telehealth services for health promotion, disease prevention, and management. Occupational health practitioners provided remote ergonomic consultation. Infection prevention and control teams delivered training sessions and telehealth surveillance of hygiene-related practices. In addition, initiatives to plan and create a system for telehealth implementation are a significant contribution to hospital management. The incorporation of telehealth across professional silos has increased the quality-of-care delivery, enhanced patient empowerment, and built system resilience in Saudi Arabia. This multidisciplinary collaboration thus underscores how furthering telehealth services can only be realized through cooperation to ensure equitable access and advance healthcare modernization under any national initiative.

Keywords: *Telehealth Integration, Saudi Arabia Healthcare, Multidisciplinary Collaboration, Pharmacy Telehealth Services, Telemedicine, Hospital Management Telehealth Strategy.*

¹ Department of Pharmacy, Qassim Armed Forces Hospital, Qassim, Saudi Arabia

² Department of Pharmacy, King Abdulaziz Hospital, Makkah, Saudi Arabia.

³ Department of Pharmacy, King Abdulaziz Specialist Hospital, Taif, Saudi Arabia.

⁴ Department of Pharmacy, Najran Health Cluster, Khubash General Hospital, Najran, Saudi Arabia..

⁵ Department of Pharmacy, Najran Health Cluster, Khubash General Hospital, Najran, Saudi Arabia.

⁶ Department of Pharmacy, Najran Health Cluster, Khubash General Hospital, Najran, Saudi Arabia.

⁷ Department of Public Health, Najran Health Cluster, Khubash General Hospital, Najran, Saudi Arabia

⁸ Department of Occupational Health, Executive Administration of Public Health at Makkah Health Cluster, Makkah, Saudi Arabia

⁹ Department of Occupational Health, Executive Administration of Public Health at Makkah Health Cluster, Makkah, Saudi Arabia

¹⁰ Department of Public Health, Executive Administration of Public Health at Makkah Health Cluster, Makkah, Saudi Arabia

¹¹ Department of Nursing, Executive Administration of Public Health at Makkah Health Cluster, Makkah, Saudi Arabia

¹² Department of Hospital Management, King Abdulaziz Hospital, Makkah, Saudi Arabia

¹³ Department of Anesthesia, King Abdulaziz Hospital, Makkah, Saudi Arabia

¹⁴ Department of Infection and Prevention Control, King Abdulaziz Hospital, Makkah, Saudi Arabia

¹⁵ Department of Infection and Prevention Control, King Abdulaziz Hospital, Makkah, Saudi Arabia.

¹⁶ Department of Pharmacy, Alrass General Hospital, Alrass, Saudi Arabia

¹⁷ Assistant Executive Director for Strategy at Alnoor Specialist Hospital, Makkah Health Cluster, Makkah, Saudi Arabia

Introduction

Telehealth is critical in every health system worldwide. The revolution, which changes how services are delivered and accessed, is a component of Saudi Arabia with a larger vision to modernize healthcare. Among other ambitions, the country seeks to ensure that health services reach rural areas [1,2]. The COVID-19 crisis significantly accelerated this. The government needs a responsive healthcare system that remains active even under such a crisis, as postulated in Vision 2030, in which the Saudi economy is diversified along with other sectors such as healthcare [2–5].

The Ministry of Health (MOH) has launched some telehealth platforms, such as the applications "Sehatty" and "Mawid," to enhance accessibility and continuity of care. These will also include remote consultations, delivery of medicines, management of chronic diseases, and health education, which places healthcare services much closer to the patient while reducing the burden on hospitals. A further immediate prospect is the efficient triaging of patients in a way that optimizes resource allocation and spares unneeded physical visits to healthcare facilities [4,6,7].

This can occur with the support and coordination of multiple disciplines within health care. Each discipline brings its view and expertise to the development of telehealth through a holistic approach to care delivery [3,6]. This paper provides an overview of pharmacy, medical, nursing, laboratory services, anesthesia, urology, public health, occupational health, infection control, and hospital management practices in facilitating telehealth services in Saudi Arabia. The roles and activities of different healthcare disciplines are discussed to reveal the interdisciplinary nature of telehealth and support the further development of telehealth capability within the Saudi healthcare system.

Pharmacy

Pharmacists in Saudi Arabia have utilized these and many other technologies to manage medication therapy, counseling, and patient adherence in rural areas with hardly any alternative means of healthcare access [7–9]. A new launch has been implemented in telepharmacy practice to enhance safety in medication usage and provide expanded pharmaceutical service for secluded communities. The primary role of pharmacists is to raise patient awareness of the appropriate use of prescribed drugs, the management of chronic conditions through virtual follow-ups, and safety surveillance regarding potential drug interactions and side effects [8,9]. More importantly, telepharmacy has advanced pharmacists to provide consultations much more frequently, which improves patient adherence and allows them to take on more patient-centered roles, particularly in managing chronic diseases, such as diabetes and hypertension. This work has improved patients' health outcomes, treatment regimens, and pharmaceutical care access [4,5,10].

In addition to these roles, pharmacists are involved in remote viewing, such as compounding medications for specialized therapies, such as oncology and pediatric care, through telepharmacy to ensure the patient's safe receipt of individualized medicine. This modality is applied through telehealth; pharmacists use telehealth to support pharmacovigilance activities because it constitutes efficient patient channels for adverse drug reaction reports and prompt intervention. Telehealth provided many services from pharmacists on public health initiatives through smoking cessation programs via telehealth, nutritional counseling for weight management, and immunization and preventive services. The pressure to switch to telehealth systems places pharmacists as core actors in strengthening primary healthcare, diminishing the load on other health workforce people, and increasing the general resiliency of the health service [8–10].

Medicine

Physicians have a direct responsibility and play an essential role in telehealth implementation. This is achieved through teleconsultations, established patient care services, chronic conditions management, and inter-departmental collaboration for comprehensive patient care [11,12]. Often, they are the first to take the lead in determining patients' needs, diagnosing, and initiating treatments with these modalities, thus bringing enormous benefits to patients located in remote and underserved areas. Other telehealth initiatives,

such as "Sehhaty," dramatically expanded access to medical consultations, an essential lifeline for those for whom geography would otherwise be a barrier to appropriate services [13,14].

Physicians use telehealth to provide patient care and are heavily involved in managing chronic conditions such as diabetes, hypertension, and asthma. The goal has been to achieve improved patient outcomes through long-term and sustained management that is highly actionable for patients, resulting in more efficient utilization of healthcare resources and outcomes for patients who always need them. They have led multidisciplinary teams from various disciplines in a virtual setting to guarantee well-coordinated care provided by all specialized health professionals, including doctors, nurses, pharmacists, and other health specialists [4,6,11].

In addition to commercial suppliers, various professional organizations are producing telehealth guidelines, standards for safety, privacy, and quality of care for patients, and physicians' practice rules. Physicians gain from telehealth solutions to increase patient participation in care [11,12]. Owing to virtual follow-up visits and remote monitoring tools, physicians now have access to key health metrics that will allow for the early detection of impending complications and reduce the likelihood of emergent interventions. In Saudi Arabia, physicians work with other professionals to design connected telehealthcare paths that ensure a patient's continuity of care across the healthcare system with seamless transitions between physical and virtual care [5,7,13].

Nursing

Through this, nurses have enabled the provision of telehealth services, whereby they can virtually offer patient education, monitor the management of chronic diseases, and triage patient symptoms over digital platforms [15,16]. This has improved patients' access to care and enabled self-management during the COVID-19 pandemic, in addition to being very comfortable. Another critical role nurses play in telehealth is outreach to community education and patients for preventive care [1,2,5].

In addition to the roles mentioned above, nurses initiated virtual care coordination. This guarantees that the patient receives appropriate follow-up and intervention over time. Nurses initiate the use of telehealth platforms to assess the needs of patients, coordinate care from multiple providers, and advocate for patients' health needs within an increasingly digital environment. In addition, they guide wearables in remote monitoring of such patients, providing cues for vital signs and early warning signals, which proved very useful in managing patients with chronic conditions such as heart failure and diabetes [4,15,17].

Moreover, nurses have transitioned to using telehealth to provide mental health care, offering counseling and emotional support to patients who might be challenged in attaining in-person services. In addition, they make a significant contribution to post-discharge care. They use telehealth to provide further instructions on home care, wound evaluation, and medication management to reduce the rate of hospital readmissions. Their complete role in telehealth is to provide patient-centered care and lift Saudi Arabia's healthcare system's capacity to enable sound, constant, and high-value quality care across the country [14,15,18].

Laboratory

Laboratory services are also key to the successful implementation of telehealth because laboratory technicians manage the real-time diagnostic data that reaches the healthcare provider. Swift diagnosis and treatment adjustments are significant for effectively managing chronic diseases and emergencies. Incorporating digital reporting platforms into the telehealth infrastructure has allowed healthcare professionals to make these decisions without requiring face-to-face visits [3,17].

In addition, laboratory professionals pioneered the remote sample collection process, in which patients collected samples at home under the direction of laboratory professionals. Such an initiative reduces the load on laboratory facilities and promotes easier and safer patient procedures. Home sample collection benefits patient well-being primarily during times of a public health emergency, such as the COVID-19

pandemic. Laboratory results can also be shared seamlessly through digital platforms to help healthcare professionals provide quick virtual consultations [2,5].

Laboratory technicians are also responsible for maintaining diagnostic results in terms of quality and correctness via the remote setting of calibrators and quality assurance check materials. Implementing telehealth applications has helped improve healthcare delivery and system efficiency by reducing time delays related to diagnoses and ensuring continuity of care. An approach that involves laboratory services working in partnership with other healthcare disciplines ensures treatment that considers the patient's condition on a broad scale, a step towards enhancing healthcare in Saudi Arabia [4,18,19].

Anesthesia

Anesthesiologists have since embraced telehealth platforms in preoperative assessment and consultation, more so in low-resource settings where physical transport of patients to a specialist facility is challenging. Available telehealth tools have improved patient triage and risk stratification, with the ultimate benefit of improved perioperative planning and safety [1,17,20].

Apart from preoperative assessments, telehealth has also enabled remote follow-ups in the postoperative period, whereby anesthesiologists can monitor their patients to detect complications such as pain, respiratory problems, or other adverse effects related to anesthesia. This has bridged the substantial gap in continuity of care while diminishing patients' physical travel for further management appointments. Tele-anesthesia also encompasses intraoperative remote monitoring technologies, where specialists can supervise anesthesia delivery to ensure patient safety in environments that do not have local specialists [3,16,20].

Anesthesiologists can now administer real-time advice through telehealth platforms to healthcare professionals at remote or under-resourced facilities, where support from specialists in person to administer anesthesia safely is unavailable. This has proven to be important in rural hospitals and emergency surgeries, where the guidance required and provided promptly can make a significant difference for patients. Furthermore, it allows anesthesiologists to undertake virtual multidisciplinary team discussions, resulting in better surgical care coordination and perioperative protocol optimization. Such expanded roles under tele-anesthesia have advanced safer surgical practices and better patient outcomes within a resilient healthcare system [4,18,21].

Urology

Another area of service expansion has been tele-urology services in Saudi Arabia, which allow follow-up consultations and chronic disease management conditions, such as benign prostatic hyperplasia and urinary tract infections. The growth of tele-urology has, in turn, reduced the need for physical consultations, which is beneficial for caseload management and, most importantly, increasing access to urologists in rural areas [21,22].

Furthermore, teleurology allows patients to receive specialized care from the comfort of their homes, especially for people in distant or less-served areas, without the need to travel long distances. Virtual consultation has also found good acceptance in the preoperative and postoperative management of patients because it allows quick information flow to patients and allows them to know what care should be expected of them, thereby reducing the planning of surgical activities and hastening recovery processes, thereby lightening the load on the hospital and increasing customer satisfaction [23,24].

Moreover, teleurology has been helping to offer care to patients with chronic urological conditions through the long-standing relationship between the patient and the healthcare worker. Long-standing follow-up is essential in the follow-up of conditions such as kidney stones, urinary incontinence, and prostatic conditions since some level of adjustment of treatment is often required. In addition, it has facilitated interdisciplinary work that urologists may engage in, including but not limited to radiologists and nephrologists, in developing a complete treatment plan for the patient [14,23,25,26].

The implementation of teleurology also fosters educational activities whereby urologists can directly lead their patients towards prevention and lifestyle changes that may stop or slow the advancement of urological diseases. Using telehealth tools, the urologist enables the patient, propels greater patient participation, and achieves better health outcomes. Therefore, including teleurology in health systems has enhanced access to quality care in Saudi Arabia [4,18,21].

Public Health

Public health workers have used telehealth to monitor and manage infectious diseases, promote health education, and disseminate preventive measures. In Saudi Arabia, during the COVID-19 pandemic, telehealth was used to promote public health communication. Implementing continuity of care, making vaccination information available, and scheduling vaccination appointments are examples of how public health officials have used these technologies [5,21,23].

In addition to the COVID-19 pandemic, telehealth has significantly contributed to preventing chronic diseases, encouraging healthy lifestyles, and enhancing communities' general health outcomes. To achieve this, public health professionals use the telehealth delivery network to conduct webinars and virtual workshops related to community outreach, focusing on lifestyle modifications, such as improved nutrition, physical activity, and smoking cessation. Such programs help marginalized and rural populations ensure availability in places where in-person services may be limited [1,2,22].

Another critical area in which non-communicable disease (NCD) management is included is the opportunity for telehealth to track and manage remote monitoring and regular virtual consultations, which aid in their early detection and preventive care. Public health campaigns using this avenue have pushed the public towards vaccination drives, maternal and child health, and preventive screening. These programs increase participation rates in different sectors and health literacy [19,27,28].

Another major group that has been using telemedicine at large is public health professionals to channel campaigns to raise mental health awareness by providing resources and virtual counseling sessions on issues such as anxiety and depression, which have become very common amidst any public health crisis. This has reduced the stigma against seeking mental help by providing such avenues, making it more available to them [5,25,28].

The availability of telemedicine for disease surveillance has allowed the public health sector to upgrade data collection and analysis to respond promptly to emerging public health threats. Thus, embedding telehealth within public health programs proved instrumental in fostering a more adaptive public health system that responds to the ever-dynamic acute and chronic health challenges within the Saudi Arabian context [4,14,24].

Occupational Health

Telehealth is critical in offering remote consultations to workers in industrial workplaces throughout Saudi Arabia. Through telehealth, workers in the industrial setting receive periodic health screenings and risk assessments from occupational health specialists, which significantly improves general health outcomes and reduces time away from work [4,14].

In addition to remote consultations, telehealth has allowed occupational health professionals to conduct virtual assessments for ergonomics, identify workplace hazards, and suggest alterations to avert work-related injuries. Virtually assessing them benefits staff working in sectors such as construction and manufacturing, where most of the work is strenuous and emphasizes safety risks [27–29].

Another significant development is that telehealth platforms enable workers to receive psychological support by attending virtual counseling sessions on stress, anxiety, and burnout. This is quite significant for workers in times of crisis, especially during the COVID-19 pandemic and after when most employees face

heavier workloads and generally increase uncertainty. Telehealth occupational health specialists maintain workforce productivity and healthy work-life by offering psychological support [1,2,17].

This would further enable proactive measures under occupational health programs, such as wellness campaigns, vaccination drives, health education sessions, and lifestyle management programs. These were taken virtually and reached the employees for whom on-site health services were out of reach. Virtual sessions for occupational health conditions have facilitated better disease surveillance for conditions such as chronic hypertension and diabetes to ensure that workers receive timely care and, in turn, reduce possible attendant complications [18,24]. Because of these extended functions, telehealth has gained significant importance in ensuring worker safety, health, and efficiency, helping create a healthier workforce, and lowering the weight of physical and occupational health clinics [25,27,30].

Infection Control

The role of infection control has expanded with telehealth, which provides opportunities for remote delivery of infection prevention training to healthcare workers. Infection control specialists can use telehealth platforms to share best practices with others, monitor and ensure compliance with such practices, and reduce the spread of hospital-acquired infections. This use would significantly reduce infections in healthcare facilities during the COVID-19 pandemic [2,31,32].

This has enabled infection control professionals to perform virtual assessments and audits on healthcare facilities where they can provide real-time feedback on hygiene and ensure that infection control measures are followed. It has been critical in perpetuating high levels of sanitation and safety, notably in areas identified as high risk for infection, such as intensive care units and operation theatres. In return, infection control practitioners have developed interactive modules for training healthcare staff, which can be delivered remotely through the Internet to ensure staff readiness to handle emerging infectious threats [25,32].

Additionally, this has allowed easy sharing of information on new infection control guidelines and protocols with attendant staff to keep up-to-date with evidence-based practice. Furthermore, the application of telehealth for routine virtual meetings and workshops has enabled more collaboration between different facilities to standardize practices regarding the spread of infection and enhance collective knowledge in this area [1,17,31].

The incorporation of telehealth has reversed the role of infection control measures from reactive to proactive; now, it involves the early identification of potential outbreaks and subsequent on-time actions. These expanded roles have made infection control efforts most effective and efficient, contributing significantly to patient safety and reducing the incidence of healthcare-associated infections in every corner of Saudi Arabia [4,32].

Hospital Management

Hospital management teams implement telehealth infrastructure strategy planning to incorporate interconnectivity and adherence to privacy regulations. This involves integrating telehealth platforms with existing hospital systems and diffusing telehealth into the organization as part of policy [4,25].

Hospital management is also involved in allocating resources for telehealth programs. This covers the provision of the technology required and the training of the healthcare workforce. Implementing telehealth is quite logistically sensitive, and management must plan to provide high-speed Internet, secure communication channels, and equipment capable of working with telehealth services [33,34].

Moreover, hospital management initiated the policy development of telehealth practices. This covers all problems concerning privacy, data security, and patient approval. Management sees that all practices are based on rules, regulations, and international standards to build the confidence of patients and health workers toward telehealth services [1,17,35].

Hospital administrators are also responsible for driving cultural change and accepting telehealth as a permanent part of service delivery in healthcare organizations. This means educating healthcare professionals and patients on telehealth, its advantages, and how it is used, overcoming resistance to new technologies, and creating incentives for its adoption [4,36].

Furthermore, hospital management continuously monitors and evaluates the performance and outcomes of telehealth programs using analytics to measure their effectiveness, patient satisfaction, and efficiency gains. These will enable top management to realign and continuously make corresponding structural changes that reflect the transformation in patient needs to maintain telehealth as an essential, high-quality component of the healthcare system in Saudi Arabia [14,18,34].

Collaborative Integration of Telehealth Across Disciplines

This success has been seen in the collaboration of multiple healthcare professionals, who bring their expertise together to ensure a holistic approach to patient care. The synergy between pharmacy, medicine, nursing, laboratory services, anesthesia, urology, public health, occupational health, infection control, and hospital management increases the efficiency and reach of telehealth services [26,31,33].

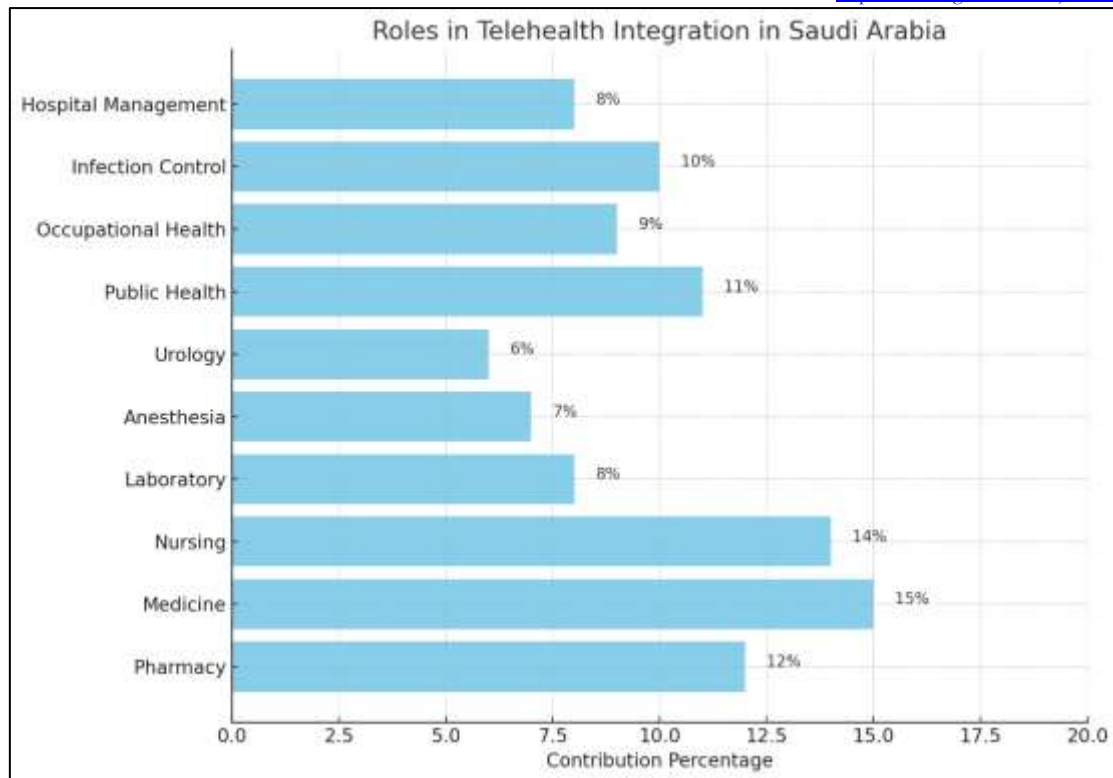
For example, the pharmacist will interact with the physician and nurse to manage medication therapies concerning how well the patient being remotely monitored adheres to the prescribed medications and to avoid adverse drug reactions. To provide comprehensive remote care, the physician can work with the nurse and laboratory professional, in which the nurse informs the physician about the patient's symptoms, and the laboratory professional provides the required diagnostics [25,35].

Anesthesiologists partner with surgeons, nurses, and hospital administrators to synchronize the entire team towards successful perioperative telemedicine consults, an effort that can improve patient outcomes, even within poorly resourced facilities. In the field of urology, in combination with nephrologists, radiologists, and public health workers, urologists can produce patient-tailored, need-specific, multi-professional care concepts that can quickly be delivered via telehealth solutions [18,28].

Preventive care initiatives involve collaboration between public health experts and occupational health specialists. They implement efforts to promote health literacy and the availability of virtual health workshops via telehealth for workers' physical and psychological needs. In their collaboration, infection control teams apply telehealth to ensure a capacity-based orientation for all staff that transcends disciplines, responds promptly to emerging health threats, and maintains standard hygiene practices in healthcare facilities [4,17,36].

Hospital management is the key to fostering these interactions by ensuring that the telehealth infrastructure is robust, up to privacy standards, and accessible to every category of healthcare professionals. If hospital administrators support this culture, innovation and adaptability will ensure that all disciplines are well-supported and can operate in an integrated manner [25,30,35].

This interdisciplinary partnership has fortified the telehealth system in delivering the care patients need well-coordinated, efficient, and of quality regardless of the patient's location. The combined work of every healthcare professional has made telehealth a vital part of healthcare in the country, guaranteeing long-lasting and robust healthcare delivery [18,29,33]. Figure 1 shows the contributions of various healthcare roles in the integration of telehealth in Saudi Arabia



Conclusion

The successful implementation of telehealth in Saudi Arabia is evidence of the bottom-up collaborative work of a diversified healthcare workforce. Pharmacists optimize medication management strategies, and physicians provide direct virtual consultations. Nurses ensure constant follow-up with patients. Laboratory technicians ensure diagnostics when required. Every other health professional contributes efficiency to telehealth practices within and outside their discipline. Anesthesiologists, urologists, public health professionals, occupational health professionals, infection control professionals, and hospital management team members create and foster an infrastructure where healthcare remains poor to patient needs and responsive in an evolving reality.

By combining the benefits from each field, telehealth can achieve access to quality health care worldwide, which is incredible. This multidisciplinary approach is practical for the patient and allows for better building in times like those we find ourselves in post-COVID-19. The present study suggests a long-term commitment to collaboration and innovation by all healthcare stakeholders as determinants of sustainability and further development of telehealth services to maintain and even improve Saudi Arabia's leading position in healthcare modernization.

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