



Review Article

Telepharmacy and Digital Health Integration in Pharmaceutical care

Rajeshree Panigrahi, Anjan Kumar Mahapatra*, D. Kajal Achary

Department of Pharmaceutics, Royal College of Pharmacy and Health Sciences, Berhampur, Ganjam, Odisha, 760002, India.

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ABSTRACT

Telepharmacy is an emerging model of pharmaceutical care that utilizes telecommunication and digital technologies to deliver pharmacy services remotely. The integration of telepharmacy with digital health systems has significantly expanded the scope of pharmacy practice by improving access to pharmaceutical care, particularly in rural, remote, and underserved populations. Telepharmacy enables pharmacists to provide services such as prescription verification, medication dispensing supervision, patient counseling, medication therapy management, and clinical decision support without the need for physical presence. Rapid advancements in digital health technologies, including electronic health records, telemedicine platforms, mobile health applications, and artificial intelligence, have further enhanced the effectiveness, safety, and efficiency of telepharmacy services. The COVID-19 pandemic accelerated the global adoption of Telepharmacy and highlighted its importance in ensuring continuity of pharmaceutical care during healthcare disruptions. However, challenges related to regulatory frameworks, data privacy, technological infrastructure, and professional acceptance continue to limit widespread implementation. This review aims to comprehensively discuss the concept, evolution, applications, benefits, challenges, and future prospects of telepharmacy, with particular emphasis on its integration into digital health systems and its role in pharmaceutical care.

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*Corresponding author:

Dr. Anjan Kumar Mahapatra

Professor, Department of Pharmaceutics

Royal college of Pharmacy and Health Sciences, Berhampur, Odisha, India-760002

Email: anjanmahapatra@gmail.com, Mob: 9437194456

INTRODUCTION

Technological advancements have transformed healthcare delivery systems, leading to the development of innovative digital health-based models of care. Among these, telepharmacy has gained increasing importance as a strategy to extend pharmaceutical services beyond traditional pharmacy settings. Telepharmacy involves the use of information and communication technologies to enable pharmacists to provide pharmaceutical care remotely when direct, face-to-face interaction is not feasible [1, 2].

The need for telepharmacy has been driven by several factors including shortage of pharmacists, rising healthcare costs, and unequal distribution of healthcare services, particularly in rural and underserved regions [3]. Integration of telepharmacy with digital health technologies such as

electronic health records (EHRs), telemedicine platforms, and mobile health applications has strengthened its role in improving medication safety, accessibility, and continuity of care [4].

The COVID-19 pandemic further emphasized the importance of telepharmacy, as physical distancing measures and lockdown disrupted conventional healthcare services. Telepharmacy enabled uninterrupted pharmaceutical care while minimizing the risk of infection transmission [2]. These developments highlight the growing significance of telepharmacy as an essential component of modern healthcare systems [5].

A conceptual overview of telepharmacy and its integration with health technologies in pharmaceutical care is shown under Figure 1.

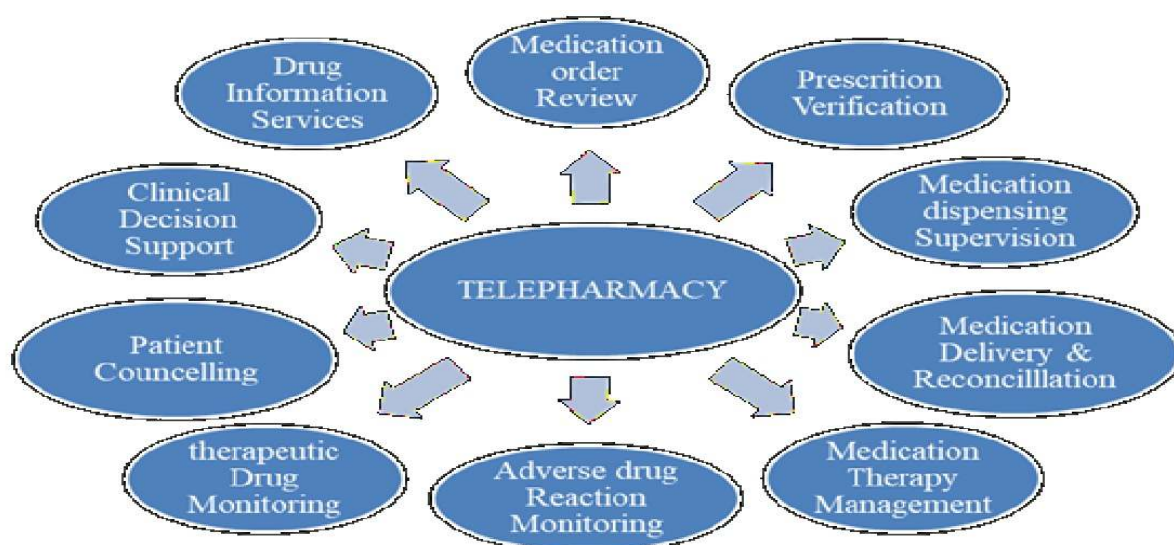


Figure 1: Conceptual overview of telepharmacy and its integration with health technologies

CONCEPT AND EVOLUTION OF TELEPHARMACY

The term “tele” originated from the Greek word “Telos” meaning “at a distance” and the term “medicine” derived from a Latin word “Meden” meaning “to heal”. This technology was devised to provide healthcare services to medically deprived population in geographically remote locations with the help from long-distance medical centres [6]. Telemedicine has been defined by the World Health Organization as the delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities [10].

Telepharmacy is defined as the provision of pharmacy services through telecommunication technologies in situations where direct in-person interaction between pharmacists and patients is limited or unavailable [8]. It allows pharmacists to remotely supervise medication dispensing, prescriptions review, provide patient counseling, and collaborate with other healthcare professionals across different locations [9].

The National Association of Boards of Pharmacy defines telepharmacy as the provision of pharmaceutical care through the use of telecommunications and information technologies to patients at a distance [4].

Initially, telepharmacy was developed to address the lack of pharmacist availability in rural and remote healthcare facilities [3]. Early telepharmacy models primarily focused on remote prescription verification and dispensing supervision. With advancements in digital infrastructure, internet connectivity, and healthcare information systems, telepharmacy has evolved to include comprehensive clinical pharmacy services [2].

Modern telepharmacy practice encompasses medication therapy management, chronic diseases monitoring, patient education, pharmacovigilance activities, outcomes-based pharmacy practice and positions telepharmacy as a vital element of contemporary pharmaceutical care [9].

Advancements in digital communication, data compression technologies, and digitalization processes have enabled the development of personal computer-based videoconference that has indeed influenced the widespread use of telemedicine [7].

DIGITAL HEALTH TECHNOLOGIES SUPPORTING TELEPHARMACY

Digital health technologies play a crucial role in the effective implementation and extension of telepharmacy services. Electronic health records (EHRs) provide pharmacists with real-time access to patient medical histories, laboratory data, and medication profiles, enabling informed clinical decision-making and reducing medication errors [9].

Telemedicine platforms facilitate real-time audio-visual communication between pharmacists, physicians, and patients, improving interdisciplinary collaboration and coordination of care. Mobile health applications support medication adherence

through reminders, educational materials, and remote monitoring of therapeutic outcomes [2].

Emerging technologies such as artificial intelligence, machine learning, and data analytics further enhance Telepharmacy by identifying medication-related problems, predicting adverse drug reactions, and supporting personalized therapy optimization [11, 12]. The integration of these digital health tools with Telepharmacy improves the quality, safety, and efficacy of pharmaceutical care delivery [11]. A schematic layout of interconnected systems of digital health technologies for telepharmacy is shown under Figure 2.

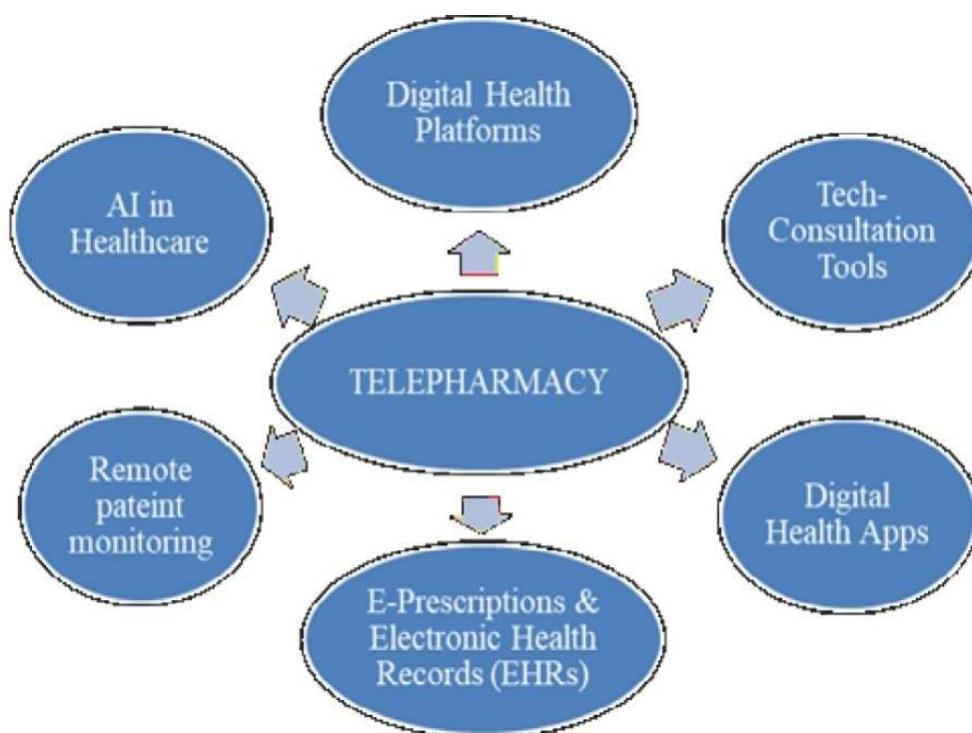


Figure 2: Highlights the digital health technologies supporting telepharmacy

APPLICATIONS OF TELEPHARMACY IN PHARMACY PRACTICE

Telepharmacy has been successfully implemented across various pharmacy practice settings. In community and rural pharmacies, Telepharmacy ensures access to professional pharmaceutical services where on-site pharmacists are unavailable [3]. It enables safe dispensing practices, patient counseling, and medication review through remote supervision [8].

In hospital pharmacy practice, telepharmacy supports prescription verification, medication reconciliation, and clinical consultations, particularly during after-hours, night shifts, and emergency situations [11]. Telepharmacy also plays a significant role in chronic disease management by facilitating continuous patient follow-up, medication counseling, and monitoring of treatment outcomes for conditions such as diabetes, hypertension, and asthma [9].

Additionally, telepharmacy has proven valuable during public health emergencies by ensuring uninterrupted access to pharmaceutical care while reducing physical contact between patients and healthcare professionals [2].

BENEFITS OF TELEPHARMACY

Telepharmacy offers several advantages for patients, healthcare professionals, and healthcare systems. It improves access to pharmaceutical care, particularly in

underserved and remote regions, thereby reducing disparities in healthcare delivery [2, 3]. Remote prescription review and clinical oversight enhance medication safety and reduce the risk of medication errors [8].

From a healthcare system perspective, telepharmacy contributes to cost-effectiveness by optimizing resource utilization and reducing unnecessary hospital visits [2]. For patients, telepharmacy improves convenience, treatment adherence, and satisfaction by providing timely and accessible pharmacy services [9].

CHALLENGES AND LIMITATIONS

Despite its benefits, telepharmacy faces several challenges that limit its widespread adoption. Regulatory and legal frameworks governing telepharmacy vary across regions, creating uncertainties related to licensure, compensation policies, and scope of pharmacy practice [8]. Ensuring data privacy and cyber security remains a major concern due to the electronic transmission and storage of sensitive patient information [7].

Technological barriers, including inadequate internet connectivity, lack of digital infrastructure, and limited technical expertise, particularly in low-resource settings, further hinders telepharmacy implementation [3]. Additionally, resistance to change among healthcare

professionals and patients may affect acceptance and effective utilization of telepharmacy services [4]. A schematic lay

out on the mechanism of activity of telepharmacy for day one is given under Figure 3.

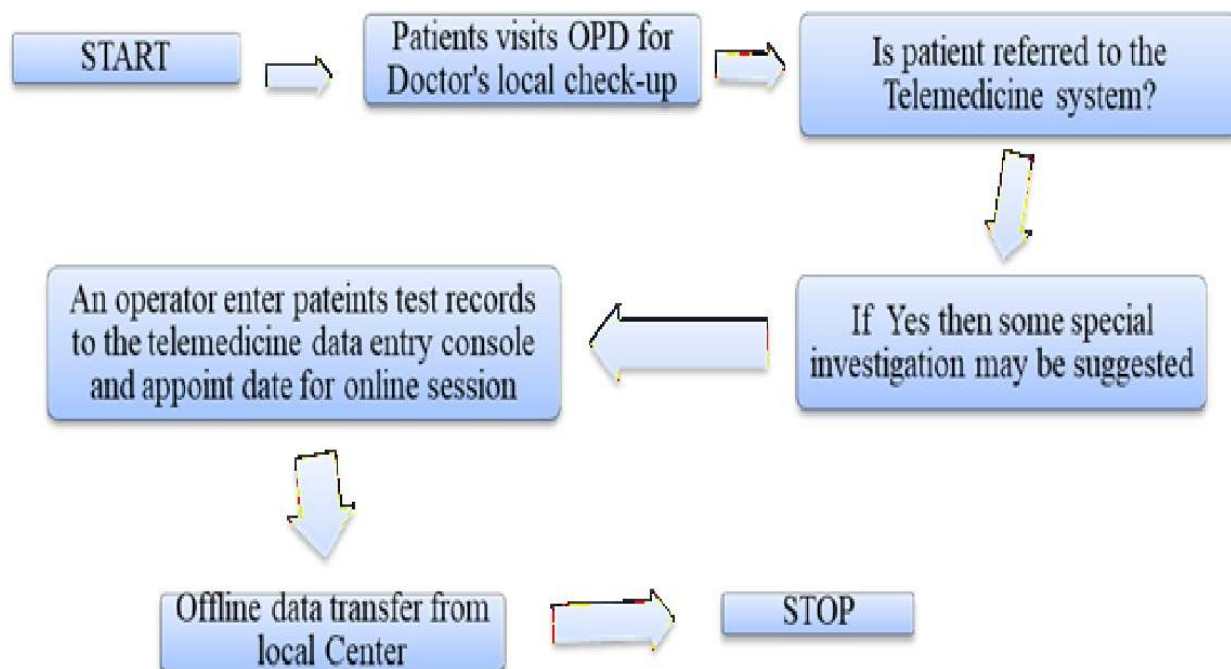


Figure 3: Schematic lay out on the mechanism of activity of telepharmacy for day one

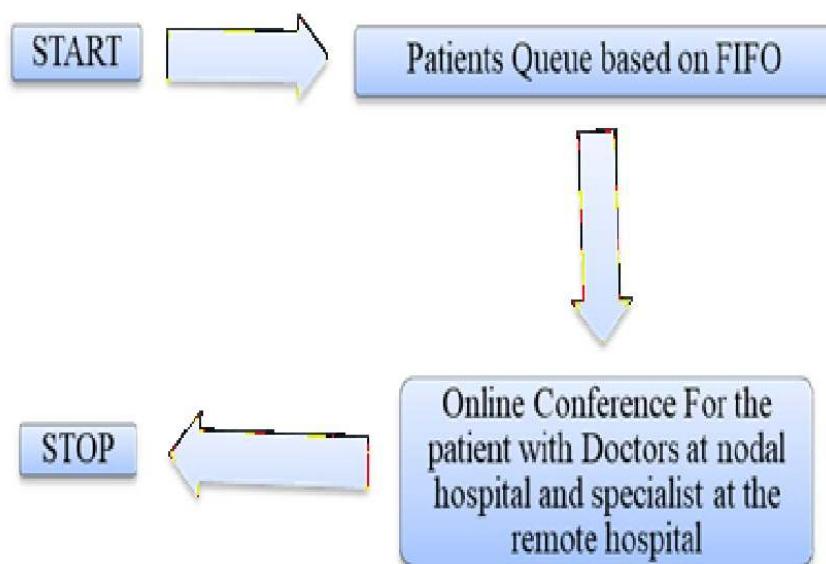


Figure 4: Schematic lay out on the mechanism of activity of telepharmacy for day two

TELEPHARMACY PRESENT STATUS AND FUTURE PERSPECTIVE

PRESENT STATUS

If there was no pandemic, a section of telepharmacy role in healthcare would have sounded a little but COVID-19 came along, and the value of telepharmacy like other forms of telehealth has become even more apparent, appreciated, and embraced. The federal government quickly championed telepharmacy as a way for pharmacists to minimize their risk of exposure to the novel corona virus and reduce the risk for patients during the COVID-19 pandemic [11].

FUTURE PERSPECTIVES

The future of telepharmacy is closely linked to on-going advancements in digital health technologies. Artificial intelligence, machine learning, and big data analytics are expected to further enhance clinical decision making and support personalized pharmaceutical care. The development of standardized frameworks and clear practice guidelines will be essential to ensure the safe and effective integration of telepharmacy into healthcare systems [12]. As reported in recent studies, a recent survey found about that three-quarters of patients who have received virtual care during the pandemic said they want to see it become a standard part of care [2]. The following steps are going to emerge in

future to fulfill the usage of telepharmacy and make advantageous to all the people over the country especially in rural area or remote areas [3, 8].

Continued research, professional training, and policy support will play a key role in expanding telepharmacy services and addressing existing challenges [6]. With appropriate infrastructure and regulatory support, telepharmacy has the potential to become a routine component of pharmacy practice worldwide [3].

Support to clinical services like, medical adherence, clinical pharmacist shortage, pharmaceutical counseling activity, remote education and handling of “Special Pharmacies”, medical staff training, prescription and reconciliation of drug therapies [8, 9].

CONCLUSIONS

Telepharmacy represents a significant advancement in pharmaceutical care delivery by enabling remote access to professional pharmacy services. Its integration with digital health technologies has expanded the scope of pharmacy practice, improved healthcare accessibility, and enhanced medication safety. Although challenges related to regulation, technology, and data security, strategic planning, supportive policies, and technological innovations can address these limitations. Telepharmacy is well-positioned to become an integral part of

future healthcare systems, supporting efficient, patient centered, and accessible pharmaceutical care.

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