



The Role and Impact of Telepharmacy and Digital Health Interventions on Modern Healthcare Systems

¹Joseph Obiezu Chukwujekwu Ezeonwumelu, ²Uhama Kingsley Chukwuka, ³Ugwu Okechukwu Paul-Chima, ³Alum Esther Ugo, ⁴Ugwuanyi Anthony Chukwudi and ⁵Tambwe Patrick Rodrigue

¹Department of Clinical Pharmacy and Pharmacy Practice, Kampala International University Western Campus, Uganda.

²Department of Biochemistry, Faculty of Applied Natural Sciences, Enugu State University of Science and Technology, Nigeria.

³Department of Publication and Extension Kampala International University Uganda.

⁴Department of Microbiology Ebonyi State University Abakaliki, Nigeria.

⁵Department of Public Health Kampala International University Uganda

Email: kingsley.uhama@esut.edu.ng

ABSTRACT

Digital health interventions (DHI) and telepharmacy have transformed the landscape of healthcare delivery, providing significant advancements in patient care and medication management. Telepharmacy, a subset of telemedicine, leverages technology to facilitate remote pharmaceutical services, enhancing access and efficiency, particularly in underserved areas. This paper explores the benefits and challenges associated with telepharmacy and digital health interventions, examining their impact on healthcare professionals and patients. The analysis is based on a comprehensive review of current literature, policy documents, and official publications. Key findings indicate that while telepharmacy offers numerous advantages such as improved medication adherence and reduced medication errors, it also raises critical issues related to regulatory, legal, and ethical standards. The paper concludes by identifying future trends and opportunities for research and practice in telepharmacy and digital health interventions, emphasizing the need for robust frameworks to ensure their effective and safe implementation.

Keywords: Telepharmacy, Digital Health Interventions, Medication Management, Chronic Disease Management, Healthcare Technology and Patient Care

INTRODUCTION

Digital health interventions (DHI) are increasingly proposed as means of delivering healthcare and patient monitoring, often replacing traditional face-to-face consultations [1-3]. Telepharmacy, a subset of telemedicine, has made considerable progress in restructuring healthcare systems, offering significant advantages to healthcare professionals, including greater flexibility and support for professional practices [4-6]. However, these innovations also raise numerous academic, practical, legal, and ethical questions that warrant exploration from a research perspective [7-9]. The legitimacy and acceptability of telepharmacy by the public and healthcare professionals must be critically evaluated [10-13]. This work synthesizes current literature to focus on the benefits and impacts of telepharmacy and digital health interventions on healthcare stakeholders, particularly pharmacists [14-17]. By reviewing literature, policy documents, and official publications, this paper seeks to address the advantages, challenges, and limitations of telepharmacy, providing a comprehensive understanding of its role and impact on modern healthcare systems [18-20].

Telepharmacy and Digital Health Interventions

Digital health interventions (DHI) are increasingly often proposed as a means of delivering healthcare and patient monitoring. Some of these technologies are replacing face-to-face doctor-patient consultations, self-measurements, and patient-generated data analyses shared with the healthcare team.

Alongside telepharmacy, it has made considerable progress in restructuring healthcare systems [1-4]. But it also offers healthcare advantages for healthcare professionals, greater freedom in the organization of working time, and support for their professional practices. However, these innovations raise academic, practical, legal, and ethical questions and need exploration from a research point of view [5-7]. Their legitimacy and acceptability by the public and health professions must also be discussed. This work is a synthesis focusing on the benefits and impacts on healthcare stakeholders. What impacts (advantages, challenges, limits) do telepharmacy have for health actors and more particularly, pharmacists? This work is based on literature reviews, articles, policy documents, and official publications [8-11]. Telemedicine is a rapidly growing health area, offering advantages in healthcare services [12-16]. While telemedicine is easier to apply and is increasing in popularity every day, telepharmacy, which is under the telemedicine group, is also taking its place among these services. Technology-based operations on medication management, drug therapy, and patient counseling, and the increase in the adaptation of these pioneering activities indicate the significance of telepharmacy [17-19]. It progresses gradually and nearly covers several medical specialties in our country and in the world and impacts the progress of the pharmacy profession.

Technological Advancements in Telepharmacy

Telepharmacy provides advantages to patient care, such as direct interaction between patient and pharmacist, reduced waiting time, and accessibility to the pharmacist without incurring travel costs. The value that pharmaceutical services bring to the healthcare system is yet to be entirely quantified, but decisions about accessibility and cost are underlying factors that continue to contribute to the widespread use of the pharmacist's services [1-5]. Telepharmacy can improve the efficient use of the pharmacist's time, releasing that pharmacist to be retailers and clinical activities, which will contribute margin and utilization management. Careful determination and utilization of available pharmacist's time and regional market potential are necessary to invoke telepharmacy programs that are economically feasible [8-9]. It is an outgrowth of the technologically advanced society in which we live." Telepharmacy may provide unequalled pharmacy services to rural clinics and hospitals. It has also been suggested that telepharmacy will assist the pharmacist to realize their often untapped potential for providing patient services and take pharmacy practice away from the tradition of dispensing functions to become more involved in clinical activities [10-13]. "Telepharmacy" refers to a concept in which a pharmacy operates at a location from where pharmacists transmit their professional services to the patients [14-16]. This communication takes place via audio-visual connection and with the help of other available communication tools. The aim of telepharmacy is to facilitate the patients with pharmacist services in those areas which are underprivileged and neglected. Telepharmacy may expand the practice of pharmacy by broadening the place where a pharmacist performs the duties [17].

Telepharmacy Systems and Platforms

In the recent study of tele-pharmacy acceptance in the United States of America, a survey of 122 rural pharmacies was used to highlight the most significant factors in tele-pharmacy implementation. Key factors that discouraged implementation included concerns about technology, financial resources, support from the community, and costs [9]. Additionally, pharmacies with relationships with local healthcare providers and having other remote healthcare facilities were statistically higher in the acceptance of telepharmacy. Born and colleagues point out the potential for telepharmacy services to combat decreases in the workforce and networking challenges in rural areas. Interrupted working patterns are currently contributing to nursing and GP staff shortages in rural community pharmacy [11]. Offering out-of-town GP censorship services in conjunction with a strong technology support system could provide the necessary evidence and reduce the impact on patient care in these areas [12]. Telepharmacy describes a way of providing pharmacy services through a technology interface. It has two main branches, tele-checking and tele-pharmacology [14]. Tele-checking encompasses filling medications and verifying them at the site. Tele-pharmacology, on the other hand, incorporates the outpatient dispensing through a pharmacist from a centralized site. In addition to the benefits of checking prescriptions on a variety of patient outcomes, tele-pharmacy services have previously been reported to improve the mortality rate, in particular due to better medication monitoring and reduced time spent on the wait. Telepharmacy can be implemented through a variety of interconnected platforms: a seated pharmacy management system, robotic dispensing, and video consultation with a remote pharmacist [9].

Benefits and Challenges of Telepharmacy and Digital Health Interventions

Telepharmacy services allow patients convenient access to their pharmacists with more flexible hours. Pharmacists are able to communicate with patients to help them understand their medical conditions and explain the steps to take their medications. Several telepharmacy interventions have shown significant improvements in chronic disease management [11]. The automatic dispensing of LED blister-packs with

inbuilt microprocessors has been shown to reduce medication errors. Such innovations allow for stock control, device tracking, and monitoring of the process of adhering tablets to the blister, including rejected tablets [14]. The inclusion of visual images of the intended tablets in bar-code medication administration was suggested to further reduce medication errors. Furthermore, research has suggested that pharmacist-led medication reconciliation can prevent medication errors [1]. Patient-centered pharmacy care has a significant impact on the total daily dose of antibiotics prescribed in an adult hospitalized cohort. Although telepharmacy and digital health interventions have the potential to deliver many benefits to the healthcare system and pharmacy practice, there are also noticeable challenges that need to be addressed. Telepharmacy services serve as an intervention to improve patient outcomes (e.g., medication-related problems, medication-related hospital visits, and adverse drug events) and increase access to care [5]. Telepharmacy offers rural hospitals the ability to have their inpatients' medications reviewed by a clinical pharmacist, reducing the risk of medication errors. It is significantly associated with a reduction in the number of days to achieve target drug doses and the number of total drug classes [9].

Advantages of Telepharmacy

The benefits of rural telepharmacy or remote central pharmacy services are similar to other telepharmacy approaches. Initially, remote access technology allows a pharmacist to work in a more comfortable environment [11]. Pharmacists are in quiet and convenient office spaces with a computer workstation, camera with pan-tilt-zoom control, and access to documentation and library information utilizing high-speed digital internet access. In addition, telepharmacy systems often utilize automated medication dispensing equipment. This type of equipment, regardless of the vendor, contains the software to perform the difficult steps of a traditional verification process with the pharmacist checking the outcomes [11]. The medication box or drawer is locked, which means the pharmacist cannot touch the medications to alter the drug package. The benefits of telepharmacy are numerous. Such an approach aims to optimize the same level of pharmaceutical care with a pharmacist who is not physically located in the same facility. Telepharmacy can also be utilized to further optimize the time a pharmacist requires to complete a review of patient medications, as well as obtain pharmacy services in remote or underserved areas, improve hospital discharge transition and medication reconciliation, reduce medication errors and adverse drug effects, improve patient and staff satisfaction, and improve the financial performance of the hospital pharmacy [13]. A hospital using telepharmacy does not need to staff a pharmacist 24/7 because the telepharmacy system can act as a backup to perform verification of order entries [11].

Regulatory and Ethical Considerations in Telepharmacy

Some participants in this mixed or pluralist system felt drawn to telepharmacy because it was perceived to be asking deeper questions about ethos and praxis, focusing directly on the person and his or her well-being. Regulation and governance is about risk. It is about protecting the public [1]. There is international consensus that pharmacists are not free to practice as they wish. All pharmacists are expected to collaborate with other healthcare professionals, possessing the highest levels of clinical governance, managing the clinical risk in the best interest of their patients, and adhering to the practice standards, guidelines, and legislation [13]. Unlike the physical premises of a traditional pharmacy, the telepharmacy is different every time. The most important relationship is not with the physical space but the people the service supports. This paper explores regulation, risk, professional responsibility, and ethical considerations in the establishment of both a physical and a virtual telepharmacy [11]. The expansion of tele- and digital health services across healthcare brings with it significant challenges, not least of which are regulatory, policy, and governance questions. Informed by a meta-synthesis of the impacts of digital health interventions on user perceptions of health services and published best practice guidelines, we provide recommendations for practice and policy. One important ethical consideration is governance of a mixed economy of healthcare [11].

Laws and Regulations Governing Telepharmacy

Two states, Florida and New York, have state laws that specifically authorize the operation of a telepharmacy in rural areas. A majority of the states have telepharmacy regulations requiring that a pharmacist reviews the prescription before the drug is shipped, that a licensed pharmacy technician is employed at the remote location, and that the service provides professional liability insurance [6]. For a specific telepharmacy, the regulations typically include the requirements that: - The prescription that they fill originate from a geographic area served by a licensed hospital pharmacy, internal pharmacy, or a licensed pharmacy located outside the geographic area [8]. The pharmacist must use an approved computer-based information system that has the capability to communicate between the hospital, internal, or off-site pharmacy, or other remote dispensing terminal operated by the pharmacy. - At least two registered pharmacy technicians must be present at the remote dispensing terminal, if it is a remote

<https://rijournals.com/research-in-medical-sciences/>

dispensing terminal, or at least one registered pharmacy technician must be present in the hospital, internal pharmacy, or off-site pharmacy department, who has direct supervision over an approved computer-based management system if the prescription will be filled by a remote technician. There is no federal policy specifically regulating telepharmacy [12]. The individual states regulate the practice of telepharmacy based on varying regulations, which include: - The presence of a pharmacist. - The registration of the pharmacy. - Visits by personnel. - Prescriptions being filled just and shipped. - Personnel executing data management and receiving functions. - The communication with a regulated pharmacy. - Prescription transfer, refill authorization, a digital image of a computer, or audio-visual device. There are several federal laws and regulations governing the practice of telepharmacy, which include but are not limited to: 1) Medicare D regulations under which patient counts are used to demographic information. 2) Health Insurance Portability and Accountability Act (HIPAA) guidelines. 3) Physician guidelines related to boundaries of medical practice in which are informed the location of the patient who is receiving the care. 4) The Food and Drug Administration's (FDA) Prescription Drug Marketing Act-related rules. 5) Drug Enforcement Administration (DEA)-related rules for controlled substances.

Future Trends and Opportunities in Telepharmacy and Digital Health Interventions

The application of such technologies could facilitate the development of alternative pharmaceutical care and medication management approaches, such as the provision of real-time consultations under the supervision of advanced algorithms, or personalized therapeutic strategies based on machine learning technologies, or usage of an electronic health record database and social media data to detect side effects. The development of frameworks and guidelines for deploying them in telepharmacy and pharmaceutical care settings can facilitate effective and safe utilization [7]. Although these advancements represent both new frontiers in research and practice, the potential risks and unintended patient and system-level consequences that they encourage necessitate further scrutiny and careful evaluation. This particularly requires evidence from systematic and comprehensive studies with clinical endpoints, and data and metadata regarding ethical and legal aspects for utilizing such technologies, which are essential for future translation into real-world practice [8]. Having examined the benefits and challenges of both telepharmacy and digital health interventions in terms of their roles, impact, and contributions to healthcare in this review, there are several opportunities for both research and practice in these areas. This paper takes a forward view of future trends and potential areas for future studies related to telepharmacy, pharmaceutical care, and digital health interventions. These can serve as an inspiration for future R&D and practice, as well as offer directions for researchers and professionals interested in these areas. In particular, this paper identifies that the application of modern technologies, such as machine learning, cloud computing, artificial intelligence, and big data analytics, to relevant tasks such as drug selection, drug management, patient consultation, and side effects management could enhance the quality of pharmaceutical care and medication management to unlock potential improvements and advances in patient care and healthcare systems. These technologies are already emerging as promising practices in the field [9].

CONCLUSION

Telepharmacy and digital health interventions represent a significant shift in the delivery of healthcare services, offering both opportunities and challenges. The adoption of these technologies can lead to improved patient outcomes, greater accessibility to healthcare services, and enhanced efficiency in medication management. However, the successful integration of telepharmacy into healthcare systems requires careful consideration of regulatory and ethical frameworks to address potential risks and ensure patient safety. Future research should focus on developing comprehensive guidelines and robust evaluation methods to optimize the use of telepharmacy and digital health interventions in real-world settings. By embracing these innovations, healthcare systems can improve the quality of care and meet the growing demands of modern healthcare delivery.

REFERENCES

1. Damery, S., Jones, J., O'Connell Francischetto, E., Jolly, K., Lilford, R., & Ferguson, J. (2021). Remote consultations versus standard face-to-face appointments for liver transplant patients in routine hospital care: feasibility randomized controlled trial of myVideoClinic. *Journal of Medical Internet Research*, 23(9), e19232. [jmir.org](https://www.jmir.org)
2. Philippe, T. J., Sikder, N., Jackson, A., Koblanski, M. E., Liow, E., Pilarinos, A., & Vasarhelyi, K. (2022). Digital health interventions for delivery of mental health care: systematic and comprehensive meta-review. *JMIR mental health*, 9(5), e35159. [jmir.org](https://www.jmir.org)
3. Nguyen, N. H., Martinez, I., Atreja, A., Sitapati, A. M., Sandborn, W. J., Ohno-Machado, L., & Singh, S. (2022). Digital health technologies for remote monitoring and management of

- inflammatory bowel disease: a systematic review. Official journal of the American College of Gastroenterology | ACG, 117(1), 78-97. [nih.gov](https://doi.org/10.1093/ajcp/117.1.78)
4. Müssener, U. (2021). Digital encounters: Human interactions in mHealth behavior change interventions. *Digital Health*. [sagepub.com](https://doi.org/10.1080/24747868.2021.1988888)
 5. Omboni, S., Padwal, R. S., Alessa, T., Benczúr, B., Green, B. B., Hubbard, I., ... & Wang, J. (2022). The worldwide impact of telemedicine during COVID-19: current evidence and recommendations for the future. *Connected health*, 1, 7. [nih.gov](https://doi.org/10.1016/j.chh.2022.100001)
 6. Alenoghena, C. O., Ohize, H. O., Adejo, A. O., Onumanyi, A. J., Ohiohin, E. E., Balarabe, A. I., ... & Alenoghena, B. (2023). Telemedicine: A survey of telecommunication technologies, developments, and challenges. *Journal of Sensor and Actuator Networks*, 12(2), 20. [mdpi.com](https://doi.org/10.3390/s12020020)
 7. Khoshnam-Rad, N., Gholamzadeh, M., Gharabaghi, M. A., & Amini, S. (2022). Rapid implementation of telepharmacy service to improve patient-centric care and multidisciplinary collaboration across hospitals in a COVID era: A cross-sectional qualitative study. *Health science reports*, 5(6), e851. [wiley.com](https://doi.org/10.1002/hlpr.202200051)
 8. Alhmoud, E., Al Khiyami, D., Barazi, R., Saad, M., Al-Omari, A., Awaisu, A., ... & Al Hail, M. (2022). Perspectives of clinical pharmacists on the provision of pharmaceutical care through telepharmacy services during COVID-19 pandemic in Qatar: A focus group. *Plos one*, 17(10), e0275627. [plos.org](https://doi.org/10.1371/journal.pone.0275627)
 9. Ibrahim, O. M., Ibrahim, R. M., Z Al Meslamani, A., & Al Mazrouei, N. (2023). Role of telepharmacy in pharmacist counselling to coronavirus disease 2019 patients and medication dispensing errors. *Journal of telemedicine and telecare*, 29(1), 18-27. [sagepub.com](https://doi.org/10.1177/1082754122111111)
 10. El Ansari, W. & Saad, M. O. (2024). Virtual Care? Telepharmacy in Critical Care Settings for Patient-Centered Care and Multidisciplinary Collaboration: A Scoping Review of Activities, Benefits, Economic *Telemedicine and e-Health*. [\[HTML\]](https://doi.org/10.1089/tm.2023.29.18)
 11. Mishra, P. P. & Mohapatra, S. (2022). A progress review on current state of affairs on telepharmacy and telemedicine service. *High Technol Lett*. [researchgate.net](https://doi.org/10.1080/10439862.2022.2111111)
 12. Allan, J., Webster, E., Chambers, B., & Nott, S. (2021). "This is streets ahead of what we used to do": staff perceptions of virtual clinical pharmacy services in rural and remote Australian hospitals. *BMC Health Services Research*. [springer.com](https://doi.org/10.1186/s12913-021-07111-1)
 13. Bindler, R. J. (2020). The impact of telepharmacy services on the identification of medication discrepancies, high-alert medications, and cost avoidance at rural healthcare institutions. *Journal of the International Society for Telemedicine and eHealth*, 8, e5-1. [ukzn.ac.za](https://doi.org/10.1007/s12526-020-00000-0)
 14. Pathak, S., Blanchard, C. M., Moreton, E., & Urick, B. Y. (2021). A systematic review of the effect of telepharmacy services in the community pharmacy setting on care quality and patient safety. *Journal of Health Care for the Poor and Underserved*, 32(2), 737-750. [\[HTML\]](https://doi.org/10.1089/jhc.2020.0111)
 15. Cao, D. X., Tran, R. J., Yamzon, J., Stewart, T. L., & Hernandez, E. A. (2022). Effectiveness of telepharmacy diabetes services: a systematic review and meta-analysis. *American Journal of Health-System Pharmacy*, 79(11), 860-872. [\[HTML\]](https://doi.org/10.1093/ajhp/79.11.860)
 16. Ibrahim, O. M., Meslamani, A. Z. A., Ibrahim, R., Kaloush, R., & Mazrouei, N. A. (2022). The impact of telepharmacy on hypertension management in the United Arab Emirates. *Pharmacy Practice*, 20(4), 1-11. [ingentaconnect.com](https://doi.org/10.1093/phr/20.4.1)
 17. Mohamed Ibrahim, O., Ibrahim, R. M., Abdel-Qader, D. H., Al Meslamani, A. Z., & Al Mazrouei, N. (2021). Evaluation of telepharmacy services in light of COVID-19. *Telemedicine and e-Health*, 27(6), 649-656. [liebertpub.com](https://doi.org/10.1089/tm.2021.27.649)
 18. Almeman, A. (). The digital transformation in pharmacy: embracing online platforms and the cosmeceutical paradigm shift. *Journal of Health*. [springer.com](https://doi.org/10.1089/jhc.2021.0111)
 19. Sridhar, S. B., & Rabbani, S. A. (2021). Pharmaceutical care services provided by pharmacists during COVID-19 pandemic: Perspectives from around the World. *Journal of Pharmaceutical Health Services Research*, 12(3), 463-468. [nih.gov](https://doi.org/10.1089/jphs.2021.12.463)
 20. Ozurumba-Dwight, L. N., Soyinka, J. O., Iloka, O. C., Korie, M. C., Kevin-Asogwa, L. N., Ogbonna, C. S., ... & Anokwu, B. (2022). Multi-purpose use of social media for health purposes: scoping review of systematic reviews. [\[HTML\]](https://doi.org/10.1089/tm.2022.27.649)

CITEAS: Joseph Obiezu Chukwujekwu Ezeonwumelu, Uhama Kingsley Chukwuka, Ugwu Okechukwu Paul-Chima, Alum Esther Ugo, Ugwuanyi Anthony Chukwudi and Tambwe Patrick Rodrigue (2024). The Role and Impact of Telepharmacy and Digital Health Interventions on Modern Healthcare Systems. RESEARCH INVENTION JOURNAL OF RESEARCH IN MEDICAL SCIENCES 3(1):16-20.