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Exploring the impact of telepharmacy and digital health at a rural tertiary care teaching hospital: A comprehensive questionnaire based cross-sectional study

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Abstract

Introduction: Telemedicine and telepharmacy bring valuable improvements in healthcare accessibility, convenience, and cost-efficiency. Overcoming technology access, regulatory, and data security hurdles is crucial for maximizing their impact. Integrating these solutions into healthcare systems holds promise for future care delivery enhancement.

Objectives: Assess the impact of telepharmacy on medication adherence and patient outcomes. Evaluate healthcare professional and patient perceptions of telepharmacy services. Identify challenges and opportunities in implementing digital health solutions in pharmacology.

Materials and Methods: A cross-sectional, questionnaire-based study at a Rural Tertiary Care Teaching Hospital involved 200 participants (65 patients and 135 healthcare professionals). The questionnaire covered demographics, the impact of telepharmacy on medication adherence and patient outcomes, perceptions of telepharmacy services, and challenges and opportunities in digital health solutions.

Results: The study included a diverse demographic, mostly 31-45 years old (31%) and 46-60 years old (27%), with 73% male and 27% female participants. Healthcare professionals, mainly physicians (63%), comprised 68% of participants. Both patients (54%) and professionals (51%) reported improved medication adherence and health outcomes with telepharmacy. Satisfaction levels were high (62% patients, 29% professionals), citing convenience and improved access. Challenges included digital literacy (36%) and technical issues (26%), while opportunities included better medication management (38%) and patient engagement (13%). Support needed includes training (34%) and improved digital infrastructure (25%).

Conclusion: Telepharmacy and digital health solutions promise to enhance medication management and patient care. This study highlights the importance of addressing challenges and seizing opportunities to optimize healthcare delivery through telepharmacy. Further research and policy development are essential for maximizing the potential of these technologies in pharmacology.

Keywords: Telepharmacy, healthcare, medication adherence, digital health

Introduction

Telemedicine is the modern way of providing health care services to patients and the general community *via* different telecommunication tools like telephones, smartphones, tablets, wireless devices, and laptops. Telemedicine services include telehealth and remote patient monitoring. Remote patient monitoring *via* web applications has been studied to improve patient-reported quality of life, and medication adherence, and decrease healthcare costs. Telepharmacy falls under the umbrella of telemedicine and is the provision of pharmaceutical care to patients using technologies and telecommunications. Telepharmacy allows the pharmacist to provide patient care services in a remote area by taking a history, reviewing patients' files, and assessing medications utilized by the patients. This practice also helps the technician to dispense patient prescriptions accurately under the remote supervision of the pharmacist. It provides opportunities for improving health outcomes for patients and the quality of healthcare systems in general. The use of telepharmacy includes patient counselling, mail order of medicines, drug management, medication therapy management, supervision of technician dispensing, central processing, and automated dispensing systems, with pharmacist tele-counselling^[1].

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Telepharmacy is a practical part of telemedicine that refers to providing pharmaceutical services within the scope of the pharmacist's obligations while maintaining a temporal and spatial distance between patients, users of health services, and healthcare professionals. Growing evidence suggests that telepharmacy and the implementation of such technology may reduce shortages and inequalities in the provision and delivery of healthcare services for patients living in rural communities or in areas where access to healthcare or pharmaceutical services is difficult. In the community setting, telepharmacy can help improve access to pharmacy services in remote or underserved areas. It can also provide more convenient access to pharmacy services for patients who may have difficulty traveling to a physical pharmacy location. The social distance between patients and healthcare providers has been enabled in many countries through the facilitation of remote pharmaceutical care services such as Internet services, virtual medical consultations, e-prescriptions, and home drug delivery. With its origins in addressing healthcare access issues in rural regions, telepharmacy reaches its maximum use during global health crises. Telepharmacy was quickly recognized as a tool capable of overcoming many of the pandemic's challenges. The introduction of COVID-19 has accelerated the changes that would make telepharmacy a viable option. As healthcare providers and patients recognize the benefits of telepharmacy, there is a chance that it will continue even after the pandemic is over ^[2].

Telepharmacy and digital health technologies are transforming the healthcare landscape, offering new ways to manage medication adherence and patient outcomes. This article presents the design and findings of a questionnaire-based study aimed at understanding the impact of telepharmacy, perceptions of its services among patients and healthcare professionals, and the challenges and opportunities in implementing digital health solutions.

Objectives

The primary objectives of this study are

- To assess the impact of telepharmacy on medication adherence and patient outcomes.
- To evaluate healthcare professional and patient perceptions of telepharmacy services.
- To identify challenges and opportunities in implementing digital health solutions in pharmacology.

Materials and Methods

A cross-sectional, questionnaire-based study was carried out at a Rural Tertiary Care Teaching Hospital, using Google Forms, the questionnaire was shared through various social media channels (Such as WhatsApp, E-mails, etc.). in which 200 study participants were recruited, utilizing a structured questionnaire targeting two main groups: patients (65 participants) and healthcare professionals (135 participants). The questionnaire contained a total of 22 questions including sections on demographic information which contains five questions, the impact of telepharmacy on medication adherence and patient outcomes contains seven questions, perceptions of telepharmacy services contains five questions, and challenges and opportunities in implementing digital health solutions contains five questions. The Excel sheet obtained from Google Forms was downloaded and then exported to the Statistical

Package for Social Science (SPSS) version 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were presented as frequency and percentage of qualitative variables.

Questionnaire Design

Section 1: Demographic Information

We collected data on age, gender, role (patient or healthcare professional), profession, and years of experience.

Section 2: Impact of Telepharmacy on Medication Adherence and Patient Outcomes

Questions assessed the frequency of telepharmacy use, its effects on medication adherence, and overall health outcomes.

Section 3: Perceptions of Telepharmacy Services

Evaluated satisfaction levels, perceived benefits and drawbacks, comfort in discussing health concerns, and effectiveness in managing patient care.

Section 4: Challenges and Opportunities in Implementing Digital Health Solutions

Identified encountered challenges, perceived opportunities, and necessary support or resources for enhancing telepharmacy effectiveness.

Results

Demographic Overview

The study included diverse participants from various age groups (the majority were 31-45 years (31%) followed by 46-60 years (27%), 18-30 years (21%), over 60 years (11%), and under 18 years (10%) respectively, genders (male (73%) and female (27%)), and role of participants (32% patients) and (68% healthcare professional), professional backgrounds (63% physician, 16% pharmacists, 14% nurse, and 7% were others), and years of experience (48% in 1-5 years of experience followed by 36% in less than 1 year, 12% in 6-10 years, and 4% in more than 10 years of experience) providing a comprehensive understanding of the telepharmacy landscape (Table 1).

Impact on Medication Adherence and Patient Outcomes

Patients: Many reported improved medication adherence (54%) and (37%) and health outcomes (57%) and (38%) due to the convenience and accessibility of telepharmacy. **Healthcare Professionals:** Most observed significant improvements in their patients' medication adherence (51%) and (32%) and overall health outcomes (52%) and (35%) (Table 2 and Figure 1).

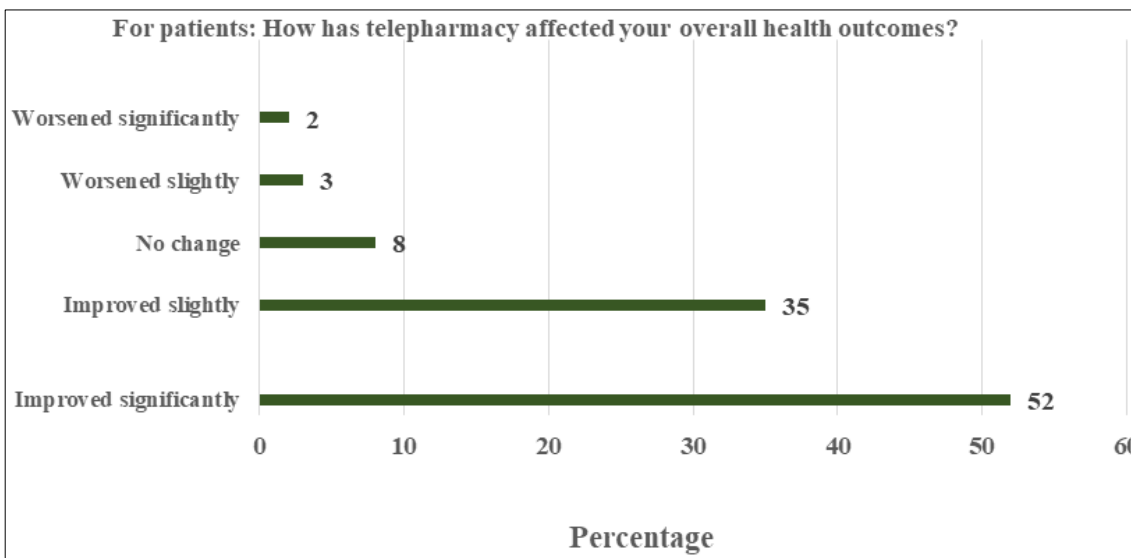
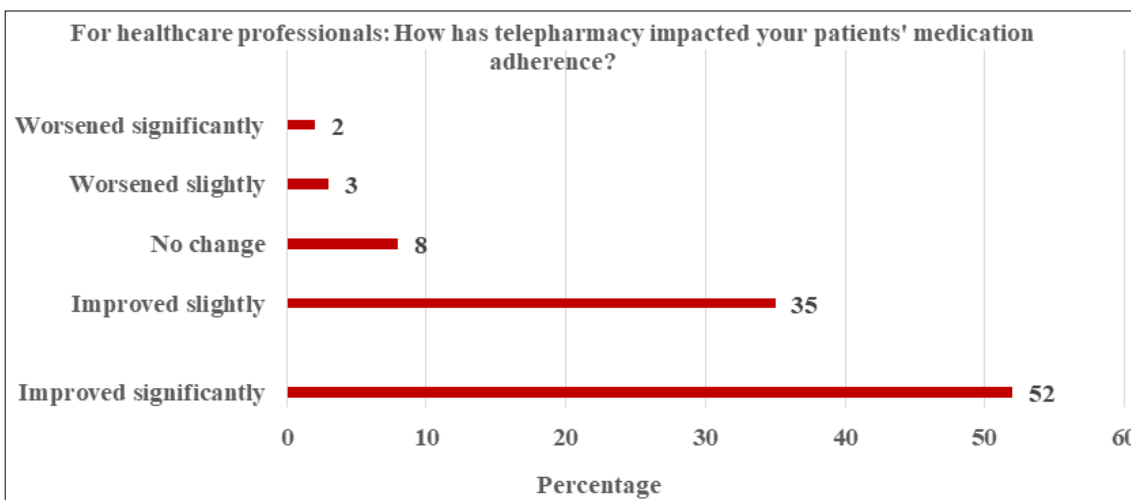
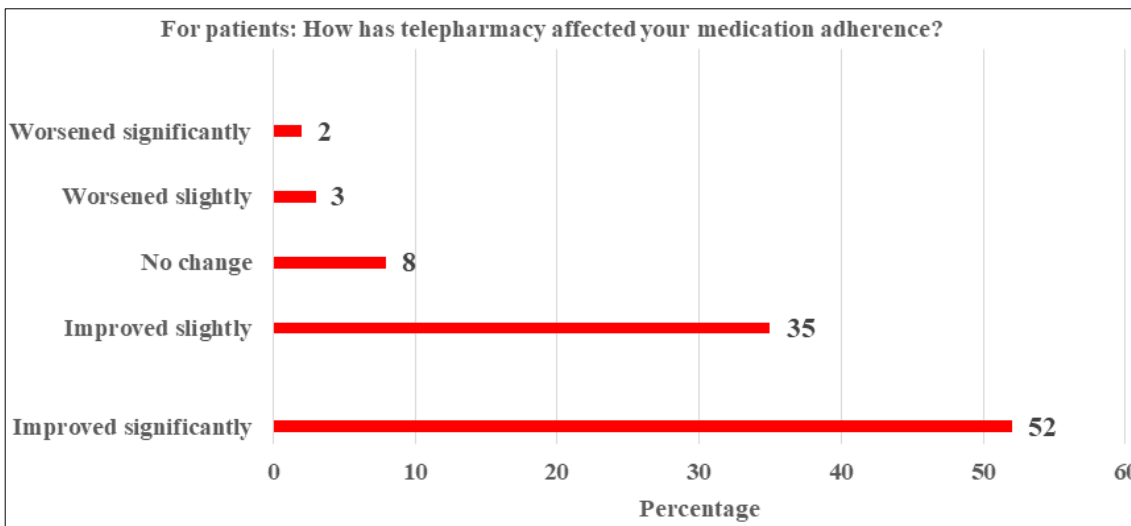
Perceptions of Telepharmacy Services

High satisfaction levels were reported by both patients and healthcare professionals (62% and 29%). Key benefits include convenience (49%), Improved medication adherence (22%), improved access to pharmacists (17%), and cost savings (8%). The main drawbacks mentioned were limited service availability (44%), technical issues (24%), difficulty in using digital platforms (18%), lack of personal interaction (10%), and privacy concerns (4%). Most patients felt comfortable discussing health concerns via telepharmacy (51%) and (33%), while healthcare professionals found it effective for managing patient care (55%) and (23%) (Table 3).

Challenges and Opportunities in Implementing Digital Health Solutions

The main challenges encountered were a lack of digital literacy (36%), followed by technical difficulties (26%), privacy/security concerns (16%), resistance to change (14%) and regulatory barriers (8%) respectively. Opportunities perceived were improved medication management (38%) followed by expanded access to care (24%), better chronic

disease management (18%), Enhanced patient engagement (13%), and cost reduction (7%) respectively. Necessary support or resources for enhancing telepharmacy effectiveness were training for healthcare professionals (34%), patient education on telepharmacy (26%), improved digital infrastructure (25%), financial incentives ((10%), and clearer regulatory guidelines (5%) (Table 4).



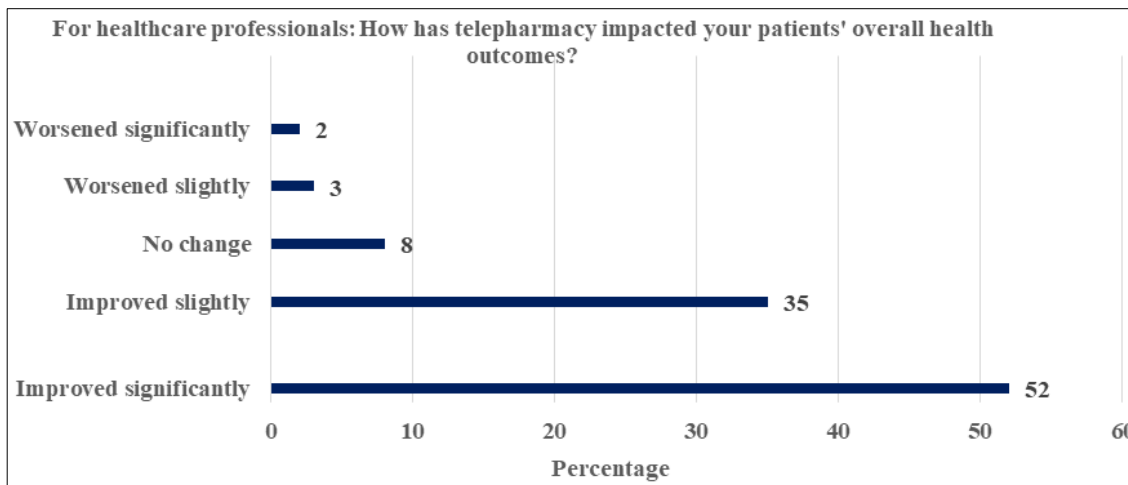


Fig 1: Impact of Telepharmacy on Medication Adherence and Patient Outcomes among study participants.

Table 1: Demographic characteristics of the study participants.

Section 1: Demographic Information		
What is your age?	Frequency	Percentage
Under 18	20	10
18-30	40	21
31-45	63	31
46-60	55	27
Over 60	22	11
What is your gender?		
Male	145	73
Female	55	27
Transgender	0	0
What is your role?		
Patient	65	32
Healthcare Professional	135	68
If you are a healthcare professional, please specify your profession:		
Physician	85	63
Pharmacist	22	16
Nurse	19	14
Other	9	7
How many years of experience do you have in your current role?		
Less than 1 year	49	36
1-5 years	65	48
6-10 years	16	12
More than 10 years	5	4

Table 2: Impact of Telepharmacy on Medication Adherence and Patient Outcomes among study participants.

Section 2: Impact of Telepharmacy on Medication Adherence and Patient Outcomes		
As a patient, have you ever used telepharmacy services?	Frequency	Percentage
Yes	55	85
No	10	15
As a healthcare professional, have you ever provided telepharmacy services?		
Yes	103	76
No	32	24
How often do you use telepharmacy services?		
Daily	12	9
Weekly	57	42
Monthly	35	26
Rarely	21	16
Never	10	7
For patients: How has telepharmacy affected your medication adherence?		
Improved significantly	35	54
Improved slightly	24	37
No change	5	8
Worsened slightly	1	1
Worsened significantly	0	0
For healthcare professionals: How has telepharmacy impacted your patients' medication adherence?		
Improved significantly	68	51

Improved slightly	43	32
No change	12	9
Worsened slightly	10	7
Worsened significantly	2	1
For patients: How has telepharmacy affected your overall health outcomes?		
Improved significantly	37	57
Improved slightly	25	38
No change	2	3
Worsened slightly	1	2
Worsened significantly	0	0
For healthcare professionals: How has telepharmacy impacted your patients' overall health outcomes?		
Improved significantly	70	52
Improved slightly	47	35
No change	11	8
Worsened slightly	4	3
Worsened significantly	3	2

Table 3: Perceptions of Telepharmacy Services among study participants.

Section 3: Perceptions of Telepharmacy Services		
How satisfied are you with telepharmacy services?	Frequency	Percentage
Very satisfied	123	62
Satisfied	57	29
Neutral	12	6
Dissatisfied	5	2
Very dissatisfied	3	1
What are the main benefits of telepharmacy services?		
Convenience	98	49
Improved medication adherence	43	22
Better access to pharmacists	36	17
Cost savings	15	8
Enhanced privacy	8	4
What are the main drawbacks of telepharmacy services?		
Technical issues	47	24
Lack of personal interaction	20	10
Privacy concerns	9	4
Limited-service availability	88	44
Difficulty in using digital platforms	36	18
For patients: How comfortable are you discussing your health concerns via telepharmacy?		
Very comfortable	33	51
Comfortable	22	33
Neutral	5	8
Uncomfortable	3	5
Very uncomfortable	2	3
For healthcare professionals: How effective do you find telepharmacy in managing patient care?		
Very effective	74	55
Effective	31	23
Neutral	15	11
Ineffective	8	6
Very ineffective	7	5

Table 4: Challenges and Opportunities in Implementing Digital Health Solutions among study participants.

Section 4: Challenges and Opportunities in Implementing Digital Health Solutions		
What challenges have you encountered with telepharmacy?	Frequency	Percentage
Technical difficulties	52	26
Lack of digital literacy	72	36
Privacy/security concerns	33	16
Regulatory barriers	15	8
Resistance to change	28	14
What opportunities do you see in the use of telepharmacy?		
Expanded access to care	47	24
Improved medication management	77	38
Enhanced patient engagement	26	13
Cost reduction	13	7
Better chronic disease management	37	18
What support or resources would enhance the effectiveness of telepharmacy?		
Training for healthcare professionals	69	34
Patient education on telepharmacy	51	26

Improved digital infrastructure	49	25
Clearer regulatory guidelines	11	5
Financial incentives	20	10
For healthcare professionals: How likely are you to recommend telepharmacy services to your patients?		
Very Likely	59	44
Likely	47	35
Neutral	15	11
Unlikely	9	6
Very unlikely	5	4
For patients: How likely are you to continue using telepharmacy services in the future?		
Very Likely	37	57
Likely	22	34
Neutral	3	4
Unlikely	2	3
Very unlikely	1	2

Discussion

The study covered a diverse demographic, mainly aged 31-45 years (31%) and 46-60 years (27%), with 73% male and 27% female participants, similar results have been reported in various contexts, indicating the patients' desire to use telepharmacy services [3, 4]. Healthcare professionals predominated (68%), with physicians (63%) being the most represented, followed by pharmacists (16%), nurses (14%), and others (7%). Experience varied, with 48% having 1-5 years, 36% less than 1 year, 12% 6-10 years, and 4% over 10 years. Both patients and professionals reported improved medication adherence (54% of patients, 51% of professionals) and health outcomes (57% of patients, 52% of professionals) with telepharmacy. Satisfaction levels were high among patients (62%) and professionals (29%), citing convenience, improved adherence, and access to pharmacists. Challenges included digital literacy (36%), technical issues (26%), and privacy concerns (16%), while opportunities included better medication management (38%) and patient engagement (13%). Necessary support included training (34%) and improved digital infrastructure (25%). Telepharmacy networks have enhanced pharmaceutical access to hospitals in rural areas that do not offer 24-hour pharmaceutical services [5]. Telepharmacy on the other hand saves travel time and expense, which are major barriers for rural elderly and disabled veterans [6]. The main barrier to telepharmacy use was cited as a lack of policies and regulations on the implementation, application, and support of telepharmacy practice [7]. The study highlights the transformative potential of telepharmacy in improving medication adherence and patient outcomes. However, the successful implementation of telepharmacy and digital health solutions requires addressing technical, educational, and regulatory challenges.

Strength of telemedicine and telepharmacy

Telemedicine and telepharmacy improve access to healthcare for patients in remote or underserved areas by providing medical and pharmaceutical services from home, reducing the need for travel and waiting times. These services lower healthcare costs by minimizing hospital visits and travel expenses and optimizing resource use. Remote patient monitoring helps prevent hospital readmissions, manage chronic conditions, and improve medication adherence and patient outcomes. The COVID-19 pandemic emphasized their importance, enabling continuous healthcare services and reducing virus transmission risks. Telepharmacy allows pharmacists to remotely supervise

multiple locations, ensuring the broader availability of pharmaceutical care.

Limitations of telemedicine and telepharmacy

Not all patients have access to the necessary technology for telemedicine and telepharmacy, creating a digital divide that can worsen health disparities. Regulatory variations across regions complicate the provision of these services. There are also concerns about data privacy and security. Telemedicine cannot fully replace in-person visits, especially when physical exams or diagnostic tests are needed, limiting the scope of remote care. Some patients and providers prefer traditional interactions or are unfamiliar with the technology. Implementing telemedicine and telepharmacy requires substantial investment in technology infrastructure, training, and maintenance, posing a barrier for some healthcare systems.

Recommendations

Training and Education: Providing comprehensive training for healthcare professionals and educational resources for patients to enhance digital literacy.

Infrastructure: Invest in robust digital infrastructure to mitigate technical issues.

Policy and Regulation: Developing clear regulatory frameworks to address privacy and security concerns and support telepharmacy practices.

Financial Support: Implementing financial incentives to encourage the adoption of telepharmacy services.

Conclusion

The study's comprehensive demographic overview provided insights into the telepharmacy landscape, highlighting the diverse age groups, gender distribution, roles of participants, professional backgrounds, and years of experience. It revealed positive impacts on medication adherence and patient outcomes, with significant improvements reported by both patients and healthcare professionals. High satisfaction levels were noted, emphasizing the convenience, and benefits of telepharmacy. Despite the benefits, challenges such as digital literacy, technical difficulties, and privacy concerns were identified. However, opportunities for improved medication management, expanded access to care, and enhanced patient engagement were recognized. Addressing challenges through adequate training, patient education, and improved digital infrastructure is crucial for

maximizing the effectiveness of telepharmacy in healthcare delivery.

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Declarations

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