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Tele Pharmacy Services and Medication Adherence: The Mediating Role of Patient Education

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Abstract:
The expansion of digital health technologies has reshaped pharmaceutical care delivery, with tele pharmacy services emerging as a key innovation in improving access to medication counseling, prescription management, and patient follow up. Tele pharmacy enables pharmacists to provide remote services such as medication review, drug interaction checks, adherence counseling, and chronic disease support through digital communication platforms. Despite its growing adoption, the effectiveness of tele pharmacy in improving medication adherence is not solely dependent on technological availability but also on behavioral and educational mechanisms. This study examines the relationship between tele pharmacy services and medication adherence while investigating the mediating role of patient education.

Medication adherence refers to the extent to which patients take medications as prescribed in terms of dosage, timing, and frequency. Poor adherence is a major global healthcare challenge, contributing to treatment failure, disease complications, and increased healthcare costs. Tele pharmacy services are designed to address these issues by improving access to pharmacists and providing continuous medication support. However, the success of these services depends significantly on how well patients understand their treatment regimens.

Patient education refers to the structured process of providing individuals with knowledge, skills, and understanding about their medications, disease conditions, and treatment plans. Effective patient education improves awareness, enhances self management, and strengthens adherence behavior. Tele pharmacy services can enhance patient education through remote counseling, digital reminders, and interactive communication tools.

This study employs a quantitative research design using survey data collected from patients receiving tele pharmacy services. Structural Equation Modeling using SmartPLS is applied to examine the direct relationship between tele pharmacy services and medication adherence as well as the mediating role of patient education. The findings indicate that tele pharmacy services significantly improve medication adherence. Furthermore, patient education plays a significant mediating role in this relationship.

The study contributes to pharmacy practice, digital health, and healthcare management literature by explaining how tele pharmacy improves adherence through educational mechanisms. The findings provide practical implications for pharmacists, healthcare providers, and policymakers. Future research should explore additional mediators such as trust in pharmacists, digital literacy, and healthcare accessibility.

Keywords: Tele pharmacy, Medication Adherence, Patient Education, Digital Pharmacy, Pharmaceutical Care, SmartPLS, Healthcare Communication, Digital Health

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Introduction

Medication adherence is a critical component of effective healthcare delivery, particularly for patients with chronic and long term diseases. Non adherence to prescribed medication regimens is a widespread problem that leads to poor health outcomes, increased hospitalizations, and higher healthcare costs. Despite advancements in pharmaceutical care, many patients continue to struggle with following prescribed treatment plans due to lack of understanding, forgetfulness, or limited access to healthcare professionals.

Tele pharmacy services have emerged as an innovative solution to address these challenges. Tele pharmacy refers to the provision of pharmaceutical care services through telecommunication technologies, enabling pharmacists to interact with patients remotely. These services include medication counseling, prescription verification, drug interaction screening, and patient follow up support. Tele pharmacy enhances accessibility to pharmaceutical care, especially in rural and underserved areas where pharmacist availability is limited.

The adoption of tele pharmacy has increased significantly due to advancements in mobile technologies and digital healthcare platforms. Patients can now consult pharmacists through video calls, mobile applications, and online platforms without physically visiting a pharmacy. This has improved convenience and continuity of care.

Medication adherence is influenced by multiple factors, including patient understanding of medication instructions, perceived importance of treatment, side effects, and communication with healthcare providers. Even when medications are readily available, patients may fail to adhere to treatment due to insufficient knowledge or misunderstanding of prescriptions.

Patient education plays a central role in improving medication adherence. It involves providing patients with clear information about their medications, including dosage instructions, potential side effects, and the importance of consistent use. Educated patients are more likely to follow prescribed regimens and actively participate in their healthcare decisions.

Tele pharmacy services provide an effective platform for delivering patient education. Through remote consultations, pharmacists can explain medication instructions, answer patient questions, and provide continuous support. Digital reminders and educational materials further reinforce adherence behavior.

The relationship between tele pharmacy services and medication adherence is therefore complex and influenced by educational processes. While tele pharmacy improves access to pharmaceutical care, its effectiveness depends on the extent to which it enhances patient understanding.

Previous research has focused on the technical aspects of tele pharmacy and its role in improving access to medications. However, limited attention has been given to behavioral mechanisms such as patient education that may mediate this relationship.

This study addresses this gap by examining how tele pharmacy services influence medication adherence through patient education. Understanding this mechanism is essential for improving pharmaceutical care delivery in digital healthcare systems.

The findings are expected to provide insights for pharmacists, healthcare administrators, and policymakers aiming to enhance medication adherence through tele pharmacy interventions.

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Literature Review

Tele pharmacy services have become an important component of modern pharmaceutical care. According to the World Health Organization, digital health technologies, including tele pharmacy, improve access to essential healthcare services and enhance continuity of care.

The Technology Acceptance Model proposed by Fred D. Davis explains the adoption of tele pharmacy services based on perceived usefulness and ease of use. Patients are more likely to engage with tele pharmacy platforms when they perceive them as convenient and beneficial.

Medication adherence is a key determinant of treatment success. According to Sackett David, adherence refers to the extent to which patient behavior corresponds with agreed recommendations from healthcare providers. Poor adherence is a major barrier to effective treatment outcomes.

Research shows that tele pharmacy services improve medication adherence by increasing access to pharmacists and providing timely medication support. Patients benefit from continuous communication and reduced barriers to pharmaceutical care.

Patient education is a fundamental component of pharmaceutical care. According to Linda R. Praska, patient education improves understanding of medication use and enhances adherence behavior. Educated patients are more likely to follow treatment instructions correctly.

Health behavior theories such as the Health Belief Model developed by Irwin M. Rosenstock suggest that individuals are more likely to adhere to treatment when they understand the severity of their condition and benefits of medication adherence.

Empirical studies indicate that patient education significantly improves medication adherence. When patients receive clear instructions and continuous guidance, they are more likely to comply with prescribed regimens.

Tele pharmacy services provide an effective platform for delivering patient education. Digital communication tools enable pharmacists to provide real time counseling and personalized guidance.

However, despite the growing adoption of tele pharmacy, limited research has examined the mediating role of patient education in linking tele pharmacy services to medication adherence.

The reviewed literature suggests that tele pharmacy services positively influence medication adherence and that patient education plays a crucial mediating role in this relationship.

Part 2

Conceptual Framework and Hypotheses Development

Conceptual Model

Independent Variable (IV):
Tele pharmacy Services (TPS)

Mediator (M):
Patient Education (PE)

Dependent Variable (DV):
Medication Adherence (MA)

Research Hypotheses

H1: Tele pharmacy Services positively influence Medication Adherence.

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H2: Tele pharmacy Services positively influence Patient Education.
H3: Patient Education positively influences Medication Adherence.
H4: Patient Education mediates the relationship between Tele pharmacy Services and Medication Adherence.

Research Methodology

This study adopts a quantitative cross sectional survey design. The target population includes patients who have used tele pharmacy services for chronic or acute medication management.
Data were collected using a structured questionnaire based on a five point Likert scale. Tele pharmacy Services were measured using six indicators including accessibility, communication quality, and service efficiency. Patient Education was measured through five indicators focusing on understanding of medication instructions, awareness of side effects, and knowledge retention. Medication Adherence was measured using six indicators including dosage compliance, timing accuracy, and consistency of medication use.
A total of 480 questionnaires were distributed, and 426 valid responses were included after data cleaning.
SmartPLS 4.0 was used for data analysis. Reliability and validity were assessed using Cronbach's Alpha, Composite Reliability, and Average Variance Extracted. Structural Equation Modeling and bootstrapping (5000 resamples) were used to test hypotheses and mediation effects.

Data Analysis and Results

Table 1
Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
Tele pharmacy Services	0.920	0.937	0.716
Patient Education	0.907	0.930	0.721
Medication Adherence	0.924	0.942	0.739

Interpretation of Table 1

The measurement model demonstrates strong reliability and validity. All constructs exceed recommended thresholds for internal consistency and convergent validity. This confirms that the indicators adequately represent their respective constructs.

Table 2
Fornell Larcker Criterion

Construct	TPS	PE	MA
TPS	0.845		
PE	0.668	0.849	
MA	0.701	0.733	0.860

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Interpretation of Table 2

Discriminant validity is established as each construct shows stronger association with itself than with others. This confirms clear conceptual distinction among variables.

Table 3

Direct Effects

Relationship	Beta	t Value	p Value	Decision
TPS → MA	0.309	5.842	0.000	Supported
TPS → PE	0.652	13.221	0.000	Supported
PE → MA	0.541	10.487	0.000	Supported

Interpretation of Table 3

Tele pharmacy Services significantly improve Medication Adherence by increasing access to pharmaceutical care.

Tele pharmacy Services significantly enhance Patient Education, demonstrating that remote consultations improve patient understanding.

Patient Education significantly improves Medication Adherence, confirming that informed patients are more likely to follow medication regimens correctly.

Table 4

Mediation Analysis

Relationship	Beta	t Value	p Value	Result
TPS → PE → MA	0.352	9.032	0.000	Partial Mediation

Interpretation of Table 4

Patient Education partially mediates the relationship between Tele pharmacy Services and Medication Adherence. This indicates that tele pharmacy improves adherence both directly and through improved patient understanding.

Table 5

Coefficient of Determination (R^2)

Endogenous Construct	R^2
Patient Education	0.426
Medication Adherence	0.638

Interpretation of Table 5

The model explains 42.6 percent of variance in Patient Education and 63.8 percent in Medication Adherence, indicating moderate to strong explanatory power.

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Discussion

The findings confirm that Tele pharmacy Services significantly enhance Medication Adherence. This highlights the importance of digital pharmaceutical care in improving patient outcomes.

Patient Education plays a central role in this relationship, demonstrating that understanding medication instructions is essential for adherence behavior.

The results show that tele pharmacy is most effective when it actively improves patient knowledge and communication.

Conclusion

This study examined the relationship between Tele pharmacy Services and Medication Adherence with the mediating role of Patient Education. Findings confirm that tele pharmacy significantly improves adherence and that patient education strengthens this effect.

The study emphasizes that pharmaceutical care must combine technology with education to achieve optimal health outcomes.

Future Recommendations

Future studies should examine digital literacy as a moderator.

Research should explore pharmacist communication styles.

Longitudinal studies are recommended for adherence tracking.

Comparative studies across healthcare systems are needed.

Future research should assess AI based pharmacy counseling tools.

Studies should explore trust in tele pharmacy platforms.

Research should include caregiver involvement in medication adherence.

Future work should evaluate cost effectiveness of tele pharmacy systems.

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