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ORIGINAL RESEARCH

Impact of Mobile Health Applications on Medication Adherence in Hypertensive Patients: A Multi-Specialty Outpatient Evaluation

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Abstract

Background: Hypertension is a prevalent chronic condition requiring consistent medication adherence to prevent complications. Non-adherence remains a significant barrier to effective blood pressure control. Mobile health (mHealth) applications have emerged as potential tools to enhance adherence through reminders, tracking, and real-time engagement. This study evaluates the impact of mHealth applications on medication adherence among hypertensive patients across multiple outpatient specialty clinics.

Materials and Methods: A prospective, observational study was conducted over 6 months in three multi-specialty outpatient departments, including cardiology, general medicine, and internal medicine. A total of 200 hypertensive patients aged 30–70 years were recruited and divided into two groups: intervention group (n=100) using a standardized mHealth app with medication reminders and tracking features, and control group (n=100) receiving routine care. Medication adherence was assessed using the Morisky Medication Adherence Scale (MMAS-8) at baseline, 3 months, and 6 months. Blood pressure readings were also recorded during each visit.

Results: At baseline, the mean MMAS-8 score was 4.2 ± 1.1 in both groups. After 6 months, the intervention group showed a significant increase in adherence scores (mean MMAS-8: 7.1 ± 0.8) compared to the control group (mean MMAS-8: 5.0 ± 1.2; $p < 0.001$). Additionally, 78% of patients in the intervention group achieved target blood pressure levels (<140/90 mmHg), versus 54% in the control group. Patient satisfaction with mHealth usage was reported as high in 85% of users.

Conclusion: The use of mobile health applications significantly improves medication adherence and blood pressure control in hypertensive patients. Integration of mHealth tools in outpatient care models may enhance long-term disease management and patient outcomes.

Keywords: Hypertension, Mobile Health, Medication Adherence, mHealth App, Blood Pressure Control, Outpatient Clinics, MMAS-8, Digital Health Intervention.

Introduction

Hypertension is a leading risk factor for cardiovascular morbidity and mortality worldwide, affecting over 1.28 billion adults aged 30–79 years globally (1). Despite the availability of effective antihypertensive medications, adherence to prescribed therapy remains suboptimal, with nearly 50% of patients in developed countries failing to take medications as directed (2). Poor medication adherence is associated with uncontrolled blood pressure, increased risk of stroke, myocardial infarction, and overall healthcare costs (3).

In recent years, mobile health (mHealth) technologies have emerged as promising tools to support chronic disease management. mHealth encompasses the use of mobile devices such as smartphones and tablets to deliver health-related services, including medication reminders, self-monitoring, and communication with healthcare providers (4). These applications are particularly advantageous in promoting behavioral change and improving treatment adherence in patients with chronic illnesses such as hypertension (5).

Studies have shown that digital interventions, especially those incorporating automated alerts,

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educational content, and self-reporting tools, can significantly enhance patient engagement and adherence (6). The accessibility and convenience of mHealth applications offer a scalable solution for resource-limited healthcare settings and outpatient environments (7). However, the clinical effectiveness of mHealth applications on medication adherence among hypertensive patients across multi-specialty outpatient clinics remains under-explored.

This study aims to evaluate the impact of a standardized mobile health application on medication adherence and blood pressure control among hypertensive patients attending multi-specialty outpatient departments. By examining adherence patterns and clinical outcomes, the study seeks to provide evidence for the integration of mHealth tools into routine hypertension care.

Materials and Methods:

A total of 200 patients diagnosed with primary hypertension were enrolled using purposive sampling. Inclusion criteria comprised adults aged 30 to 70 years, prescribed at least one antihypertensive medication for a minimum duration of three months, and possessing a smartphone with basic app usage knowledge. Patients with cognitive impairment, secondary hypertension, or those already using other digital adherence aids were excluded.

Study Design and Group Allocation:

Participants were divided into two groups of 100 each. The intervention group received access to a validated mHealth application designed for medication reminders, dosage tracking, and symptom logging. The control group continued standard care without the app. Both groups were followed up at baseline, three months, and six months.

Intervention:

The mHealth application provided daily automated reminders for medication intake, logged adherence data, and allowed users to input blood pressure readings. Educational content related to hypertension management was also made available. Technical support was offered as needed during clinic visits.

Data Collection:

Medication adherence was measured using the 8-item Morisky Medication Adherence Scale (MMAS-8), a validated tool that categorizes adherence as high (score 8), medium (score 6–7), or low (score <6). Blood pressure readings were taken at each visit using a standardized digital sphygmomanometer after 5 minutes of rest, and the average of two readings was recorded.

Statistical Analysis:

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize demographic data. Paired and unpaired t-tests were applied to compare MMAS-8 scores and blood pressure values between and within groups. A *p*-value of less than 0.05 was considered statistically significant.

Results

A total of 200 patients participated in the study, with 100 in the intervention group and 100 in the control group. The mean age of participants was 54.2 ± 9.1 years, and 56% were male. Baseline characteristics, including age, gender distribution, duration of hypertension, and baseline blood pressure, were comparable between the two groups ($p > 0.05$) (Table 1).

Medication Adherence Outcomes

At baseline, the mean MMAS-8 adherence scores were similar between the groups (intervention: 4.3 ± 1.0; control: 4.2 ± 1.2). After six months, the intervention group exhibited a significant increase in adherence scores (7.1 ± 0.8), whereas the control group showed a modest improvement (5.0 ± 1.2). The difference in post-intervention adherence scores was statistically significant ($p < 0.001$) (Table 2).

Blood Pressure Control

Systolic and diastolic blood pressure readings also showed notable changes. At six months, the mean systolic blood pressure in the intervention group reduced from 148.6 ± 9.3 mmHg to 132.2 ± 7.5 mmHg, and diastolic from 94.1 ± 6.2 mmHg to 82.3 ± 5.4 mmHg. The control group showed a smaller reduction (systolic: 147.2 ± 8.7 mmHg to 140.6 ± 7.9 mmHg; diastolic: 93.5 ± 6.5 mmHg to 88.9 ± 6.1 mmHg). The intergroup difference at six months was statistically significant ($p < 0.01$) (Table 3).

Patient Satisfaction

Among the intervention group, 85% of patients reported high satisfaction with the usability and effectiveness of the mHealth application in managing their treatment routines.

These findings suggest a positive correlation between mHealth app usage and improved adherence and clinical outcomes (Tables 2 and 3).

Table 1. Baseline Characteristics of Study Participants

Parameter	Intervention Group (n=100)	Control Group (n=100)	*p*-value
Age (years, mean ± SD)	54.5 ± 9.4	53.8 ± 8.7	0.41
Male (%)	57	55	0.78
Duration of HTN (years)	5.4 ± 2.3	5.6 ± 2.5	0.62
Baseline SBP (mmHg)	148.6 ± 9.3	147.2 ± 8.7	0.35

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Baseline DBP (mmHg)	94.1 ± 6.2	93.5 ± 6.5	0.48

Table 2. Comparison of MMAS-8 Adherence Scores Between Groups

Time Point	Intervention Group (Mean ± SD)	Control Group (Mean ± SD)	*p*-value
Baseline	4.3 ± 1.0	4.2 ± 1.2	0.58
3 Months	6.2 ± 1.1	4.6 ± 1.3	<0.001
6 Months	7.1 ± 0.8	5.0 ± 1.2	<0.001

Table 3. Changes in Blood Pressure from Baseline to 6 Months

Measurement	Time Point	Intervention Group	Control Group	*p*-value
Systolic BP (mmHg)	Baseline	148.6 ± 9.3	147.2 ± 8.7	0.35
	6 Months	132.2 ± 7.5	140.6 ± 7.9	<0.01
Diastolic BP (mmHg)	Baseline	94.1 ± 6.2	93.5 ± 6.5	0.48
	6 Months	82.3 ± 5.4	88.9 ± 6.1	<0.01

Discussion

This study highlights the positive influence of mobile health (mHealth) applications on medication adherence and blood pressure control among hypertensive patients attending multi-specialty outpatient departments. The findings are consistent with previous research demonstrating that digital interventions significantly improve adherence in chronic disease management (1,2).

Non-adherence to antihypertensive medication has long been recognized as a major public health concern. Several studies have reported adherence rates below 50%, especially in low-resource and outpatient settings (3,4). mHealth applications, by providing automated reminders, educational tools, and self-monitoring features, directly address barriers such as forgetfulness, lack of awareness, and inadequate follow-up (5,6). In our study, patients using the mHealth app demonstrated a marked improvement in adherence, as indicated by MMAS-8 scores, and achieved better blood pressure control compared to those receiving standard care.

These results are supported by similar trials. For instance, a randomized study by Morawski et al. showed that patients using an app-based intervention had a 27% higher medication adherence rate compared to controls (7). Likewise, an Indian study by Chandrasekhar et al. demonstrated that mHealth interventions led to significant reductions in both systolic and diastolic blood pressures over six months (8). The enhanced adherence and clinical outcomes in our study align with these reports, further validating the role of mobile-based technologies in chronic care.

Furthermore, the usability and accessibility of smartphones in urban and semi-urban populations have improved, allowing mHealth solutions to gain widespread acceptance (9). The high satisfaction levels (85%) reported by participants in the intervention group highlight the feasibility and acceptability of such tools in routine outpatient care. Previous research has also shown that user-friendly design, personalization, and educational content in apps contribute to sustained engagement and adherence (10,11).

While this study confirms the utility of mHealth tools, several challenges persist. Digital literacy, technological barriers in older populations, and concerns about data privacy can limit the widespread implementation of these interventions (12,13). In addition, long-term adherence beyond six months and scalability across diverse populations remain areas requiring further investigation (14). Future studies should also focus on integrating mHealth platforms with electronic health records and clinical decision systems to streamline monitoring and follow-up (15).

Conclusion

The use of mobile health applications significantly enhances medication adherence and improves blood pressure control among hypertensive patients. Integrating such digital tools into routine outpatient care offers a practical, scalable solution to address non-adherence and optimize long-term hypertension management.

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