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Original Article

Artificial Intelligence-Enabled Digital Health Tool Use, Blood Pressure Control, and Medication Adherence Among Hypertensive Patients in a Hospital Setting: A Comparative Cross-Sectional Study

Alena Jose Thamarasseril[1], Deborah Ayodele Odewale[2], Oswald Theo-Doe[3], Oluwasegun Daniel Ajala[4], Prashanth Kumar Patnaik[5]

[1,2,3,4]Student, Department of Internal Medicine, All Saints University School of Medicine, Dominica
[5]Associate Professor, Department of Pharmacology, All Saints University School of Medicine, Dominica

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Corresponding Author:

Dr Prashanth Kumar Patnaik
Associate Professor, Department of Pharmacology, All Saints University School of Medicine, Dominica

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ABSTRACT

Background: Hypertension remains a major contributor to cardiovascular morbidity, and inadequate blood pressure control is frequently linked to poor medication adherence and limited patient engagement. Artificial intelligence-enabled digital health tools provide reminders, blood pressure tracking, feedback, and lifestyle support, but hospital-based comparative evidence remains limited.
Objectives: To compare blood pressure control and medication adherence between hypertensive patients using artificial intelligence-enabled digital health tools and those not using such tools in a hospital setting.
Methods: This comparative cross-sectional study was conducted at All Saints University School of Medicine, DCF Hospital, Dominica, from January 2025 to December 2025. A total of 220 hypertensive patients were included. Patients were classified as digital tool users or non-users. Baseline characteristics, pattern of tool use, blood pressure status, and medication adherence were assessed. Group comparisons and multivariable logistic regression analysis were performed.
Results: Among 220 patients, 108 used artificial intelligence-enabled digital health tools and 112 did not. The mean age was 56.8 ± 11.4 years, and 126 patients were male. Controlled blood pressure was observed in 64.8% of tool users and 45.5% of non-users. Mean systolic and diastolic blood pressure values were lower among tool users. High medication adherence was more frequent among users than non-users. Digital tool use remained independently associated with controlled blood pressure and high medication adherence.
Conclusion: Artificial intelligence-enabled digital health tool use was associated with better blood pressure control and higher medication adherence among hypertensive patients in this hospital-based sample. Integration of validated digital support tools into hypertension care can strengthen self-monitoring, adherence behaviour, and patient participation.

Keywords: *Artificial intelligence; digital health; hypertension; blood pressure control; medication adherence; mHealth.*

INTRODUCTION

Hypertension is one of the most common chronic non-communicable diseases and remains a leading modifiable risk factor for cardiovascular disease, stroke, chronic kidney disease, and premature mortality. Global estimates show a substantial and continuing burden of hypertension across both high-income and low- and middle-income settings, with major gaps in awareness, treatment, and blood pressure control [1]. Effective management requires accurate diagnosis, regular blood pressure monitoring, adherence to antihypertensive medication, risk-factor modification, and long-term patient participation in care [2]. In routine hospital practice, however, many patients remain uncontrolled despite

receiving prescribed therapy, showing the practical gap between evidence-based recommendations and real-world disease control.

Medication adherence is central to successful hypertension management. Poor adherence contributes to persistent blood pressure elevation, therapeutic escalation, avoidable cardiovascular risk, and repeated healthcare visits [3]. Adherence behaviour is influenced by multiple factors, including patient knowledge, symptom perception, drug burden, adverse effects, cost, forgetfulness, social support, health literacy, and clinician-patient communication. Self-reported adherence tools are commonly used in clinical research because they are feasible, inexpensive, and suitable for outpatient settings, although they require careful interpretation because adherence is a dynamic behaviour [4]. Hence, interventions that provide repeated reminders, behavioural support, and feedback are clinically relevant for hypertensive patients.

Digital health tools have become increasingly important in chronic disease care. Mobile applications, connected blood pressure devices, telemonitoring platforms, web-based dashboards, automated messages, and self-management portals can improve patient engagement and provide data outside the hospital visit [5-8]. Recent trials and meta-analyses suggest that digital health interventions improve blood pressure outcomes, especially when self-monitoring is combined with feedback, lifestyle guidance, clinician support, or structured self-management [7-12]. These tools are particularly attractive in busy hospital settings because they support continuity between visits and reduce dependence on brief face-to-face counselling alone.

Artificial intelligence-enabled digital health tools represent a newer stage in hypertension care. These systems can personalise reminders, classify blood pressure patterns, generate automated feedback, guide lifestyle modification, and support adherence through adaptive prompts. Recent evidence shows that AI-based lifestyle coaching and mobile application-based feedback can improve blood pressure control and patient engagement [13,14]. However, real-world comparative data from hospital settings remain limited, especially where patients differ in age, education, comorbidity burden, and digital access.

The present study was conducted with the objective of comparing blood pressure control and medication adherence among hypertensive patients who used artificial intelligence-enabled digital health tools and those who did not use such tools in a hospital setting. The study also aimed to describe the pattern of AI-enabled digital health tool use and to identify whether tool use was independently associated with controlled blood pressure and high medication adherence after adjusting for selected clinical and demographic variables.

METHODOLOGY

Study design and setting: This comparative cross-sectional study was conducted at All Saints University School of Medicine, DCF Hospital, Dominica, from January 2025 to December 2025. A hospital-based design was selected to evaluate hypertensive patients receiving routine care and to compare blood pressure control and medication adherence according to use of artificial intelligence-enabled digital health tools.

Study population and sample size: The study included adult patients with diagnosed hypertension who attended the hospital during the study period and were receiving antihypertensive medication. A total of 220 patients were included. Patients were classified into two groups based on self-reported use of AI-enabled digital health tools such as medication reminders, blood pressure recording applications, wearable-linked tracking, chatbot-based advice, or automated lifestyle guidance.

Eligibility criteria: Patients aged 18 years and above with diagnosed hypertension and available clinic blood pressure measurements were eligible. Patients with complete information on digital tool use, adherence, and clinical characteristics were included. Patients with incomplete records, severe acute illness, pregnancy-related hypertension, inability to answer the questionnaire, or refusal to participate were excluded.

Study variables and operational definitions: The main exposure variable was use of AI-enabled digital health tools. The primary outcomes were blood pressure control and medication adherence. Controlled blood pressure was defined as clinic blood pressure below 140/90 mmHg, consistent with commonly applied hypertension management thresholds [2]. Medication adherence was assessed using a structured self-reported adherence score based on medication-taking behaviour, missed doses, forgetfulness, and continuity of prescribed therapy, with patients categorised as high, medium, or low adherence. Self-reported adherence measures are widely used in outpatient hypertension research [4].

Data collection procedure: Data were collected using a predesigned case record form. Age, sex, duration of hypertension, diabetes mellitus, education level, and number of antihypertensive medications were recorded. Blood pressure values were obtained using standard hospital procedures. Type and frequency of AI-enabled digital tool use were documented, and adherence was recorded using the structured score.

Statistical analysis: Data were analysed using descriptive and inferential statistics. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequency and percentage. Group differences were assessed using appropriate tests. A p-value less than 0.05 was considered statistically significant. Multivariable logistic regression assessed independent associations of AI-enabled tool use with controlled blood pressure and high adherence after adjustment for age, sex, hypertension duration, diabetes mellitus, education, and number of antihypertensive drugs.

Ethical considerations: The study was conducted after institutional ethical approval. Written informed consent was obtained before inclusion. Patient confidentiality was maintained by anonymising data and using information only for academic and research purposes. Participation was voluntary, and refusal did not affect clinical care.

RESULTS

A total of 220 hypertensive patients were included in the final analysis. Among them, 108 patients reported use of artificial intelligence-enabled digital health tools for hypertension-related support, while 112 patients did not use such tools. The overall mean age of the study population was 56.8 ± 11.4 years. Males constituted 126 patients (57.3%), and females constituted 94 patients (42.7%). AI-enabled digital health tool users were younger than non-users, with a mean age of 54.7 ± 10.8 years compared with 58.8 ± 11.6 years, respectively. The proportion of patients aged ≥60 years was higher among non-users than users. The distribution of sex, duration of hypertension, diabetes mellitus, and number of antihypertensive medications was comparable between the two groups (Table 1).

Table 1. Baseline characteristics of hypertensive patients according enabled digital health tool use to AI-

Variable	Total patients n=220	AI tool users n=108	Non-users n=112	p-value
Age, years, mean ± SD	56.8 ± 11.4	54.7 ± 10.8	58.8 ± 11.6	0.008
Age ≥60 years	98 (44.5%)	39 (36.1%)	59 (52.7%)	0.013
Male sex	126 (57.3%)	64 (59.3%)	62 (55.4%)	0.558
Female sex	94 (42.7%)	44 (40.7%)	50 (44.6%)	0.558
Duration of hypertension >5 years	113 (51.4%)	51 (47.2%)	62 (55.4%)	0.225
Diabetes mellitus	80 (36.4%)	37 (34.3%)	43 (38.4%)	0.525
On ≥2 antihypertensive drugs	97 (44.1%)	44 (40.7%)	53 (47.3%)	0.326
College education or above	96 (43.6%)	52 (48.1%)	44 (39.3%)	0.186

Among the 108 AI-enabled digital health tool users, the most commonly used features were medication reminders in 74 patients (68.5%), blood pressure recording or monitoring applications in 69 patients (63.9%), automated lifestyle guidance in 43 patients (39.8%), and chatbot-based health advice in 31 patients (28.7%). The frequency of digital tool use was daily in 46 patients (42.6%), several times per week in 38 patients (35.2%), and occasional in 24 patients (22.2%) (Table 2).

Table 2. Pattern of AI-enabled digital health tool use among users

Type of AI-enabled digital health support	Number n=108	Percentage
Medication reminder application	74	68.5%
Blood pressure recording/monitoring application	69	63.9%
Automated lifestyle or diet guidance	43	39.8%
Chatbot-based health advice	31	28.7%
Wearable-linked blood pressure or activity tracking	26	24.1%
Daily use	46	42.6%
Several times per week	38	35.2%
Occasional use	24	22.2%

Blood pressure control was better among AI tool users compared with non-users. Overall, 121 patients (55.0%) had controlled blood pressure. Controlled blood pressure was observed in 70 of 108 AI tool users (64.8%) and 51 of 112 non-users (45.5%). The mean systolic blood pressure was lower among AI tool users than non-users, measuring 132.8 ± 13.6 mmHg and 141.6 ± 15.2 mmHg, respectively. Similarly, the mean diastolic blood pressure was 82.4 ± 8.5 mmHg among users and 87.3 ± 9.1 mmHg among non-users. These differences were statistically significant (Table 3).

Medication adherence was also higher among AI tool users. High adherence was documented in 58 patients (53.7%) among users and 34 patients (30.4%) among non-users. Low adherence was less frequent among users than non-users, reported in 17 patients (15.7%) and 36 patients (32.1%), respectively. The mean medication adherence score was significantly higher among AI tool users than non-users (Table 3).

Table 3. Blood pressure control and medication adherence according to AI-enabled digital health tool use

Outcome	AI tool users n=108	Non-users n=112	p-value
Mean systolic BP, mmHg	132.8 ± 13.6	141.6 ± 15.2	<0.001
Mean diastolic BP, mmHg	82.4 ± 8.5	87.3 ± 9.1	<0.001
Controlled BP	70 (64.8%)	51 (45.5%)	0.004
Uncontrolled BP	38 (35.2%)	61 (54.5%)	0.004
Mean medication adherence score	6.9 ± 1.4	5.8 ± 1.7	<0.001
High adherence	58 (53.7%)	34 (30.4%)	<0.001
Medium adherence	33 (30.6%)	42 (37.5%)	0.278
Low adherence	17 (15.7%)	36 (32.1%)	0.005

On multivariable logistic regression analysis, use of AI-enabled digital health tools remained independently associated with controlled blood pressure after adjustment for age, sex, duration of hypertension, diabetes mellitus, education status, and number of antihypertensive medications. AI tool users had higher odds of achieving controlled blood pressure compared with non-users. High medication adherence was also independently associated with controlled blood pressure. In a separate model, AI-enabled digital health tool use was independently associated with high medication adherence (Table 4).

Table 4. Multivariable analysis of factors associated with blood pressure control and high medication adherence

Variable	Adjusted odds ratio	95% confidence interval	p-value
Factors associated with controlled blood pressure			
AI-enabled digital health tool use	2.11	1.19-3.73	0.011
High medication adherence	3.02	1.71-5.34	<0.001
Age ≥60 years	0.72	0.41-1.27	0.258
Diabetes mellitus	0.81	0.45-1.46	0.486
Hypertension duration >5 years	0.76	0.43-1.35	0.354
Factors associated with high medication adherence			
AI-enabled digital health tool use	2.48	1.39-4.43	0.002
College education or above	1.54	0.87-2.75	0.138
On ≥2 antihypertensive drugs	0.69	0.38-1.25	0.221
Diabetes mellitus	0.91	0.50-1.67	0.764

Overall, AI-enabled digital health tool use was associated with better blood pressure control and higher medication adherence among hypertensive patients in the hospital setting. The findings indicate that digital tool users had lower systolic and diastolic blood pressure values, a higher proportion of controlled hypertension, and better adherence scores compared with non-users.

DISCUSSION

The present hospital-based comparative cross-sectional study showed that hypertensive patients using AI-enabled digital health tools had better blood pressure control and higher medication adherence than non-users. Nearly half of the sample reported use of such tools, suggesting growing acceptance of digital support in routine hypertension care. The difference in controlled blood pressure was clinically meaningful, with 64.8% of tool users achieving control compared with 45.5% of non-users. Mean systolic and diastolic blood pressure values were also lower among users. These findings support the concept that structured digital assistance can strengthen day-to-day self-management beyond conventional clinic visits.

Medication adherence appeared to be a key pathway linking digital tool use with blood pressure control. High adherence was observed in more than half of AI tool users but in less than one-third of non-users. This pattern is consistent with the established role of adherence as a central determinant of hypertension control [3]. Digital tools can reduce forgetfulness, provide repeated behavioural cues, reinforce prescription routines, and help patients connect home readings with medication-taking behaviour. Previous work has shown that self-reported adherence measures are useful in outpatient hypertension research, although they require cautious interpretation [4].

The findings are consistent with evidence from digital hypertension interventions. Self-monitoring is more effective when combined with feedback, counselling, or structured support rather than used as an isolated activity [5]. Mobile health strategies have shown potential for blood pressure self-management, including in populations with digital barriers [6]. Randomised studies such as HOME BP and app-based self-management trials reported benefits from digital support integrated with behavioural or clinical feedback [7,8]. Recent meta-analyses also indicate that digital health and mHealth

interventions can improve blood pressure outcomes and adherence-related behaviours among hypertensive patients [9-12].

The independent association observed in regression analysis strengthens the interpretation that AI-enabled tool use was related to better outcomes even after adjusting for selected clinical and demographic factors. The adjusted odds of controlled blood pressure were higher among users, and digital tool use was independently associated with high medication adherence. These results align with newer evidence that app-based feedback and AI-based lifestyle coaching can improve engagement and blood pressure outcomes [13,14]. In practical terms, AI-enabled tools can support personalised reminders, trend interpretation, automated lifestyle prompts, and patient-facing feedback, thereby extending hypertension care outside the consultation room.

At the same time, digital tool users were younger than non-users, and the proportion of older patients was higher among non-users. This reflects a possible digital divide. Age, education, smartphone access, health literacy, and confidence in technology can influence adoption. Hospital-based hypertension programmes should therefore avoid assuming equal digital readiness among all patients. Training, simple interfaces, multilingual support, and clinician review of digital data are important for safe implementation. AI-enabled digital health tools should complement, not replace, clinical judgement, physician counselling, medication optimisation, and regular follow-up.

Limitations

The study has limitations. Its cross-sectional design prevents causal inference. Digital health tool use and adherence were self-reported, so recall and social desirability bias were possible. The single-hospital setting limits generalisability. Unmeasured factors such as income, health literacy, smartphone access, prescription refill patterns, and clinician counselling were not fully captured. Longitudinal blood pressure readings and objective app-use analytics were unavailable.

CONCLUSION

In this hospital-based comparative cross-sectional study of 220 hypertensive patients, use of AI-enabled digital health tools was associated with better blood pressure control and higher medication adherence. Patients using digital tools had lower mean systolic and diastolic blood pressure values, a higher proportion of controlled hypertension, and better adherence scores than non-users. Digital tool use remained independently associated with controlled blood pressure and high adherence after adjustment for selected patient characteristics. These findings support the integration of validated AI-enabled reminders, blood pressure tracking, and personalised feedback into routine hypertension care, while ensuring clinician supervision and equitable access for older and less digitally confident patients.

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