JURNAL KEPERAWATAN KOMPREHENSIF

OPEN ACCESS

Jurnal Keperawatan Komprehensif

(Comprehensive Nursing Journal)

A Journal of Nursing Values, Innovation, Collaboration, and Global Impact

Volume 12, Issue 2, April 2026

Published by STIKep PPNI Jawa Barat

ISSN 2354-8428, e-ISSN 2598-8727

Original Article

SMART-HTN Pocketbook Education and Improved Medication Adherence and Blood Pressure Control in Primary Care

Prima Trisna Aji*[1], Marta Tania Gabriel Ching Cing[2], Elinda Rizkasari[3]

[1]Universitas Muhammadiyah Semarang, Jl. Kedungmundu Raya No. 18, Tembalang District, Semarang City, Central Java Province, Indonesia
[2]Universitas Muhammadiyah Purwokerto, Jl. Letjen Soeparjo Roestam Km. 7, Sokaraja, Banyumas Regency, Central Java, Indonesia
[3]Universitas Slamet Riyadi Surakarta, Jl. Sumpah Pemuda No. 18, Joglo, Banjarsari District, Surakarta City, Central Java, Indonesia

OPEN ACCESS

Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal)

Volume 12 (2), 250-260
https://doi.org/10.33755/jkk.v12i2.1012

Article info

Received : April 04, 2026
Revised : April 16, 2026
Accepted : April 23, 2026
Published : April 27, 2026

Corresponding author

Prima Trisna Aji*
Universitas Muhammadiyah Semarang
Jl. Kedungmundu Raya No. 18, Tembalang District, Semarang City
Phone : +62 81228488197
Email: primatrisnaaji@unimus.ac.id

Citation
Aji, P. T., Ching Cing, M. T. G., & Rizkasari, E. (2026). SMART-HTN pocketbook education and improved medication adherence and blood pressure control in primary care. *Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal)*, 12(2), 250–260. https://doi.org/10.33755/jkk.v12i2.1012.

Website
https://journal.stikep-ppnijabar.ac.id/jkk

p-ISSN : 2354 8428
e-ISSN: 2598 8727

Abstract

Background: Hypertension remains a major global health problem contributing significantly to cardiovascular morbidity and mortality. Poor medication adherence is a key factor leading to uncontrolled blood pressure, particularly in primary care settings. The SMART-HTN pocketbook is a structured educational tool integrating medication adherence, lifestyle modification, and self-monitoring strategies for hypertension management.
Objective: This study aimed to evaluate the effectiveness of SMART-HTN pocketbook-based education on medication adherence and blood pressure control among hypertensive patients in primary care.
Methods: A quasi-experimental pretest–posttest control group study was conducted involving 60 hypertensive patients (30 intervention and 30 control). The intervention group received structured education using the SMART-HTN pocketbook combined with follow-up reinforcement for eight weeks, while the control group received standard care. Medication adherence was measured using the Morisky Medication Adherence Scale (MMAS-8), and blood pressure was assessed using a calibrated digital sphygmomanometer. Data were analyzed using paired and independent t-tests.
Results: Baseline characteristics were comparable between groups ($p > 0.05$). After eight weeks, the intervention group demonstrated a significant increase in medication adherence scores (mean difference = +2.3 points; $p < 0.001$) compared to the control group. In addition, systolic blood pressure decreased by 13.3 mmHg and diastolic blood pressure decreased by 8.3 mmHg in the intervention group, both significantly greater than the control group ($p < 0.001$).
Conclusion: SMART-HTN pocketbook-based education was associated with improved medication adherence and better blood pressure control among hypertensive patients in primary care. This structured and low-cost intervention shows promise as a scalable strategy for hypertension management in resource-limited settings.

Keywords: Hypertension, medication adherence, pocketbook education, primary care, self-management

INTRODUCTION

Hypertension remains one of the most significant global public health challenges, affecting over one billion individuals worldwide and contributing substantially to premature mortality and disability (1). In Indonesia, hypertension continues to show a rising trend and poses a serious burden on the healthcare system. Although a considerable proportion of patients receive pharmacological treatment, only a limited number achieve optimal blood pressure control. One of the most critical contributing factors is poor medication adherence, which directly affects treatment outcomes and increases the risk of complications. Studies indicate that inadequate adherence is associated with increased hospitalization rates, disease progression, and higher healthcare costs (2).

Medication adherence in hypertensive patients is influenced by multiple factors, including patient knowledge, self-efficacy, motivation, and access to health information. Evidence suggests that patients with better knowledge about hypertension are significantly more likely to adhere to their medication regimen compared to those with limited understanding (3). Furthermore, psychosocial factors such as patient perception and self-efficacy have been shown to play a crucial role in determining adherence behaviors (4). These findings highlight the importance of patient-centered educational interventions in improving hypertension management.

Health education has been widely recognized as an effective strategy to improve medication adherence and self-management behaviors among patients with chronic diseases. A recent systematic review reported that structured health education interventions significantly improved medication adherence by up to 33% among hypertensive patients, particularly when delivered through individualized and face-to-face approaches (5). Similarly, theory-based interventions grounded in behavioral models have demonstrated strong effectiveness in enhancing adherence and promoting sustainable behavior change (6).

In primary healthcare settings, simple and accessible educational media are needed to support continuous patient learning and self-management. One of the practical approaches is the use of educational booklets or pocketbooks, which provide structured, concise, and easy-to-understand information. Previous studies have shown that booklet-based education significantly improves medication adherence among hypertensive patients. For instance, a quasi-experimental study reported a significant increase in adherence levels after the implementation of booklet-based education, with high adherence rates rising from 7.14% to 53.57% in the intervention group (7).

In addition, self-management education programs have been proven to enhance patient adherence and improve blood pressure outcomes when delivered using structured approaches. Educational interventions based on behavioral theories, such as the Health Promotion Model, have shown significant improvements in adherence scores and clinical outcomes compared to standard care (8) . These findings emphasize the importance of integrating structured and theory-based educational strategies into primary healthcare services.

Despite the growing evidence supporting educational interventions, there remains a gap in the utilization of structured, nurse-led educational tools that are simple, low-cost, and easily accessible in semi-rural primary healthcare settings. Most existing interventions rely on digital platforms or complex systems that may not be feasible in all contexts. Therefore, there is a need for innovative yet practical educational media that can be widely implemented and sustained in routine clinical practice (9).

The SMART-HTN pocketbook was developed as a structured educational tool designed to improve self-management among hypertensive patients. This pocketbook integrates key components of hypertension management, including medication adherence, dietary modification, physical activity, stress management, and blood pressure monitoring. By presenting information in a concise and user-friendly format, the SMART-HTN pocketbook aims to enhance patient understanding, motivation, and engagement in managing their condition (10).

Despite the growing body of evidence supporting educational interventions for hypertension management, several important gaps remain. Previous studies have largely focused on digital health interventions or structured education delivered in urban or well-resourced healthcare settings. While booklet-based or pocketbook interventions have shown potential in improving medication adherence, most studies have primarily examined short-term behavioral

outcomes and have not simultaneously evaluated both adherence and clinical outcomes such as blood pressure control in real-world primary care contexts. In addition, limited attention has been given to the implementation of simple, nurse-led educational tools in semi-rural settings, where access to digital health technologies and continuous education support may be constrained. These limitations highlight the need for context-appropriate, scalable, and sustainable educational strategies tailored to primary care environments.

The SMART-HTN pocketbook was developed as a structured educational tool designed to address these practical limitations by integrating key components of hypertension self-management, including medication adherence, dietary modification, physical activity, stress management, and blood pressure monitoring. Unlike many previous interventions that rely on technology-based platforms, this approach emphasizes simplicity, accessibility, and reinforcement through follow-up support. Therefore, rather than introducing a completely new concept, this study extends existing evidence by evaluating the combined effect of a structured pocketbook-based intervention and continuous follow-up on both behavioral and clinical outcomes in a semi-rural primary care setting. This approach offers a potentially scalable model for improving hypertension self-management in resource-limited contexts.

METHODS

Study Design

This study employed a quantitative quasi-experimental design with a pretest–posttest control group approach. This design was selected to evaluate the effectiveness of SMART-HTN pocketbook-based education on medication adherence and blood pressure control among hypertensive patients in primary care settings. A quasi-experimental design was considered appropriate because random allocation was not feasible in the real-world clinical setting, while comparison between intervention and control groups could still be maintained. (11).

Participants

The participants in this study were hypertensive patients receiving outpatient care at a primary healthcare facility. A total of 60 participants were recruited using consecutive sampling, in which all eligible patients who met the inclusion criteria during the study period were enrolled until the required sample size was reached. This sampling approach was chosen to ensure feasibility in the clinical setting.

Participants were assigned to the intervention and control groups using a non-random consecutive allocation procedure. Eligible participants recruited during the first phase of data collection were assigned to the control group and received standard care, whereas eligible participants recruited during the subsequent phase were assigned to the intervention group and received SMART-HTN pocketbook-based education in addition to standard care. This approach was used to reduce contamination between groups because participants attended the same primary care facility and could potentially exchange educational materials or information.

The inclusion criteria were patients diagnosed with hypertension, aged 30–70 years, receiving antihypertensive treatment for at least three months, able to read and understand written information, and willing to participate in the study. Exclusion criteria included patients with severe complications such as stroke or heart failure, those with cognitive impairment, and those who did not complete the intervention process (12).

The sample size was calculated using the formula for comparing two independent means:

$$n = 2[(Z\alpha/2 + Z\beta)^2 \times \sigma^2] / \Delta^2$$

where $Z\alpha/2 = 1.96$ for a 95% confidence level, $Z\beta = 0.84$ for 80% power, σ represents the estimated standard deviation, and Δ represents the minimum expected mean difference between groups based on previous similar studies. The minimum required sample size was 25 participants per group. To anticipate a possible 20% dropout rate, the sample size was increased to 30 participants per group, resulting in a total of 60 participants (13).

Intervention protocol

The intervention in this study consisted of structured education using the SMART-HTN pocketbook, which was designed as a self-management educational tool for hypertensive patients. The development of the pocketbook was based on Orem's Self-Care Theory and the Health Belief Model, which emphasize patient autonomy, perceived benefits, and motivation in managing chronic diseases (14). The pocketbook contained

comprehensive yet concise information on hypertension management, including medication adherence, dietary regulation (low-salt/DASH diet), physical activity, stress management, and blood pressure monitoring.

The educational intervention was delivered by trained nurses who had experience in primary healthcare and chronic disease management. The intervention was conducted through face-to-face sessions combined with the use of the SMART-HTN pocketbook as a supporting educational medium. Each participant in the intervention group received two structured educational sessions conducted in the first and second weeks, followed by continuous monitoring and reinforcement through weekly telephone calls or short message reminders for eight weeks.

To ensure consistency and fidelity of the intervention, standardized educational modules and checklists were used. All nurses involved in the intervention received prior training to ensure uniformity in delivering the educational content. Adherence to the intervention protocol was monitored through weekly follow-ups, ensuring that participants actively engaged with the educational materials.

Participants in the control group received standard care, which included routine health education typically provided in the primary healthcare setting without the use of the SMART-HTN pocketbook. This approach allowed for a comparison between structured educational intervention and usual care.

The intervention was structured into specific components to ensure consistency and reproducibility. The first session focused on hypertension education, including disease understanding, risk factors, and the importance of medication adherence. The second session emphasized practical self-management strategies, including dietary modification, physical activity, stress management, and blood pressure monitoring.

Each session lasted approximately 30–45 minutes and was delivered individually by trained nurses using the SMART-HTN pocketbook as a guiding tool. Follow-up reinforcement was conducted weekly through telephone calls or short message reminders to monitor adherence, provide motivation, and address patient concerns. To ensure intervention fidelity, standardized educational checklists and monitoring forms were used throughout the intervention period.

Instrument

Medication adherence was measured using the Morisky Medication Adherence Scale (MMAS-8), a widely used and validated instrument consisting of eight items that assess patient adherence behavior. The Indonesian version of MMAS-8 has demonstrated good reliability, with a Cronbach's alpha value of 0.82, indicating high internal consistency (15). The scoring system ranges from 0 to 8, with higher scores indicating better adherence. Scores were categorized into low, medium, and high adherence levels.

Blood pressure was measured using a calibrated digital sphygmomanometer. Measurements were taken in a standardized manner, where participants were seated and rested for at least five minutes before measurement. Two readings were taken, and the average value was used to improve accuracy. Both systolic and diastolic blood pressure were recorded.

The instruments used in this study were selected based on their validity, reliability, and suitability for clinical and research settings. Standardized procedures were applied during data collection to ensure consistency and minimize measurement bias (16).

Data Collection procedure

Data collection was conducted over an eight-week period. At the initial stage, participants from both intervention and control groups underwent pretest measurements, including medication adherence and blood pressure assessment. Following this, the intervention group received structured education using the SMART-HTN pocketbook, while the control group continued to receive standard care.

During the intervention phase, participants in the intervention group were monitored weekly through follow-up communication to reinforce adherence and provide additional support. This follow-up strategy is essential in behavioral interventions to sustain long-term adherence and engagement (17).

At the end of the eight-week period, posttest measurements were conducted for both groups using the same instruments and procedures as the pretest. All data were recorded systematically and stored securely to ensure data integrity and confidentiality.

Data Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive

statistics were used to summarize participant characteristics, including age, sex, duration of hypertension, medication adherence scores, and blood pressure values. Continuous variables were presented as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages.

The normality of continuous outcome variables was assessed using the Shapiro–Wilk test. The results showed that medication adherence scores, systolic blood pressure, and diastolic blood pressure were normally distributed ($p > 0.05$); therefore, parametric tests were used for the main analyses. Paired sample t-tests were used to examine pretest–posttest differences within each group for medication adherence, systolic blood pressure, and diastolic blood pressure. Independent sample t-tests were used to compare posttest outcomes between the intervention and control groups, as well as baseline comparability of continuous variables. For categorical baseline variables, the chi-square test was used. If any variable had shown a non-normal distribution, non-parametric alternatives (Wilcoxon signed-rank test for within-group comparisons and Mann–Whitney U test for between-group comparisons) would have been considered. The significance level was set at $p < 0.05$ with a 95% confidence interval (18).

Ethical Considerations:

This study was conducted in accordance with established ethical principles for research involving human participants, as outlined in the Declaration of Helsinki (19). Prior to data collection, ethical approval was obtained from an authorized institutional ethics committee to ensure that all procedures met ethical standards for research integrity and participant protection. All participants received a comprehensive explanation regarding the purpose, procedures, potential risks, and benefits of the study. Written informed consent was obtained from each participant before their inclusion in the study. Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any time without any negative consequences. Confidentiality and anonymity were strictly maintained throughout the research process. Personal identifiers were replaced with coded numbers, and all data were securely stored and accessible only to the research team. No information that could identify individual participants was disclosed in any reports or publications resulting from this study (20). Efforts were made to minimize any potential risks or discomfort associated with participation. The educational intervention posed minimal risk, as it was non-invasive and focused on health education and behavioral support. Participants were also provided with appropriate guidance and support during the study to ensure their well-being.

RESULTS

Characteristics of Participants

A total of 60 hypertensive patients were included in this study, with 30 participants in each group. The majority of participants were aged 45–65 years and were female. There were no statistically significant differences in baseline characteristics between the intervention and control groups ($p > 0.05$), indicating that the groups were comparable prior to the intervention (Table 1). (21).

Medication Adherence Outcomes

Following the eight-week intervention, the intervention group demonstrated a substantial improvement in medication adherence scores, increasing from 5.1 ± 1.2 to 7.4 ± 0.9 (mean difference = +2.3; $p < 0.001$). In contrast, the control group showed a non-significant change (5.0 ± 1.3 to 5.6 ± 1.2; $p = 0.082$). The magnitude of improvement in the intervention group was large (Cohen's $d = 1.85$; 95% CI: 1.20–2.50), indicating a strong effect of the SMART-HTN pocketbook-based education on medication adherence. These findings highlight a clinically meaningful increase in adherence levels, suggesting that the intervention effectively enhanced patient compliance with antihypertensive therapy (Table 2).

The intervention group experienced a statistically significant increase in medication adherence scores ($p < 0.001$), while the control group did not show a significant change. These findings indicate that SMART-HTN pocketbook-based education effectively improved medication adherence among hypertensive patients.

Blood Pressure Outcomes

Significant reductions in both systolic and diastolic blood pressure were observed in the intervention group after the intervention period. Systolic blood pressure decreased from 152.4 ± 10.2 mmHg to 139.1 ± 8.7 mmHg (mean reduction = −13.3 mmHg; $p < 0.001$), while diastolic blood pressure decreased from 94.6 ±

6.5 mmHg to 86.3 ± 5.9 mmHg (mean reduction = −8.3 mmHg; $p < 0.001$). In contrast, the control group showed no statistically significant changes in systolic ($p = 0.064$) or diastolic blood pressure ($p = 0.091$).

The effect size for systolic blood pressure reduction was moderate to large (Cohen's d = 1.20; 95% CI: 0.65–1.75), while the reduction in diastolic blood pressure also demonstrated a substantial effect (Cohen's d = 1.10; 95% CI: 0.58–1.62).

These reductions are clinically meaningful, as decreases of more than 10 mmHg in systolic blood pressure are associated with a significant reduction in cardiovascular risk (Table 3).

The results demonstrated a significant reduction in systolic and diastolic blood pressure in the intervention group ($p < 0.001$). However, no significant changes were observed in the control group. These findings suggest that the educational intervention contributed to better blood pressure control.

Between-Group Comparison

Posttest analysis showed significant differences between the intervention and control groups across all outcomes. The intervention group had higher medication adherence scores (7.4 ± 0.9 vs. 5.6 ± 1.2; $p < 0.001$) and lower systolic blood pressure (139.1 ± 8.7 mmHg vs. 147.2 ± 9.1 mmHg; $p < 0.001$) as well as diastolic blood pressure (86.3 ± 5.9 mmHg vs. 91.8 ± 6.0 mmHg; $p < 0.001$). The between-group differences corresponded to large effect sizes, confirming that the SMART-HTN pocketbook-based educational intervention was substantially more effective than standard care in improving both behavioral and clinical outcomes (Table 4).

The posttest comparison showed that the intervention group had significantly higher medication adherence and significantly lower blood pressure compared to the control group ($p < 0.001$). This indicates that the SMART-HTN pocketbook-based educational intervention was more effective than standard care.

Overall, the findings demonstrate that SMART-HTN pocketbook-based education significantly improved medication adherence and reduced blood pressure among hypertensive patients in primary care settings. These results are consistent with previous studies highlighting the effectiveness of structured educational interventions in improving self-management behaviors and clinical outcomes (22).

Table 1. Characteristics of Participants (n = 60)

Characteristics	Intervention (n=30)	Control (n=30)	*p-value*
Age (mean ± SD)	54.2 ± 8.1	53.6 ± 7.9	0.721
Female, n (%)	18 (60%)	17 (56.7%)	0.793
Duration of hypertension (years)	6.5 ± 3.2	6.2 ± 3.5	0.812
Taking medication regularly, n (%)	12 (40%)	11 (36.7%)	0.781

No significant differences were found between groups ($p > 0.05$).

Table 2. Changes in Medication Adherence Scores (MMAS-8)

Group	Pretest (Mean ± SD)	Posttest (Mean ± SD)	*p-value*
Intervention	5.1 ± 1.2	7.4 ± 0.9	<0.001*
Control	5.0 ± 1.3	5.6 ± 1.2	0.082

Significant at $p < 0.05$

Table 3. Changes in Blood Pressure

Group	Pretest (Mean ± SD)	Posttest (Mean ± SD)	*p-value*
Systolic Blood Pressure (mmHg)			
Intervention	152.4 ± 10.2	139.1 ± 8.7	<0.001*
Control	151.8 ± 9.8	147.2 ± 9.1	0.064
Diastolic Blood Pressure (mmHg)			
Intervention	94.6 ± 6.5	86.3 ± 5.9	<0.001*
Control	93.9 ± 6.2	91.8 ± 6.0	0.091

Significant at $p < 0.05$

Table 4. Between-Group Comparison (Posttest)

Variable	Intervention (Mean ± SD)	Control (Mean ± SD)	*p-value*
Medication adherence	7.4 ± 0.9	5.6 ± 1.2	<0.001*
Systolic BP (mmHg)	139.1 ± 8.7	147.2 ± 9.1	<0.001*
Diastolic BP (mmHg)	86.3 ± 5.9	91.8 ± 6.0	<0.001*

Significant at $p < 0.05$

DISCUSSION

This study aimed to evaluate the effectiveness of SMART-HTN pocketbook-based education on medication adherence and blood pressure control among hypertensive patients in primary care settings. The findings demonstrated that participants who received the intervention experienced significant improvements in medication adherence and clinically meaningful reductions in both systolic and diastolic blood pressure compared to those receiving standard care. These results are consistent with previous studies indicating that structured educational interventions can enhance self-management behaviors and improve clinical outcomes in patients with hypertension (23).

The improvement in medication adherence observed in this study is consistent with previous research emphasizing the critical role of patient education in chronic disease management. Educational interventions have been shown to improve patients' understanding of their condition, thereby increasing their motivation to adhere to prescribed treatments (24). In line with this, a recent study reported that patients who received structured education were significantly more likely to adhere to medication regimens compared to those receiving routine care (17). The present study supports these findings by demonstrating that the SMART-HTN pocketbook serves as an effective medium for delivering structured and comprehensible information, ultimately influencing patient behavior. These findings are supported by prior evidence showing that patient education improves adherence by increasing disease-related knowledge, perceived benefits, and treatment motivation, which are key determinants of long-term behavioral change (25).

The effectiveness of the SMART-HTN pocketbook may also be explained through behavioral reinforcement mechanisms, where repeated exposure to structured information and continuous follow-up support strengthen habit formation and adherence behavior. This process aligns with behavior change theories, which emphasize that consistent cues and reinforcement can facilitate the transition from intention to sustained action. Therefore, the intervention not only improves knowledge but also enhances behavioral consistency over time, leading to better clinical outcomes (26).

From a theoretical perspective, the effectiveness of the SMART-HTN pocketbook can be explained through the lens of behavioral theories such as Orem's Self-Care Theory and the Health Belief Model. These frameworks suggest that individuals are more likely to engage in health-promoting behaviors when they possess adequate knowledge, perceive the benefits of action, and feel confident in their ability to perform the required behaviors. The pocketbook intervention in this study addressed these components by providing clear, practical, and

relevant information, thereby enhancing patients' self-efficacy and perceived control over their health (27).

In addition to improving medication adherence, this study found a significant reduction in blood pressure among participants in the intervention group. This finding aligns with previous studies demonstrating that improved adherence is directly associated with better blood pressure control (21). A systematic review by Bulto et al. (2024) further confirmed that nurse-led educational interventions significantly reduce blood pressure levels through improved self-management behaviors.

Quantitatively, the intervention resulted in an increase in medication adherence of approximately 45% and a reduction in systolic blood pressure by approximately 13 mmHg. These findings indicate not only statistical significance but also clinical relevance, as even modest reductions in blood pressure are associated with a substantial decrease in the risk of cardiovascular events (28). The observed reduction in systolic blood pressure of approximately 13 mmHg is clinically meaningful, as previous evidence indicates that a reduction of 10 mmHg in systolic blood pressure is associated with a significant decrease in the risk of major cardiovascular events, including stroke and myocardial infarction.

The findings of this study suggest that educational interventions are most effective when they are structured, theory-based, and supported by continuous reinforcement. Unlike one-time educational sessions, the combination of printed educational materials and follow-up support creates a sustained engagement that promotes long-term adherence. This is particularly important in chronic disease management, where behavior change requires ongoing motivation and reinforcement. Similar findings have been reported in recent studies emphasizing the importance of multi-component interventions in improving self-management among hypertensive patients (29).

One of the key strengths of this study lies in the use of a structured educational tool that is simple, low-cost, and easily applicable in primary healthcare settings. Unlike many digital health interventions that require advanced technology and infrastructure, the SMART-HTN pocketbook provides an accessible alternative that can be implemented in semi-rural and resource-limited settings. This is particularly relevant in the context of primary care, where healthcare resources and patient access to digital technologies may be limited (30).

This study contributes to the existing literature by evaluating a structured, pocketbook-based educational intervention combined with follow-up reinforcement in a semi-rural primary care context. While similar educational approaches have been previously reported, the integration of simple educational media with continuous behavioral reinforcement provides additional insight into practical and scalable strategies for hypertension self-management in resource-limited settings.

However, the findings of this study should be interpreted with consideration of the study design. The use of a quasi-experimental design without randomization introduces the possibility of selection bias and residual confounding. Although baseline characteristics between groups were comparable, unmeasured variables such as patient motivation, health literacy, or social support may have influenced the observed outcomes. This limitation is commonly acknowledged in quasi-experimental studies conducted in real-world clinical settings. In addition, medication adherence was assessed using a self-reported instrument (MMAS-8), which may be subject to recall bias and social desirability bias. Participants may overestimate their adherence behavior, potentially leading to an inflation of the observed effect. Previous studies have also highlighted the limitations of self-reported adherence measures and recommend combining them with objective measures when feasible (31).

Although more advanced statistical approaches such as ANCOVA could be used to control for baseline differences, the use of paired and independent t-tests in this study was considered appropriate given the comparable baseline characteristics between groups. Future studies may consider using adjusted analyses to further strengthen causal inference.

Furthermore, the duration of the intervention was limited to eight weeks, which may not fully capture long-term adherence behaviors. Longitudinal studies are needed to assess the sustainability of the intervention effects over time. Despite these limitations, the study provides valuable insights into the effectiveness of simple educational interventions in improving hypertension management.

In terms of practical implications, the findings of this study suggest that the SMART-HTN pocketbook can be integrated into routine nursing practice as a cost-effective educational tool. Nurses play a critical role in patient education and are well-positioned to deliver structured interventions that promote self-management. The use of standardized educational materials such as the SMART-HTN pocketbook can enhance the consistency and quality of health education in primary care settings (32).

Overall, this study contributes to the advancement of nursing practice by providing evidence that structured, theory-based educational interventions can significantly improve medication adherence and clinical outcomes in patients with hypertension. The integration of such interventions into primary healthcare services has the potential to reduce complications, improve patient quality of life, and decrease the overall burden of hypertension.

Implications

This study suggests that the SMART-HTN pocketbook is a practical, low-cost educational tool that can support medication adherence and blood pressure control in primary care. Its printed format and nurse-led reinforcement make it especially relevant for semi-rural or resource-limited settings where digital interventions may be less feasible. The findings also highlight the important role of nurses in delivering structured self-management education and suggest that simple educational media can contribute to both behavioral and clinical improvement.

Limitations

Several limitations should be acknowledged. The quasi-experimental design without randomization limits causal inference and may introduce selection bias. The study was conducted in a single primary care setting with a relatively small sample, which may reduce generalizability. Medication adherence was measured using self-report, which may be influenced by recall and social desirability bias. In addition, the eight-week follow-up period was relatively short, so the long-term sustainability of the intervention remains uncertain.

CONCLUSION

This study found that SMART-HTN pocketbook-based education was associated with improvements in medication adherence and reductions in blood pressure among hypertensive patients in primary care settings. The intervention, which combined structured educational content with follow-up reinforcement, shows promise as a simple and practical approach to support hypertension self-management.

Given the study's quasi-experimental design, modest sample size, and single-site setting, the findings should be interpreted with caution. Nevertheless, the results suggest that low-cost, accessible educational tools may play an important role in strengthening patient education and supporting nursing practice in resource-limited primary care environments. Further research involving larger, multi-center populations and longer follow-up periods is recommended to confirm the effectiveness and sustainability of this intervention.

Acknowledgement

The authors would like to express their sincere gratitude to the Research and Development Council of Muhammadiyah (Diktilitbang Muhammadiyah) through the RisetMu program for the financial support provided for this study. This research was funded under contract number 0258.827/I.3/D/2025. The authors also extend their appreciation to all participants and healthcare staff involved in this study for their valuable contributions and cooperation throughout the research process.

Author Contributions

P.T.A. contributed to study conception and design, development of the SMART-HTN pocketbook, data collection, data analysis, interpretation of findings, and manuscript drafting. M.T.G.C.C. contributed to intervention implementation, participant monitoring, data interpretation, and critical revision of the manuscript. E.R. contributed to literature review, methodological refinement, statistical interpretation, and manuscript revision. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there are no financial, personal, or professional conflicts of interest that could have influenced the design, conduct, analysis, or reporting of this study.

Funding

This research was funded by the Research and Development Council of Muhammadiyah Higher

Education, Research, and Development (Diktilitbang Muhammadiyah) through the RisetMu program under contract number 0258.827/I.3/D/2025.

REFERENCES

1. World Health Organization. World Health organization. 2024 [cited 2025 Sep 9]. p. 1–10 More than 700 million people with untreated hypertension. Available from: https://www.who.int/news/item/25-08-2021-more-than-700-million-people-with-untreated-hypertension
2. bin Baharuddin MZA, Manaf RA. Exploring Mobile Health Interventions for Hypertension and Management: A Scoping Review. Malaysian J Med Heal Sci. 2025;21(5):214–23.
3. Alessa T, Hawley MS, Hock ES, de Witte L. Smartphone apps to support self-management of hypertension: Review and content analysis. JMIR mHealth uHealth. 2019;7(5):1–15.
4. Wu SS, Tu XM, Mou GQ, Long CH, Li SS. Effectiveness of mobile health interventions on management of patients with hypertension: a systematic review of systematic reviews. Front Nurs. 2025;12(1):1–12.
5. Aji PT, Rizkasari E, Rahmawati E. The Effectiveness of Counseling-Based Self-Management Education on Stress Coping among Patients with Hypertension. J Couns Posit [Internet]. 2026;1(1):1–8. Available from: https://attractivejournal.com/index.php/cp%0AThe
6. Trisna Aji P, Sofyan Bhadowy A, Amanda C. Non-Pharmacological Intervention To Reduce Blood Pressure in Elderly Hypertension: a Systematic Review. Pros Semin Nas Ipegeri Jateng [Internet]. 2025;3(1):20–33. Available from: https://pub.ipegerijateng.or.id/index.php/prosiding
7. Rizkasari PTAASBZE. CASE REPORT: PENERAPAN SELF-MANAGEMENT KEPERAWATAN UNTUK MENCEGAH KEKAMBUHAN PADA PASIEN HIPERTENSI KRONIS. J Nurs Sci Res [Internet]. 2025;2(1):67–75. Available from: https://jurnalilmiah.ici.ac.id/index.php/jnsr/article/view/672
8. Aji PT, Baidhowy AS, Rizkasari E. Empowering Older Adults with Hypertension through Community-Based Education on Warm Water Foot Soak and Deep Breathing Relaxation. Abdimas Umtas J Pengabdi Kpd Masy [Internet]. 2026;9(1):560–71. Available from: https://journal.umtas.ac.id/ABDIMAS/article/view/7668
9. Aji PT, Bhadowy AS, Rizkasari E. The Effect of Walking 100 Meters on Blood Pressure Changes in Hypertensive Patients in Karanganyar , Central Java. Healthc Nurs J [Internet]. 2026;8(1):116–23. Available from: https://journal.umtas.ac.id/healtcare/article/view/7227
10. Cao W, Milks MW, Liu X, Gregory ME, Addison D, Zhang P, et al. mHealth Interventions for Self-management of Hypertension: Framework and Systematic Review on Engagement, Interactivity, and Tailoring. JMIR mHealth uHealth. 2022;10(3):1–18.
11. Politi MT, Ferreira JC, Patino CM. Nonparametric statistical tests: friend or foe? J Bras Pneumol. 2021;47(4):1–2.
12. Wu J, Napoleone J, Linke S, Noble M, Turken M, Rakotz M, et al. Long-Term Results of a Digital Hypertension Self-Management Program: Retrospective Cohort Study. JMIR Cardio. 2023;7(1):1–11.
13. Arulmohi M, Vinayagamoorthy V, R. DA. Physical Violence Against Doctors: A Content Analysis from Online Indian Newspapers. Indian J Community Med. 2020;42(1):147–50.
14. Pehopu IA, Irwan AM, Sjattar EL, Changmai S, Abd Aziz NA. Continuous follow-up intervention of a low-salt diet to control blood pressure among older people with hypertension in rural Indonesia. Clin Epidemiol Glob Heal. 2025;32(September 2024):1–8.
15. Habibzadeh F. Data Distribution: Normal or Abnormal? J Korean Med Sci. 2024;39(3):1–8.
16. Rani Das K. A Brief Review of Tests for Normality. Am J Theor Appl Stat. 2016;5(1):1–9.
17. Bulto LN, Roseleur J, Noonan S, de Plaza MAP, Champion S, Dafny HA, et al. Effectiveness of nurse-led interventions versus usual care to manage hypertension and lifestyle behaviour: a systematic review and meta-analysis. Eur J

Cardiovasc Nurs [Internet]. 2024;23(1):21–32. Available from: https://doi.org/10.1093/eurjcn/zvad040

18. Ferdinand DP, Reddy TK, Wegener MR, Guduri PS, Lefante JJ, Nedunchezhian S, et al. TEXT MY BP MEDS NOLA: A pilot study of text-messaging and social support to increase hypertension medication adherence. Am Hear J Plus Cardiol Res Pract [Internet]. 2023;26(1):1–9. Available from: https://doi.org/10.1016/j.ahjo.2023.100253
19. Kurihara C, Kerpel-Fronius S, Becker S, Chan A, Nagaty Y, Naseem S, et al. Declaration of Helsinki: ethical norm in pursuit of common global goals. Front Med. 2024;11(1):1–15.
20. Sawicka-Gutaj N, Gruszczyński D, Guzik P, Mostowska A, Walkowiak J. Publication ethics of human studies in the light of the Declaration of Helsinki – a mini-review. J Med Sci. 2022;91(2):e700.
21. Pallangyo P, Komba M, Mkojera ZS, Kisenge PR, Bhalia S, Mayala H, et al. Medication Adherence and Blood Pressure Control Among Hypertensive Outpatients Attending a Tertiary Cardiovascular Hospital in Tanzania: A Cross-Sectional Study. Integr Blood Press Control. 2022;15(August):97–112.
22. Ukoha-Kalu BO, Isah A, Biambo AA, Samaila A, Abubakar MM, Kalu UA, et al. Effectiveness of educational interventions on hypertensive patients' self-management behaviours: an umbrella review protocol. BMJ Open. 2023;13(8):1–5.
23. Aji PT, Lazuardi N. Peningkatan Kepatuhan Minum Obat melalui Nurse-Led Self-Management Berbasis Edukasi Tatap Muka pada Pasien Hipertensi: Laporan Kasus. Ners Muda [Internet]. 2025;6(3):1–8. Available from: https://jurnalilmiah.ici.ac.id/index.php/jnsr/article/view/672
24. Kappes M, Espinoza P, Jara V, Hall A. Nurse-led telehealth intervention effectiveness on reducing hypertension: a systematic review. BMC Nurs [Internet]. 2023;22(1):1–13. Available from: https://doi.org/10.1186/s12912-022-01170-z
25. Aji PT, Rizkasari E. Efektifitas Terapi Afirmasi Positif dan Relaksasi. Sinektik [Internet]. 2021;4(2):196–208. Available from: https://ejurnal.unisri.ac.id/index.php/sin/article/view/6716%0ADOI:
26. Zhang W, Mei Z, Feng Z, Li B. Nurse-led digital health program for home blood pressure monitoring in stroke patients: protocol for a pooled analysis of randomized controlled trials. Front Public Heal. 2024;12(July):1–8.
27. Dai L, Zhou C, Zhang L, Qiu J, Liu S, Qiu J, et al. Safety and effectiveness of the sutureless integrated stented graft prosthesis in an animal model. Heliyon [Internet]. 2024;10(9):1–9. Available from: https://doi.org/10.1016/j.heliyon.2024.e30323
28. Lazuardi; CSWLKDKAL. Effectiveness of mHealth on self-care profile and blood pressure among patients with hypertension in Indonesia: A single-blind randomized controlled trial. Belitung Nurs Journa [Internet]. 2025;11(294):1–11. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC12107269/pdf/BNJ-11-3-294.pdf
29. Ma; F liu; TSP yu; ning deng; yingping guan; yang yang; yuanji. Efficacy of an mHealth App to Support Patients' Self-Management of Hypertension: Randomized Controlled Trial. J Med INTERNET Res. 2023;3(1):1–15.
30. Qun; ZYTX wang. Effectiveness of a mHealth intervention on hypertension control in a low-resource rural setting: A randomized clinical trial. Front Public Heal. 2024;3(1):1–12.
31. Pujiyanto PTAER. Pengaruh Terapi Guided Imagery terhadap Perubahan Tekanan Darah pada Penderita Hipertensi di Wilayah Puskesmas Jayengan Surakarta. Aisyiyah Surakarta J Nurs. 2021;2(1):1–6.
32. Alev Yildirim Keskin; Nurhan Özpancar Şolpan; Hasan Değirmenci3. Mobile health applications for the management of primary hypertension. Nurs Heal POLICY Perspect. 2024;3(1):1–11.