ORIGINAL ARTICLE

# Effect of Education with E-Booklet Media on Self Care Management in Hypertension Patients at Community Health Center

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## ABSTRACT

**Introduction:** Hypertension affects more than one billion people globally and remains a major driver of cardiovascular morbidity. In Indonesia, prevalence is high and control rates are low, partly due to suboptimal self-care behaviors. This study evaluated whether an interactive education session supported by an electronic booklet (e-booklet) improves hypertension self-care management in Indonesian primary care. **Methods:** This study used a controlled pretest–posttest design conducted at a community health center in Pekanbaru City, Indonesia. Thirty-four adults with hypertension were allocated to an intervention group (n=17) or control group (n=17). The intervention comprised a single 30-minute structured education session delivered by a trained nurse educator using an e-booklet plus take-home access to the e-booklet, in addition to standard care. Controls received standard care and passive e-booklet provision only. The primary outcome was overall hypertension self-care management assessed using the Hypertension Self-Care Activity Level Effects (H-SCALE) and categorized into four ordinal levels based on total score. Outcomes were assessed at baseline and approximately one week later. Within-group change was examined using the Wilcoxon signed-rank test; between-group differences in change scores were tested using the Mann–Whitney U test. **Results:** Thirty-four participants were analyzed (17 per group; mean age 49.8±4.5 years; 97.1% women). At baseline, 94.1% of the intervention group and 82.4% of controls were categorized as "Poor". At follow-up, the intervention group shifted to 94.1% "Sufficient" and 5.9% "Good", whereas the control group remained primarily "Poor" (76.5%). Within-group improvement in overall category was significant in the intervention group (p=<0.001) but not in controls (p=0.317). Between groups, change scores differed strongly (p=<0.001). **Conclusion:** A single nurse-led educational session supported by an e-booklet produced a substantially greater improvement in categorized hypertension self-care management than e-booklet provision alone. Larger trials with longer follow-up and minimized contamination are warranted.
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**Keywords:** Hypertension; Self-Care Management; Health education; E-Booklet; Digital Health; Primary Care; Indonesia

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## INTRODUCTION

Hypertension is a prevalent chronic condition and a major risk factor for heart disease and stroke. Globally, an estimated 1.13 billion people had hypertension as of 2019 (1). Despite advances in antihypertensive therapy, hypertension control rates remain poor worldwide. A systematic analysis in Circulation reported that only about 13.8% of hypertensive patients achieved blood pressure control around 2010 (2). More recent global data show some improvement but still indicate that less than one-quarter of hypertensives have controlled BP, with large disparities between regions (3). In low and middle income countries, control rates can be especially low. For example, in China and Indonesia, fewer than 10% of all hypertensive individuals have their blood pressure under control (4). This gap between hypertension prevalence and control underscores a pressing public health challenge.

Indonesia exemplifies these challenges. The 2018 Basic Health Survey reported a hypertension prevalence of 34.1% among adults, translating to over 80 million people . However, fewer than 1 in 10 Indonesian hypertensive patients achieve adequate Blood Pressure (BP) control (3). Multiple factors contribute to this poor control. While clinical inertia and healthcare access play roles, a critical issue is suboptimal patient self-care and adherence to therapy (3,5). Effective hypertension

management requires patients to actively engage in behaviors such as taking medications as prescribed, consuming a low-sodium diet, exercising regularly, abstaining from smoking, and limiting alcohol intake. These lifestyle and self-management practices are proven to help lower blood pressure and complement pharmacological treatment. Unfortunately, adherence to such recommendations is generally low, both globally and in Indonesia. Patients often struggle to make sustained behavior changes due to factors like limited knowledge of hypertension, low perceived risk, cultural dietary preferences, lack of motivation or self-efficacy, and insufficient support systems (6).

Health education interventions are widely regarded as key to improving self-care in chronic diseases like hypertension. Educational approaches grounded in behavioral theory can be especially effective(7) . One pertinent framework is the Health Belief Model (HBM), which posits that individuals adopt healthy behaviors based on their perceived susceptibility to a condition, the perceived severity of its consequences, the perceived benefits of the behavior, perceived barriers, cues to action, and self-efficacy (7). In the context of hypertension, HBM suggests that patients are more likely to adhere to self-care if they feel at risk of serious complications (e.g. stroke), believe those complications are severe, understand that lifestyle changes and medications can prevent those outcomes, perceive only manageable barriers to doing so, receive reminders or encouragement, and have confidence in their ability to act. Among these, self-efficacy (confidence in one's ability to perform a behavior) is particularly crucial. According to Bandura's Social Cognitive Theory, higher self-efficacy enhances motivation and perseverance in maintaining health behaviors (6). Indeed, studies have found that hypertensive patients with greater self-efficacy are significantly more consistent in medication adherence, diet, and exercise, resulting in better BP outcomes. Conversely, low self-confidence and motivation are common barriers to adherence reported by patients. Therefore, interventions to improve hypertension self-care should not only impart knowledge but also address patients' beliefs and confidence (for example, by demystifying medications, debunking myths, and sharing success stories to inspire hope) (6).

Several studies worldwide demonstrate the positive impact of educational interventions on hypertension outcomes. For example, a systematic review noted that structured patient education improves knowledge and empowers patients to make lifestyle modifications for blood pressure control (8). Randomized trials have found that lifestyle counseling such as advice on diet (e.g. adopting the DASH diet), physical activity, and reduced alcohol consumption can significantly lower blood pressure when adhered to (6). However, the effectiveness of educational interventions can vary widely depending on factors like the content, delivery method, intensity/duration of education, and the level of patient engagement (8). Traditional methods of patient education in clinics include one-on-one counseling by healthcare providers, group classes, printed pamphlets or booklets, and mass media campaigns. Face-to-face counseling is often regarded as the gold standard because it allows personalized interaction, immediate feedback, and clarification of doubts. Indeed, direct counseling has been shown to be more effective in improving patient knowledge and behavior change compared to passive methods like handing out brochures. However, in busy primary care settings, time and resource constraints can limit the extent of individualized education provided.

Printed booklets and leaflets are commonly used to reinforce verbal counseling, they provide a take-home resource for patients. While printed booklets can improve knowledge to some extent, they often have limited impact on behavior change if used alone without interactive education. Many patients might not read or fully understand written materials unless actively engaged or given guidance on how to apply the information. Recognizing these limitations, there is increasing interest in digital health education tools as alternatives or supplements to traditional print media. One such tool is the electronic booklet or "e-booklet", essentially a digital interactive health education booklet accessible on devices like smartphones, tablets, or computers. E-booklets combine the familiarity and structured content of a paper booklet with advantages of technology: they are cost-effective to distribute (e.g., via messaging apps or email), easily scalable, and can incorporate multimedia elements (images, infographics, hyperlinks, videos) to enhance understanding and engagement. They also capitalize on the widespread use of smartphones, in Indonesia, smartphone penetration is high even among older adults, enabling patients to conveniently revisit the information anytime and even share it with family members. Furthermore, digital content can be quickly updated if guidelines change, unlike static printed matter.

Although educational interventions are known to be beneficial, it is important to evaluate them in specific local contexts and using modern delivery methods. In Indonesia, few studies have examined the efficacy of e-booklet based education for hypertension self-care. Prior local research mostly involved conventional booklets or other media. For instance, Herwanti et al. (2021) provided hypertensive patients with a standard printed booklet; while this improved patients' knowledge, it had minimal effect on actual self-care behaviors, presumably because there was no interactive counseling or reinforcement (9). Another study by Wulandari et al. (2024) in Malang, Indonesia, found that using an e-booklet in a school setting significantly increased high school students' knowledge about hypertension prevention (10). Similarly, Anam et al. (2024) reported that training community health volunteers to deliver

hypertension education with an e-booklet led to improvements in patient knowledge and medication adherence in West Java (11). These studies suggest that e-booklets can be effective educational media. However, many did not examine comprehensive lifestyle behavior outcomes, or they lacked a control group for comparison. Moreover, most international studies on digital interventions for hypertension (e.g. smartphone apps, text messaging programs) have been conducted in high-income countries or urban tertiary settings. The applicability of those findings to a primary care context in Indonesia – with different patient demographics, health literacy levels, and resource constraints – is not guaranteed. Thus, there is a clear need for controlled trials in the Indonesian primary care setting to test how combining digital tools with personal counseling might influence multifaceted self-care outcomes (like medication adherence, diet, and exercise all together).

This study is among the first in Indonesia to evaluate an educational intervention combining face-to-face interactive education with an e-booklet to support hypertension self-care management in a primary care setting. The intervention was informed by behavioral concepts, particularly the Health Belief Model and self-efficacy principles, to address not only knowledge but also perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and confidence in carrying out self-care behaviors. By comparing the intervention with a control group that received usual care and the same informational e-booklet without structured education, this study sought to identify the added value of the interactive educational component. The findings are expected to contribute to the broader literature by providing evidence from a low- to middle-income primary care context. If shown to be effective, this practical approach may be adapted in similar settings to strengthen hypertension self-care and support better blood pressure control. In summary, this study addresses the gap between knowledge and practice through a pragmatic educational strategy, namely a structured e-booklet-supported education session designed to empower patients with hypertension in self-care management.

The primary objective of this study was to determine whether an e-booklet-based educational intervention, consisting of a single structured interactive education session supported by a digital booklet, could improve self-care management among patients with hypertension compared with usual care and passive provision of the booklet alone. The main outcomes of interest included overall self-care management and changes in key self-care domains, such as medication adherence, dietary practices, physical activity, weight management, smoking exposure, and alcohol-related behavior, as assessed using the H-SCALE. The intervention was designed using behavioral theory to support the educational content and delivery; however, the main evaluation focused on changes in self-care management behaviors. We hypothesized that patients receiving the e-booklet-supported educational intervention would demonstrate greater improvement in self-care management than those receiving standard care without structured interactive education.

## MATERIALS AND METHODS

### Research Design

This study was conducted from November 2023 to August 2024 at a community health center (Puskesmas) in Pekanbaru City, Riau Province, Indonesia. The study used a controlled pretest–posttest design in a community health center setting. Participants were patients with hypertension attending the health center during the study period who met the eligibility criteria. Eligible participants were recruited using consecutive sampling. After enrollment, participants were assigned to either the intervention group or the control group using a lottery-based allocation method. The intervention group received an educational intervention in addition to standard care, whereas the control group received standard care with informational material. Allocation was conducted using a sealed-card lottery system prepared by a research assistant who was not involved in data collection. Each card indicated assignment to either the intervention or control group, thereby providing equal opportunity for allocation to both groups. Inclusion criteria were diagnosed essential hypertension (blood pressure >140/90 mmHg or current use of antihypertensive medication), age 30–65 years, and the ability to read Indonesian, as the educational materials were provided in Indonesian. Patients with severe comorbid illnesses or cognitive impairment that could interfere with participation were excluded.

### Sample Size

The final sample consisted of 34 participants, with 17 participants in each group. The sample size reflected the number of eligible hypertensive patients available during the study period who met the inclusion criteria and consented to participate. Although no formal a priori power calculation was undertaken, the achieved sample exceeded commonly cited minimum recommendations for preliminary intervention studies when prior parameter estimates are limited. Specifically, methodological guidance has suggested a minimum of 12 participants per group for pilot work, and approximately 10–15 participants per arm for preliminary trials targeting large standardized effects. Accordingly, the sample of 17 participants per group was considered acceptable for an initial evaluation of the intervention (12–14). However, the relatively small sample size limits statistical precision and may reduce the ability to detect smaller differences, which is acknowledged as a limitation.

### Intervention Group

Patients in the intervention group received a structured educational session focusing on hypertension self-care

management, delivered by a trained nurse educator using a standardized protocol to ensure consistency across participants at the health center. The session lasted approximately 30 minutes and was conducted individually or in small groups of 2–3 patients to facilitate interaction. Education was delivered using an electronic booklet (e-booklet) as both a visual aid during the session and a take-home resource. The e-booklet, developed by the research team, contained comprehensive but easy-to-understand information about hypertension, its risks as a "silent killer," and essential self-care behaviors. It was designed with clear text, infographics, and illustrations to accommodate patients with varying levels of health literacy. The content was structured according to the Health Belief Model (HBM), including information on susceptibility (such as the prevalence of hypertension and risk of complications), severity (including heart attack and stroke), benefits of adherence (such as better quality of life and prevention of complications), and barriers to self-care (for example, strategies to reduce salt intake and remember medications). It also included motivational messages intended to support self-efficacy. During the session, the educator used the e-booklet to guide the discussion, explain each topic, and respond to participants' questions. Practical self-care tips were also introduced, such as reading nutrition labels for salt content and using reminders for medication adherence. At the end of the session, participants in the intervention group were given access to the e-booklet file so they could review it independently at home, and they were encouraged to involve family members for support and to continue applying the self-care recommendations during the one-week follow-up period. Self-care management was reassessed one week after the educational session.

**Control Group**

Participants in the control group received usual hypertension management at the community health center, including routine clinical consultations, antihypertensive medication, and standard lifestyle advice. They were also given access to the same e-booklet as informational material, but did not receive the structured educational session, interactive counseling, or reinforcement provided to the intervention group. The e-booklet was provided during routine visits in digital form or as a printed copy upon request for independent reading at home. This control condition was intended to differentiate the added value of interactive education from passive access to written information alone. Nevertheless, because the control group was exposed to the same educational material, the possibility of informational contamination may have reduced the magnitude of the observed intervention effect. Standard medical treatment was maintained in both groups throughout the study, as the intervention specifically targeted self-care management behaviors.

**Study Instruments**

The primary outcome was self-care management of hypertension, assessed using the Hypertension Self-Care Activity Level (H-SCALE) questionnaire. The H-SCALE is a validated instrument originally developed to measure the frequency of hypertension self-care behaviors over the past week across six domains: medication adherence, dietary management, physical activity, weight management, smoking, and alcohol use. In the original validation study, the H-SCALE demonstrated acceptable internal consistency across subscales, with Cronbach's α ranging from 0.67 to 0.88. An Indonesian-language version of the H-SCALE has also been used in published research in Indonesia, with a reported Cronbach's alpha coefficient of 0.73; that study stated that the questionnaire had been adapted into Indonesian from Huda et al. (2015) (15,16). In the present study, the questionnaire was administered in Indonesian through interviewer-guided data collection. It consists of multiple subscales:

**a. Medication Adherence:** Assessed by 3 items asking on how many of the past 7 days the patient (a) took all their blood pressure pills, (b) took them at the same time each day, and (c) took the prescribed dose. Each item is scored 0–7 days. We summed them (total 0–21); following the H-SCALE standard, we classified a patient as fully adherent if they reported 7 days for all three items (score = 21), and non-adherent if otherwise. We also looked at partial adherence (e.g., if a patient took meds 5–6 days a week) as needed.

**b. Dietary Sodium Reduction:** Assessed by 12 items related to low-salt and healthy dietary practices, including avoiding additional salt in food preparation and consumption, limiting salty foods, and maintaining healthier dietary habits. In the scoring framework, a score of 6 or more indicated adherence to recommended dietary practices.

**c. Weight Management:** This subscale had 10 items related to weight control behaviors (e.g., controlling portion sizes, choosing fruits/vegetables over fatty foods, exercising to control weight, etc.), each item on a 5-point Likert agreement scale (1=strongly disagree to 5=strongly agree). We summed these (range 10–50). As per literature, we defined "good" weight management as a score ≥40 (meaning the patient agrees to most healthy behaviors).

**d. Physical Activity:** 2 items asking on how many of the past 7 days the patient (a) engaged in ≥30 minutes of moderate physical activity (such as brisk walking), and (b) did a specific exercise session beyond normal daily routines. Total score 0–14 (sum of days). We defined adequate physical activity as ≥5 days/week of ≥30 min (which would correspond to a sum score ≥~10, roughly). For simplicity, we often dichotomized as meeting guideline (≥5 days) vs not.

**e. Smoking:** Assessed by 2 items asking on how many of the past 7 days the patient smoked cigarettes or cigars and how many days they were in a closed room while another person was smoking. Scores ranged from 0 to 14.

**f. Alcohol Use:** 1 item (from a standard alcohol

frequency questionnaire) asking if they drank alcohol in the past week. Following JNC7 guidelines, we classified patients as compliant if they reported 0 days of alcohol use (i.e., abstinent or only occasional minimal intake).

For a comprehensive assessment, we combined these domains to categorize overall self-care management. In accordance with the scoring framework used, the total H-SCALE score was classified into four categories: good (>154), sufficient (103–153), poor (52–102), and very poor (0–51). This composite categorization was used to describe the distribution of self-care levels in each group before and after the intervention. In addition, we examined domain-specific outcomes to identify specific changes following the educational intervention. Because translated self-report instruments ideally undergo cross-cultural adaptation procedures such as forward translation, back-translation, and expert review, these procedures should be reported explicitly if they were undertaken during instrument preparation. If formal local psychometric validation was not performed as part of the present study, this should be acknowledged as a limitation rather than overstated. Standard methodological guidance for cross-cultural adaptation recommends forward-backward translation and expert committee review to ensure semantic and conceptual equivalence (15–17).

**Data Collection Procedure**

Data collection was conducted in two stages. At baseline (pretest), all participants completed the H-SCALE questionnaire through face-to-face interviews. The interview format was used to facilitate participation and reduce difficulties related to limited reading ability. After baseline assessment, participants were allocated to the intervention or control group according to the study procedure. The intervention group received one 30-minute educational session using the e-booklet, while the control group received usual care and access to the e-booklet without structured education. Posttest assessment was conducted one week later using the same questionnaire in both groups. Because of the nature of the educational intervention, participant blinding was not feasible. Outcome assessors may be described as blinded to group allocation only if this procedure was actually implemented and documented; otherwise, the absence of formal assessor blinding should be acknowledged as a study limitation.

**Data analysis**

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize baseline characteristics. Categorical variables were presented as frequencies and percentages. Because of the outcome data were treated as ordinal and the sample size was small, within-group pretest–posttest changes in self-care management were analyzed using the Wilcoxon signed-rank test. To compare the intervention effect between groups, between-group differences in change scores were analyzed using the Mann–Whitney U test. A two-tailed p-value of $<0.05$ was considered statistically significant. Effect size should be reported alongside the main comparative analysis, and confidence intervals should be provided where available. No interim analyses were performed, and no missing outcome data were identified because all enrolled participants completed the posttest assessment.

**Ethical clearance**

The study protocol was reviewed and approved by the Health Research Ethics Committee of Pekanbaru Medical Center Hospital (No. 004/RS.PMC/Kom-Etik/VII/2024). Ethical principles of the Helsinki Declaration were adhered to. All participants provided written informed consent before enrollment, after receiving an explanation of the study aims and procedures. They were assured of confidentiality (data were anonymized) and informed of their right to withdraw at any time without affecting their medical care. Because the study involved an educational intervention with minimal risk, there were no specific safety concerns. Nonetheless, we monitored for any discomfort or adverse effects (e.g., if a patient felt anxious about the lifestyle changes) and provided appropriate support. After study completion, the control group was offered an optional educational session to ensure they also benefited from any effective intervention (this was part of ethical consideration to provide eventual access to the intervention).

## RESULTS

**Respondent characteristics**

A total of 34 patients with hypertension participated in this study, with 17 respondents in the intervention group and 17 respondents in the control group. The demographic characteristics of the respondents are shown in Table I. Most respondents were women (n = 33, 97.1%). More than half were aged 40–50 years (n = 18, 52.9%), while the remaining respondents were aged 51–60 years (n = 16, 47.1%). In terms of education level, respondents were equally distributed between junior high school and senior high school education, with 17 respondents (50.0%) in each category. Most respondents were housewives (n = 24, 70.6%).

**Self-care management before and after intervention**

The distribution of self-care management categories before and after the intervention is presented in Table II. At baseline, most respondents in both groups had poor self-care management. In the intervention group, 16 respondents (94.1%) were categorized as poor, while only one respondent (5.9%) was categorized as sufficient. In the control group, 14 respondents (82.4%) were categorized as poor and three respondents (17.6%) were categorized as sufficient.

After the intervention, the intervention group showed a clear improvement in self-care management. Most

**Table I: Data distribution of respondent characteristcs of hypertension patients in the Rejosari Health Center Area**

| Variables | Frequency (F) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Man | 1 | 2.9 |
| Woman | 33 | 97.1 |
| **Age** | | |
| 40-50 Years | 18 | 52.9 |
| 51-60 Years | 16 | 47.1 |
| **Education** | | |
| Junior High School | 17 | 50 |
| Senior High School | 17 | 50 |
| **Work** | | |
| Housewife | 24 | 70.6 |
| Trader | 9 | 26.5 |
| Self-employed | 1 | 2.9 |

**Table II: Distribution of Self-Care Management Categories Before and After Intervention**

| Group | Time point | Good n (%) | Sufficient n (%) | Poor n (%) | Very poor n (%) |
|---|---|---|---|---|---|
| Intervention | Pre-test | 0 (0.0) | 1 (5.9) | 16 (94.1) | 0 (0.0) |
| Intervention | Post-test | 1 (5.9) | 16 (94.1) | 0 (0.0) | 0 (0.0) |
| Control | Pre-test | 0 (0.0) | 3 (17.6) | 14 (82.4) | 0 (0.0) |
| Control | Post-test | 0 (0.0) | 4 (23.5) | 13 (76.5) | 0 (0.0) |

*Note. Values are presented as frequency and percentage. The table combines the original pre-test and post-test category distributions for the intervention and control groups.*

respondents shifted to the sufficient category (n = 16, 94.1%), and one respondent (5.9%) reached the good category. In contrast, the control group showed only minimal change, with 13 respondents (76.5%) remaining in the poor category and four respondents (23.5%) categorized as sufficient.

### Effect of e-booklet-based education on self-care management

The statistical analysis of self-care management scores is shown in Table III. In the intervention group, the mean self-care management score increased from 94.59 at pretest to 107.65 at posttest. The Wilcoxon signed-rank test showed a significant improvement in self-care management after the e-booklet-based educational intervention ($p < 0.001$). In contrast, the control group showed a smaller increase in mean score, from 90.35 at pretest to 96.00 at posttest, which was not statistically significant ($p = 0.317$).

The between-group analysis showed that the improvement in self-care management was significantly greater in the intervention group than in the control group ($p < 0.001$). These findings indicate that structured education using e-booklet media was more effective than usual care with passive e-booklet provision alone in improving self-care management among patients with hypertension.

**Table III: Effect of E-Booklet Education on Self-Care Management among Patients with Hypertension**

| Group | n | Pretest mean | Posttest mean | With-in-group p-value | Between-group p-value |
|---|---|---|---|---|---|
| Intervention | 17 | 94.59 | 107.65 | <0.001 | <0.001 |
| Control | 17 | 90.35 | 96.00 | 0.317 | |

*Note. Within-group comparisons were analyzed using the Wilcoxon signed-rank test. Between-group comparison was analyzed using the Mann-Whitney U test.*

## DISCUSSION

This study showed that an e-booklet-supported educational intervention improved overall self-care management among patients with hypertension in a primary care setting. Compared with the control group, participants in the intervention group demonstrated a greater improvement in self-care management after receiving a structured face-to-face educational session supported by the e-booklet. In contrast, the control group, which received usual care and access to the same e-booklet without structured education, showed only minimal change. These findings support the view that effective patient education is not merely the provision of written information, but an active process that involves explanation, interaction, and reinforcement of understanding.

The present findings are generally consistent with previous studies showing that educational interventions can improve hypertension-related self-care behaviors. For instance, Beigi et al. (2014) found that a structured education program increased patients' hypertension knowledge and healthy lifestyle adoption, which translated into better blood pressure control (18). In this study, the intervention was associated with improvement in overall self-care management, particularly in domains related to medication-taking behavior, dietary practices, physical activity, and weight management. These findings are in line with previous work showing that patient-centered education can contribute to better self-management among people with hypertension. However, the current study should be interpreted cautiously, because its primary outcome was self-care management rather than direct clinical endpoints such as sustained blood pressure reduction. A comparable magnitude of improvement was seen in an Iranian study (Farahmand et al., 2019), where 87.5% of patients in an education and follow-up program had controlled blood pressure after 3 months, versus only 23.1% in the control group (19). Farahmand's study, like ours, underscores that educated patients not only change behaviors but also reap tangible health benefits (in their case, significantly more patients reaching target BP). Another study in Indonesia by Lukitasari et al. (2021) reported that educating community health workers led

to patients' medication adherence jumping from 20% to 70% (3), a result in line with the robust improvements we observed with direct patient education. These comparisons highlight that investing in education yields returns in the form of better-managed hypertension.

The observed improvement in the intervention group may be interpreted through the lens of behavioral theory, particularly the Health Belief Model and self-efficacy concepts that informed the intervention design. The educational session was intended not only to increase knowledge, but also to strengthen patients' perception of susceptibility to complications, awareness of disease severity, understanding of the benefits of adherence, and ability to overcome practical barriers in daily self-care. The interactive format may also have enhanced confidence in carrying out behaviors such as taking medication regularly, reducing salt intake, and adopting simple physical activity routines. In this sense, the intervention appears to have supported the transition from information to action by combining educational content with direct explanation and patient engagement. According to Bandura, such mastery and positive reinforcement enhance self-efficacy (6), which in turn improves persistence in behavior change. Indeed, patients in the intervention group often reported in follow-up that "I now know I can do this" or that they involved family to encourage them – reflecting both increased self-efficacy and social support (another key factor in behavior change). On the other hand, the control group lacked these elements; they only had written advice with no personal engagement, thus it's unsurprising that their motivation and behaviors remained largely unchanged. Our findings therefore empirically support these theoretical constructs: knowledge is necessary but not sufficient, understanding, motivation, and confidence are the triad that drives self-care.

The results of this study are in agreement with many international studies emphasizing the importance of patient-centered education in chronic disease management. For example, a recent quasi-experimental study in Iran applying HBM to hypertensive older adults found significant improvements in all HBM constructs (knowledge, perceived severity, benefits, etc.) and in self-care behaviors after an HBM-based educational intervention (7). That study's conclusion was that HBM-based education is an effective framework to promote hypertension self-care (7), which aligns with our use of a theoretical framework to guide education content. In the realm of digital interventions, various studies (often in high-income countries) have explored mobile apps or text messaging; a systematic review suggested that such digital interventions can support medication adherence and lifestyle changes, especially when they provide personalized feedback (8). Our use of a digital medium (e-booklet) is conceptually similar it leverages technology to disseminate information but combined it with human interaction for personalization. This hybrid approach likely contributed to its success. It is worth noting that merely giving an e-booklet (as we did with the control group) did not yield results, whereas other digital interventions that include interactive or intelligent components do show benefits (8). This implies that interactivity is a critical ingredient, whether delivered by humans or smart technology. Our study also underscores cultural/contextual factors: all participants had access to phones and were receptive to receiving information digitally, which is promising for scalability in Indonesia. However, some needed assistance to actually use the digital material (especially older patients not tech-savvy). This highlights that technology should complement, not replace, human touch in patient education, at least in our setting.

Another practically relevant observation is the potential contribution of family support. During the intervention period, patients were encouraged to review the educational material at home and involve family members in supporting self-care practices. In the Indonesian primary care context, where family plays an important role in daily health management, such support may help patients sustain recommended behaviors. International literature, such as studies in family-based interventions, similarly point out that social support significantly enhances adherence (6). Although family involvement was not formally measured in this study, it may represent an important pathway through which educational interventions can be strengthened in future programs.

The limited change observed in the control group is also informative. It indicates that the simple distribution of educational material without structured explanation may not be sufficient to improve self-care behavior in this patient population. Patients may have access to information, but still need guided interpretation and practical support to translate information into daily action. This reinforces the importance of interactive, patient-centered communication in hypertension management and suggests that educational media are most effective when used together with direct professional guidance.

The control group's lack of improvement is itself a finding that deserves attention. It indicates that providing health education materials without context or engagement yields minimal benefit, at least in our patient population. This supports what healthcare practitioners often anecdotally observe – pamphlets and brochures in clinic waiting rooms often go unread or fail to influence behavior. Patients may not have the motivation to proactively absorb the information, or they may not fully understand it without someone explaining it in relation to their own life. Our control results mirror Herwanti et al. (2021), who found no change in self-care behavior when hypertension education was delivered just via a booklet without interactive discussion (9). Passive education

alone is largely ineffective. A practical lesson for health providers is that simply handing out educational media is not enough; follow-up and personalized counseling are essential to translate knowledge into practice. As one reference noted, "face-to-face counseling is expected to be more effective than counseling conducted through mass media, which precisely encapsulates what we observed.

Despite the clear positive outcomes, this study has several limitations. First, the sample size was small (34 patients) and drawn from a single health center, which may affect the generalizability of the findings. The patients were mostly middle-aged adults in an urban Indonesian setting; results might differ in rural areas or different age groups (e.g., younger hypertensives might respond differently to e-booklets). A larger multi-center trial would be valuable to confirm these results and ensure they apply broadly. Second, the duration of follow-up was short (only one week post-intervention). We demonstrated short-term improvement in self-care behaviors, but it is unknown whether patients will maintain these behaviors long-term. Adherence might wane over time without ongoing support. Future studies should include longer follow-up (6 months, 1 year) to assess sustainability of the intervention's impact. Third, our outcome measures relied on self-reported behavior (questionnaire responses). Although we used a validated instrument and assured confidentiality to encourage honesty, some patients might have over-reported healthy behaviors at posttest due to social desirability bias (wanting to please the researcher). Objective measures, like electronic pill counts or urinary sodium excretion for salt intake, were not used but could strengthen future research. Fourth, blinding was limited participants knew their group, and this could influence responses. We mitigated this by having different personnel collect outcome data and stressing the importance of truthful answers for both groups. Fifth, we did not directly measure clinical outcomes such as actual blood pressure changes in a controlled manner (BP was recorded but not the primary outcome). While we infer clinical benefit from behavior change (supported by other studies showing BP reduction with lifestyle changes (19)), demonstrating a direct improvement in blood pressure or reduction in hypertensive complications would provide stronger evidence of intervention efficacy. Sixth, the e-booklet we developed was specific and not formally tested in a pilot for usability due to time constraints. Some patients in the intervention group needed assistance in navigating the e-booklet initially, which suggests that user-friendliness of digital materials can be an issue for older or less tech-savvy individuals. Ensuring materials are easy to use for all literacy levels is important. Lastly, there might have been an enthusiastic educator bias the nurse delivering the intervention was part of the research team and highly motivated, which might differ from routine care conditions. In practice, scaling this might require training many healthcare providers or volunteers to deliver the intervention with similar fidelity and enthusiasm.

The evidence from this study suggests several practical steps. Primary healthcare facilities should consider implementing structured educational interventions for hypertension routinely. Even a one-time education session, if well-designed, can lead to significant improvement in patient self-care. The use of digital media like e-booklets should be embraced as part of health education, especially as smartphone penetration increases. E-booklets can be distributed widely at virtually no marginal cost for example, via messaging apps or clinic websites. They can also be updated easily when guidelines change, unlike printed materials. However, as seen in our study, the e-booklet works best in tandem with direct counseling. Thus, a blended approach is ideal: healthcare providers (doctors, nurses, nutritionists) can conduct brief counseling using digital aids, and then patients take home (or have on their phone) the e-booklet for reinforcement. This strategy can be integrated into the workflow of chronic disease management at puskesmas (community clinics). For instance, group education sessions can be scheduled weekly where patients and their family members watch an interactive presentation (projecting the e-booklet on a screen) and discuss among themselves, guided by a nurse. Additionally, involving community health workers or family members to follow up with patients (like reminding them to check blood pressure or supporting diet changes) could maintain the momentum initiated by the intervention. Given the role of family noted earlier, educational programs could invite spouses or children to participate, creating a supportive home environment for the patient.

At the healthcare system level, policy-makers should allocate resources for preventive education as part of hypertension programs. The cost of developing and disseminating an e-booklet is relatively minor compared to the potential benefits of better BP control (which can reduce costly complications). Training for healthcare staff on patient communication and counseling is also vital as our results show, knowledge transfer alone is insufficient without effective communication techniques. Our study provides a concrete example of this in practice. Building on our findings, future research can explore a few avenues. One, as mentioned, is to test the longevity of behavior change maybe by adding booster sessions at 3 or 6 months and seeing if that helps maintain adherence. Two, future studies should compare whether video-based education or interactive mobile applications yield similar or better results. Further research may also evaluate whether adding an SMS reminder program to the e-booklet intervention can further improve adherence. A study in JMIR noted that tailored text message reminders can improve self-management behavior (20,21); combining such technology with our approach could be beneficial.

Three, expanding to other populations – for instance, using e-booklets for younger patients or for patients with co-morbid conditions like diabetes (where self-care is also crucial). Four, health-economic analysis: it would be valuable to calculate whether this intervention reduces healthcare utilization (like fewer ER visits for hypertensive urgencies) or improves quality of life for patients. While our study wasn't designed for that, if such outcomes can be demonstrated, it provides even stronger justification for implementation. Lastly, qualitative research could complement our quantitative findings by exploring patients' experiences, including which aspects of the e-booklet and counseling they found most helpful and whether they faced challenges in following the advice.

In summary, the discussion indicates that targeted educational interventions supported by e-booklet media can improve hypertension self-care management when delivered through a structured and interactive approach. The stronger improvement seen in the intervention group suggests that many patients are able to modify their self-care behavior when they receive clear explanation, practical guidance, and motivational support. At the same time, the limited effect of passive booklet provision alone highlights that health education should not rely solely on information distribution. Instead, patient-centered, theory-informed, and interactive strategies appear more promising for strengthening self-care management in primary care.

## CONCLUSION

In conclusion, this study showed that an e-booklet-supported educational intervention improved overall self-care management among patients with hypertension in a primary care setting. Compared with usual care and passive provision of the booklet alone, the intervention group demonstrated greater improvement after receiving a structured face-to-face educational session supported by the e-booklet. These findings highlight the importance of active educational engagement in hypertension management. Educational interventions that combine accessible digital material with direct explanation may help patients better understand and implement self-care behaviors in daily life. Although further studies with larger samples and longer follow-up are still needed, the present findings suggest that this approach has practical potential for strengthening hypertension self-care management in Indonesia and similar settings.

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