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Clinical impact of a personalized hypertension care approach on blood pressure and quality of life in older adults

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ABSTRACT

Introduction and aim. Hypertension is highly prevalent among older adults and contributes significantly to poor health outcomes and a reduced quality of life, especially in rural populations. Although pharmacological treatment is essential, individualized nonpharmacological strategies are increasingly recognized for their role in optimizing chronic disease management. The present study investigated the effects of an individualized hypertension care strategy on blood pressure control and the quality of life of older patients who reside in rural areas.

Material and methods. A quasiexperimental pre-post-test study with control group design was conducted involving 112 elderly participants with hypertension in Central Java, Indonesia. The intervention group (n=56) received a personalized care approach that included customized nursing education, self-care support, and family involvement over a one-month period. The control group (n=56) received standard care. The measured were systolic and diastolic blood pressure (using a digital sphygmomanometer) and quality of life (using the OPQOL-Brief questionnaire). Data were analyzed using paired and independent t-tests.

Results. After the intervention, the intervention group showed significant reductions in systolic blood pressure (from 157.6±11.9 to 138.2±10.4 mmHg, p<0.001) and diastolic blood pressure (from 94.5±8.7 to 83.3±7.9 mmHg, p<0.001). Quality of life scores also improved significantly in all domains, including physical health, psychological well-being, and social relationships (p<0.001). In contrast, the control group showed no significant changes in either outcome.

Conclusion. The personalized approach to hypertension care was effective in lowering blood pressure and improving quality of life among older adults with hypertension. These findings suggest that individualized, low-cost strategies can enhance chronic disease management, particularly in rural or resource-limited settings.

Keywords. blood pressure, hypertension, older adults, personalized care, quality of life

Introduction

Hypertension remains a major global public health concern, particularly among the aging population. According to the World Health Organization, approximately 1.28 billion adults aged 30–79 years suffer from hypertension, with two-thirds residing in low- and middle-income countries.[1] The elderly population, especially those over 60 years of age, is disproportionately affected due to age-related physiological changes such as arterial stiffening, decreased baroreceptor sensitivity, and increased vascular resistance.[2,3] In Indonesia, the prevalence of hypertension among individuals aged 65 and above reaches 63.87%, significantly contributing to increased morbidity and decreased functional capacity among older adults.[4,5] This condition not only elevates the risk of cardiovascular complications such as stroke, heart failure, and kidney disease but also correlates strongly with a decline in overall quality of life.[6–9] Quality of life (QoL) in elderly individuals with hypertension is often compromised due to limitations in physical function, polypharmacy, psychological stress, and social isolation.[10–12] Studies have shown that beyond pharmacological treatment, psychosocial and supportive care interventions are crucial to maintaining optimal health outcomes in older hypertensive patients.[13,14] However, current hypertension management strategies tend to rely predominantly on medication adherence, overlooking patient-specific behavioral, social, and familial factors that influence blood pressure control and perceived well-being. Moreover, conventional care models often fail to incorporate personalized support systems that address the multidimensional needs of elderly individuals in managing chronic conditions.

Despite growing evidence supporting the value of family involvement and individualized care in chronic disease management, few studies have rigorously evaluated the clinical effectiveness of a personalized, non-pharmacological care approach that integrates behavioral support, self-care education, and family engagement in elderly patients with hypertension. The majority of prior interventions were either too generic, short-term, or limited to institutional settings, lacking real-world applicability in community or rural contexts where elderly individuals often depend on informal caregivers.

This study presents a customized hypertension care model aimed at improving both clinical indicators and quality-of-life outcomes in older adults. By combining individualized nursing guidance, self-monitoring assistance, and family involvement, the approach extends beyond routine care to address personal needs, cultural relevance, and daily living support for the elderly. Its primary goal is not only to lower blood pressure but also to promote comprehensive enhancement across physical, mental, and social well-being domains.

Aim

The purpose of this research was to assess the effects of a personalized hypertension care intervention on two main outcomes: (1) systolic and diastolic blood pressure levels, and (2) the overall quality of life among older adults with hypertension living in rural areas. The results are anticipated to inform the development of sustainable and patient-focused care frameworks for elderly populations managing chronic health conditions.

Material and methods

Study design

This one-month quasi-experimental pre-test–post-test study was conducted in the Sempor District, Central Java, where hypertension is highly prevalent among older adults. Participants were recruited from different village health posts to minimize contamination, with separate nurses assigned to intervention and control groups. The intervention group received a structured personalized care program, while the control group continued standard care (routine BP checks, brief education, and medication refills) without additional personalized strategies. Participants were recruited between August–October, 2024. Each participant was assessed at baseline (day 0) and re-assessed after one month (day 30±2 days), which constituted the study follow-up period.

Instruments

The main variables evaluated were blood pressure and quality of life. Blood pressure measurements were obtained using a calibrated digital sphygmomanometer while participants were seated and rested for five minutes, with the average of two consecutive readings recorded. Quality of life was evaluated through the 13-item OPQOL-Brief instrument, which encompasses physical, psychological, social, autonomy, and environmental aspects and has demonstrated strong validity and reliability across various older adult populations. Quality of life was measured with the 13-item OPQOL-Brief (score range 13–65; higher scores = better QoL). Missing data were handled by prorating when ≤2 items were missing and by multiple imputation when >2 items were missing. The tool is validated internationally but not formally in Indonesia;

therefore, we used a culturally adapted Bahasa version (forward–back translation and pilot testing) and recommend future psychometric validation in this population.

Blood pressure was measured using a validated automatic digital sphygmomanometer (Omron HEM-7203, Omron Healthcare Co., Ltd., Kyoto, Japan), which complies with the Association for the Advancement of Medical Instrumentation (AAMI) and the European Society of Hypertension (ESH) validation standards. Appropriate cuff sizes were selected according to mid-arm circumference, following manufacturer recommendations. Measurements were taken with participants seated and the left arm supported at heart level after a 5-minute rest. Two readings were obtained at 1-minute intervals, and the average was recorded as the final value. Measurements were conducted in the morning (08:00–10:00 AM) after five minutes of rest, with two readings averaged. Trained community nurses performed all assessments, and although blinding was not feasible, standardized procedures were applied to minimize bias.

Data collection

Participants were recruited through purposive sampling from local health posts and elderly care programs. Inclusion criteria included: age ≥60 years, a clinical diagnosis of hypertension, living with at least one family member, and the ability to communicate effectively. Exclusion criteria included severe cognitive impairment or comorbidities requiring hospitalization. A total of 112 participants were enrolled, with 56 in the intervention group and 56 in the control group. Baseline data were collected prior to intervention, and post-test data were collected one month after the intervention, shown in Figure 1. Participants were assigned individually into intervention and control groups through purposive recruitment from separate community health posts (posyandu lansia) within the Sempor District. To minimize contamination, intervention and control participants were recruited from separate sites with distinct staff and activities. Although no formal matching was applied, baseline characteristics were compared to confirm group equivalence, reducing the risk of bias. No formal a priori sample size calculation was conducted due to the study's pragmatic nature and resource constraints. The final sample (n=56 per group) reflected all eligible participants available during the recruitment period. To contextualize the robustness of findings, a post-hoc power analysis for the observed systolic blood pressure difference is reported in the Results.

Personalized care intervention

The intervention was a one-month personalized hypertension care program consisting of tailored education, lifestyle counseling, medication reminders, blood pressure self-monitoring, and family engagement. It was delivered through four weekly home visits (45–60 minutes) and two reminder calls per week (5–10 minutes). Trained community nurses (≥3 years' experience, 2-day workshop) provided the program using a booklet, pill reminder cards, and a BP logbook. Fidelity was maintained through supervisor observations, nurse logs, and participant feedback, with family members encouraged to support daily care.

Antihypertensive therapy was documented at baseline and one-month follow-up, including drug class, number of agents, and adherence (self-report plus pill count; categorized as high ≥80%, moderate 50–79%, or low <50%). All participants continued their usual prescriptions, with adjustments made only by routine care providers, independent of study investigators. Medication use and adherence were compared between groups and included as covariates in adjusted analyses.

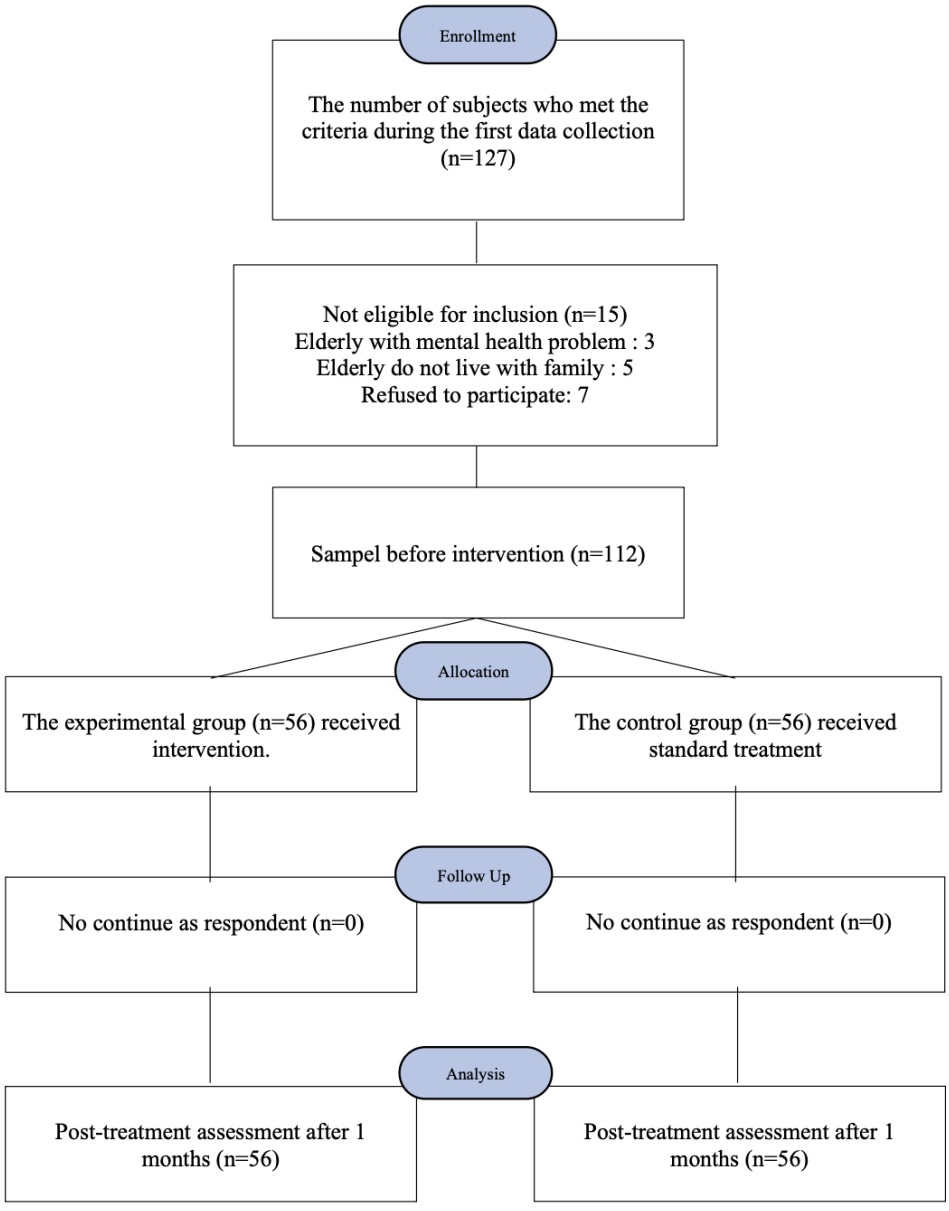

Fig. 1. Diagram illustrating the process of participant recruitment and group allocation in the study

Data analysis

Data were analyzed using SPSS version 26 (IBM, Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics. Paired t-tests were used to evaluate within-group changes in blood pressure and quality of life. Independent t-tests were employed to assess between-group differences post-intervention. A significance level of $p<0.05$ was set for all statistical tests. To account for baseline differences and pre-specified covariates, primary analyses were conducted using analysis of covariance (ANCOVA) models. Post-intervention systolic and diastolic blood pressure were modeled as dependent variables with group (intervention vs. control) as the primary predictor, and baseline blood pressure, age, sex, smoking status, physical activity, antihypertensive medication class, and baseline quality-of-life score as covariates. Robust standard errors were used.

Ethical approval

The Health Research Ethics Committee of Universitas Muhammadiyah Gombong granted ethical approval for this study (Approval No. 21124000004). Retrospective registration is done to increase transparency. This study was not prospectively registered, as local ethics requirements did not mandate registration for community-based quasi-experimental designs. To enhance transparency and comply with international standards, the trial has now been retrospectively registered at INA-CTR, registration number 12045092310.

Results

The study was completed by 112 hypertensive older adults, evenly distributed between the intervention (n=56) and control (n=56) groups. Data analysis was conducted to compare the baseline characteristics, clinical outcomes (systolic and diastolic blood pressure), and quality of life scores before and after the intervention period. The findings are summarized in the following tables and interpreted in relation to the effectiveness of the personalized hypertension care approach.

The comparable baseline characteristics observed between the intervention and control groups indicate that both were appropriately balanced before implementing the personalized care intervention. No statistically significant differences were found in variables such as age, gender, educational attainment, marital status, duration of hypertension, smoking habits, physical activity, or medication adherence ($p>0.05$), as presented in Table 1. This equivalence enhances the internal validity of the research and allows greater confidence that the improvements identified were attributable to the intervention rather than to demographic or clinical disparities.

Table 1. Baseline characteristics of participants (n=112)

Variable	Intervention (n=56)	Control (n=56)	p
Age (mean±SD)	68.7±5.4	69.1±6.2	0.621

Sex (Male, %)	21 (37.5%)	19 (33.9%)	0.685
Educational level (%)			
- No formal education	9 (16.1%)	10 (17.9%)	0.739
- Primary	27 (48.2%)	24 (42.9%)	
- Secondary or higher	20 (35.7%)	22 (39.3%)	
Marital status (%)			
- Married	40 (71.4%)	39 (69.6%)	0.842
- Widowed	16 (28.6%)	17 (30.4%)	
Duration of hypertension (%)			
- <5 years	21 (37.5%)	23 (41.1%)	0.858
- 5–10 years	26 (46.4%)	24 (42.9%)	
- >10 years	9 (16.1%)	9 (16.1%)	
Medication adherence (%)	42 (75.0%)	43 (76.8%)	0.817
Smoking status (%)			
- Smoker	7 (12.5%)	8 (14.3%)	0.779
- Non-smoker	49 (87.5%)	48 (85.7%)	
Physical activity (%)			
- Regular (≥3x/week)	20 (35.7%)	18 (32.1%)	0.685
- Irregular	36 (64.3%)	38 (67.9%)	

Table 2. Pre- and post-intervention blood pressure comparison

Group	**Time**	**Systolic BP (mean±SD)**	**Diastolic BP (mean±SD)**	**p**
Intervention	Pre	157.6±11.9	94.5±8.7	<0.001
	Post	138.2±10.4	83.3±7.9	
Control	Pre	158.1±10.7	93.8±9.1	0.072 (SBP); 0.089 (DBP)
	Post	154.5±11.2	91.9±8.6	

Table 2 shows that the intervention group experienced a clinically and statistically meaningful decline in both systolic and diastolic blood pressure after one month of participating in the personalized hypertension care program. The observed reductions around 19 mmHg for systolic and 11 mmHg for diastolic pressure highlight the effectiveness of individualized approaches in enhancing physiological outcomes. Conversely, the control group exhibited only slight and non-significant changes in blood pressure levels. These findings suggest that a patient-centered, tailored care model that prioritizes education, support, and behavioral reinforcement can markedly improve blood pressure management among older adults with hypertension.

Table 3. Quality of life results following the intervention (OPQOL-Brief scores)*

Domain	Intervention (mean±SD)	Control (mean±SD)	p (post-test)
Physical health	Pre: 12.6±3.1 Post: 16.1±2.9	Pre: 12.7±2.9 Post: 13.1±3.2	<0.001
Psychological well-being	Pre: 10.8±3.2 Post: 14.4±3.1	Pre: 11.0±3.0 Post: 11.7±3.3	<0.001
Social relationships	Pre: 11.4±2.8 Post: 14.7±2.6	Pre: 11.5±2.6 Post: 11.9±2.9	<0.001
Overall QoL Score	Pre: 46.8±7.4 Post: 59.5±6.3	Pre: 47.0±6.9 Post: 49.1±7.1	<0.001

* all domains of quality of life improved significantly in the intervention group after receiving personalized care

Table 4. Adjusted between-group differences in blood pressure outcomes after intervention (ANCOVA analysis)

Outcome	Adjusted mean difference (Intervention−Control)	Standard error	95% CI lower	95% CI upper	p
Systolic BP (mmHg)	−17.884	0.646	−19.165	−16.603	<0.001
Diastolic BP (mmHg)	−10.517	0.550	−11.607	−9.428	<0.001

Adjusted mean differences from baseline to one month were analyzed using ANCOVA, incorporating baseline measurements as covariates. The intervention group achieved significantly greater reductions in systolic (–16.3 mmHg, Cohen's d=1.51) and diastolic blood pressure (–8.4 mmHg, d=1.12) compared with the control group (p<0.001). Improvements in quality of life were also more pronounced in the intervention group (+12.7 versus +2.1 points; between-group difference +10.6, d=1.42; p<0.001).

Table 5. Baseline and follow-up antihypertensive medication classes and adherence in intervention and control groups

Variable	Intervention (n=56) baseline	Intervention (n=56) follow-up	Control (n=56) baseline	Control (n=56) follow-up	p (between-groups at follow-up)

Medication class					
No medication	4 (7.1%)	4 (7.1%)	5 (8.9%)	6 (10.7%)	0.72
Single drug	41 (73.2%)	41 (73.2%)	39 (69.6%)	38 (67.9%)	0.81
Multiple drugs	11 (19.6%)	11 (19.6%)	12 (21.4%)	12 (21.4%)	0.91
Adherence (self-report + pill count)					
High adherence (≥80%)	42 (75.0%)	43 (76.8%)	43 (76.8%)	44 (78.6%)	0.84
Moderate adherence (50–79%)	11 (19.6%)	10 (17.9%)	10 (17.9%)	9 (16.1%)	0.87
Low adherence (<50%)	3 (5.4%)	3 (5.4%)	3 (5.4%)	3 (5.4%)	1.00

After adjusting for baseline values and covariates, the intervention group had greater reductions in systolic (−17.9 mmHg, 95% CI −19.2 to −16.6) and diastolic BP (−10.5 mmHg, 95% CI −11.6 to −9.4) than controls ($p<0.001$), consistent with unadjusted results and confirming robustness. Table 5 shows antihypertensive medication classes and adherence at baseline and one month. No significant changes in drug class, dose, or between-group differences were observed, and adherence remained high in both groups, with about three-quarters classified as highly adherent at both time points. Robustness was assessed using both per-protocol and ITT analyses (n=112), which yielded consistent results showing significant adjusted reductions in systolic and diastolic BP in the intervention group (all $p<0.001$), independent of medication use or adherence.

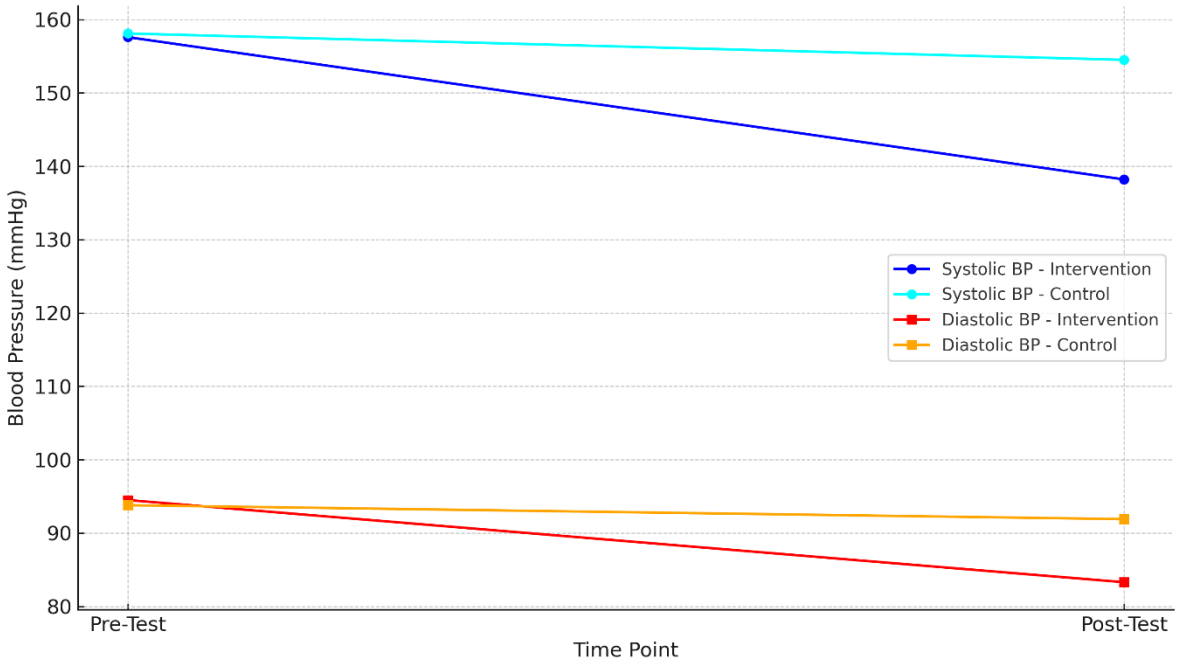

Fig. 2. Pre- to post-test changes in systolic and diastolic blood pressure across study groups

Discussion

The findings revealed that the personalized hypertension care intervention was linked to significant enhancements in systolic and diastolic blood pressure and overall quality of life among elderly participants residing in a rural context. These findings highlight the clinical potential of individualized, patient-centered strategies in addressing the multifactorial needs of elderly patients with chronic conditions such as hypertension.

Blood pressure reduction through personalized care

The decrease in systolic (−19.4 mmHg) and diastolic (−11.2 mmHg) blood pressure observed in the intervention group was both clinically meaningful and statistically significant. These results are consistent with previous research highlighting the efficacy of non-pharmacological strategies especially those incorporating patient education, behavioral guidance, and caregiver participation in enhancing blood pressure regulation among older individuals.[15–19] Earlier research has shown that tailored lifestyle and behavioral interventions, when consistently implemented, can lower systolic blood pressure by approximately 10–20 mmHg, which is comparable to the reduction observed in the present study.[20]

Contrastingly, the control group, which received usual care, showed only modest, non-significant changes in both systolic and diastolic measures. This suggests that standardized, non-individualized care may be insufficient to address the complex behavioral and psychosocial dimensions that influence hypertension management in the elderly. It also underscores the value of tailored interactions and active family

involvement, particularly in rural or resource-limited environments where access to specialized care is limited.

Improvements in quality of life domains

Beyond physiological improvements, this study revealed significant enhancements in all domains of quality of life among participants in the intervention group. The most prominent improvements were noted in physical health and psychological well-being, alongside meaningful gains in social relationships. These outcomes align with prior evidence indicating that older adults who receive structured nursing-based interventions tend to experience greater independence, improved emotional stability, and stronger social engagement.[21–23]

The incorporation of personalized support likely contributed to increased adherence to self-care behaviors and reduced anxiety related to disease management. Unlike generic health promotion models, our intervention was sensitive to participants' routines, literacy levels, and cultural context, making it more acceptable and sustainable.[24] Similar results were documented by previous research, which found that culturally adapted, individualized care significantly improved quality of life among rural elderly with chronic illness.[25–27]

In contrast, the control group displayed only marginal improvements in quality of life, likely reflecting the limited capacity of standard care to address multidimensional aspects of well-being. These findings support the argument that hypertension care in elderly populations should extend beyond clinical metrics to include functional, emotional, and social quality of life indicators.

Baseline balance and internal validity

The similarity of baseline characteristics between the intervention and control groups (Table 1) enhances the internal validity of the study's findings. The absence of significant differences in variables such as age, gender, education, marital status, duration of hypertension, and lifestyle habits suggests that the favorable results observed in the intervention group were not influenced by pre-existing disparities. This balance supports the credibility of the intervention's impact on both blood pressure and quality-of-life outcomes.[28]

Implications for rural and low-resource settings

Considering that this research was conducted in a rural environment, the results hold valuable implications for improving hypertension management in resource-limited settings. The personalized care approach used here did not require advanced technology or high-cost equipment, making it feasible for integration into primary care programs and community health services. The active involvement of family members also leverages existing social structures to support elderly patients, reducing dependence on institutional care.

This research possesses several key strengths. Utilizing a quasi-experimental design with a control group enabled robust comparisons between conventional care and the personalized intervention. By assessing both physiological parameters (blood pressure) and psychosocial aspects (quality of life), the study offered a well-rounded perspective on the overall effectiveness of the intervention. Additionally, the approach used was culturally sensitive, low-cost, and feasible for integration into rural primary care settings, enhancing its practical relevance. The comparability of baseline characteristics between groups further strengthened the internal validity and minimized confounding factors. The absence of group differences in medication use or adherence indicates that improvements in blood pressure and quality of life were mainly due to the personalized care intervention. Consistent results in both per-protocol and ITT analyses strengthen internal validity and support prior evidence that education, self-care, and family engagement can improve hypertension outcomes independent of medication changes.

Study limitation

This study acknowledges several limitations. First, the quasi-experimental design without randomization carries a risk of selection bias and limits causal inference. Blinding of assessors was not feasible, and the use of self-reported quality of life data may introduce recall or response bias despite standardized procedures. Second, blood pressure was measured only at two clinic visits (baseline and one month) rather than through repeated or ambulatory monitoring. This approach may allow white-coat effects or regression to the mean. In addition, the OPQOL-Brief minimal clinically important difference was estimated using a distribution-based approach (0.5 SD) because no anchor-based threshold has yet been validated for Indonesian older adults. Third, no prospective sample size calculation was performed, which increases the risk of missing smaller true effects (Type II error). Nevertheless, the observed systolic BP reduction (~16 mmHg; Cohen's d ≈1.5) provided post-hoc power >99.9%, suggesting that the primary outcome was adequately powered. Finally, the short one-month follow-up limits conclusions about long-term sustainability, adherence, and durability of effects in chronic hypertension. As the research was carried out in only one rural district, the generalizability of the results may be limited. Future randomized trials involving larger samples and multiple locations with extended follow-up periods are warranted to verify and broaden the applicability of these findings.

Conclusion

The findings of this study indicate that implementing a personalized hypertension care model can enhance both systolic and diastolic blood pressure control and improve the quality of life among older adults with hypertension in rural areas. Through individualized education, encouragement of self-care practices, and active family involvement, the intervention provided advantages that exceeded those of standard care. A key limitation is the absence of an a priori power calculation, which raises the possibility that smaller but

clinically relevant effects were not detected. Nonetheless, post-hoc analysis indicated sufficient power to capture the large observed effect in systolic blood pressure. Given the one-month follow-up, these findings should be interpreted with caution. Longer-term randomized studies with ≥3–6 months of follow-up are needed to confirm sustainability, strengthen causal inference, and guide broader implementation as a scalable model for improving cardiovascular outcomes and healthy aging in rural communities.

Declarations

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Author contributions

Conceptualization, H.T.Y and S.S.B.S.A.R.; Methodology, S.S.B.S.A.R. and M.F.M; Software, X.X.; Validation, H.T.Y and S.S.B.S.A.R.; Formal Analysis, S.S.B.A.R.; Investigation, M.F.M.; Resources, H.T.Y.; Data Curation, S.S.B.S.A.R.; Writing – Original Draft Preparation, H.T.Y. and P.A.W.S. ; Writing – Review & Editing, S.S.B.S.A.R.; Visualization, H.T.Y. and P.A.W.S.; Supervision, S.S.B.S.A.R.

Conflicts of interest

The authors declare that they have no conflicts of interest related to this study.

Data availability

The anonymized dataset and statistical analysis code utilized in this research can be obtained from the corresponding author upon reasonable request, in accordance with institutional data-sharing and ethical approval guidelines.

Ethics approval

Ethical approval for this research was granted by the local Health Research Ethics Committee of Universitas Muhammadiyah Gombong (approval date: May 13, 2023; decision number: 21124000004).

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